

MonoidalCategories

**Monoidal and monoidal (co)closed
categories**

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Chapter 1

Monoidal Categories

1.1 Monoidal Categories

A 6-tuple $(\mathbf{C}, \otimes, 1, \alpha, \lambda, \rho)$ consisting of

- a category \mathbf{C} ,
- a functor $\otimes : \mathbf{C} \times \mathbf{C} \rightarrow \mathbf{C}$ compatible with the congruence of morphisms,
- an object $1 \in \mathbf{C}$,
- a natural isomorphism $\alpha_{a,b,c} : a \otimes (b \otimes c) \cong (a \otimes b) \otimes c$,
- a natural isomorphism $\lambda_a : 1 \otimes a \cong a$,
- a natural isomorphism $\rho_a : a \otimes 1 \cong a$,

is called a *monoidal category*, if

- for all objects a, b, c, d , the pentagon identity holds:

$$(\alpha_{a,b,c} \otimes \text{id}_d) \circ \alpha_{a,b \otimes c,d} \circ (\text{id}_a \otimes \alpha_{b,c,d}) \sim \alpha_{a \otimes b,c,d} \circ \alpha_{a,b,c \otimes d},$$

- for all objects a, c , the triangle identity holds:

$$(\rho_a \otimes \text{id}_c) \circ \alpha_{a,1,c} \sim \text{id}_a \otimes \lambda_c.$$

The corresponding GAP property is given by `IsMonoidalCategory`.

1.1.1 TensorProductOnMorphisms (for IsCapCategoryMorphism, IsCapCategory-Morphism)

▷ `TensorProductOnMorphisms(alpha, beta)` (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, a' \otimes b')$

The arguments are two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$. The output is the tensor product $\alpha \otimes \beta$.

1.1.2 TensorProductOnMorphismsWithGivenTensorProducts (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryMorphism, IsCapCategoryObject)

▷ TensorProductOnMorphismsWithGivenTensorProducts(s , α , β , r) (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, a' \otimes b')$

The arguments are an object $s = a \otimes b$, two morphisms $\alpha : a \rightarrow a'$, $\beta : b \rightarrow b'$, and an object $r = a' \otimes b'$. The output is the tensor product $\alpha \otimes \beta$.

1.1.3 AssociatorRightToLeft (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ AssociatorRightToLeft(a , b , c) (operation)

Returns: a morphism in $\text{Hom}(a \otimes (b \otimes c), (a \otimes b) \otimes c)$.

The arguments are three objects a, b, c . The output is the associator $\alpha_{a,(b,c)} : a \otimes (b \otimes c) \rightarrow (a \otimes b) \otimes c$.

1.1.4 AssociatorRightToLeftWithGivenTensorProducts (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ AssociatorRightToLeftWithGivenTensorProducts(s , a , b , c , r) (operation)

Returns: a morphism in $\text{Hom}(a \otimes (b \otimes c), (a \otimes b) \otimes c)$.

The arguments are an object $s = a \otimes (b \otimes c)$, three objects a, b, c , and an object $r = (a \otimes b) \otimes c$. The output is the associator $\alpha_{a,(b,c)} : a \otimes (b \otimes c) \rightarrow (a \otimes b) \otimes c$.

1.1.5 AssociatorLeftToRight (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ AssociatorLeftToRight(a , b , c) (operation)

Returns: a morphism in $\text{Hom}((a \otimes b) \otimes c \rightarrow a \otimes (b \otimes c))$.

The arguments are three objects a, b, c . The output is the associator $\alpha_{(a,b),c} : (a \otimes b) \otimes c \rightarrow a \otimes (b \otimes c)$.

1.1.6 AssociatorLeftToRightWithGivenTensorProducts (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ AssociatorLeftToRightWithGivenTensorProducts(s , a , b , c , r) (operation)

Returns: a morphism in $\text{Hom}((a \otimes b) \otimes c \rightarrow a \otimes (b \otimes c))$.

The arguments are an object $s = (a \otimes b) \otimes c$, three objects a, b, c , and an object $r = a \otimes (b \otimes c)$. The output is the associator $\alpha_{(a,b),c} : (a \otimes b) \otimes c \rightarrow a \otimes (b \otimes c)$.

1.1.7 LeftUnitor (for IsCapCategoryObject)

▷ LeftUnitor(a) (attribute)

Returns: a morphism in $\text{Hom}(1 \otimes a, a)$

The argument is an object a . The output is the left unitor $\lambda_a : 1 \otimes a \rightarrow a$.

1.1.8 LeftUnitorWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftUnitorWithGivenTensorProduct(a, s) (operation)

Returns: a morphism in $\text{Hom}(1 \otimes a, a)$

The arguments are an object a and an object $s = 1 \otimes a$. The output is the left unitor $\lambda_a : 1 \otimes a \rightarrow a$.

1.1.9 LeftUnitorInverse (for IsCapCategoryObject)

▷ LeftUnitorInverse(a) (attribute)

Returns: a morphism in $\text{Hom}(a, 1 \otimes a)$

The argument is an object a . The output is the inverse of the left unitor $\lambda_a^{-1} : a \rightarrow 1 \otimes a$.

1.1.10 LeftUnitorInverseWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftUnitorInverseWithGivenTensorProduct(a, r) (operation)

Returns: a morphism in $\text{Hom}(a, 1 \otimes a)$

The argument is an object a and an object $r = 1 \otimes a$. The output is the inverse of the left unitor $\lambda_a^{-1} : a \rightarrow 1 \otimes a$.

1.1.11 RightUnitor (for IsCapCategoryObject)

▷ RightUnitor(a) (attribute)

Returns: a morphism in $\text{Hom}(a \otimes 1, a)$

The argument is an object a . The output is the right unitor $\rho_a : a \otimes 1 \rightarrow a$.

1.1.12 RightUnitorWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ RightUnitorWithGivenTensorProduct(a, s) (operation)

Returns: a morphism in $\text{Hom}(a \otimes 1, a)$

The arguments are an object a and an object $s = a \otimes 1$. The output is the right unitor $\rho_a : a \otimes 1 \rightarrow a$.

1.1.13 RightUnitorInverse (for IsCapCategoryObject)

▷ RightUnitorInverse(a) (attribute)

Returns: a morphism in $\text{Hom}(a, a \otimes 1)$

The argument is an object a . The output is the inverse of the right unitor $\rho_a^{-1} : a \rightarrow a \otimes 1$.

1.1.14 RightUnitorInverseWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ RightUnitorInverseWithGivenTensorProduct(a, r) (operation)

Returns: a morphism in $\text{Hom}(a, a \otimes 1)$

The arguments are an object a and an object $r = a \otimes 1$. The output is the inverse of the right unitor $\rho_a^{-1} : a \rightarrow a \otimes 1$.

1.1.15 TensorProductOnObjects (for IsCapCategoryObject, IsCapCategoryObject)

- ▷ `TensorProductOnObjects(a, b)` (operation)
Returns: an object
 The arguments are two objects a, b . The output is the tensor product $a \otimes b$.

1.1.16 TensorUnit (for IsCapCategory)

- ▷ `TensorUnit(C)` (attribute)
Returns: an object
 The argument is a category C . The output is the tensor unit 1 of C .

1.2 Additive Monoidal Categories

1.2.1 LeftDistributivityExpanding (for IsCapCategoryObject, IsList)

- ▷ `LeftDistributivityExpanding(a, L)` (operation)
Returns: a morphism in $\text{Hom}(a \otimes (b_1 \oplus \cdots \oplus b_n), (a \otimes b_1) \oplus \cdots \oplus (a \otimes b_n))$
 The arguments are an object a and a list of objects $L = (b_1, \dots, b_n)$. The output is the left distributivity morphism $a \otimes (b_1 \oplus \cdots \oplus b_n) \rightarrow (a \otimes b_1) \oplus \cdots \oplus (a \otimes b_n)$.

1.2.2 LeftDistributivityExpandingWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsList, IsCapCategoryObject)

- ▷ `LeftDistributivityExpandingWithGivenObjects(s, a, L, r)` (operation)
Returns: a morphism in $\text{Hom}(s, r)$
 The arguments are an object $s = a \otimes (b_1 \oplus \cdots \oplus b_n)$, an object a , a list of objects $L = (b_1, \dots, b_n)$, and an object $r = (a \otimes b_1) \oplus \cdots \oplus (a \otimes b_n)$. The output is the left distributivity morphism $s \rightarrow r$.

1.2.3 LeftDistributivityFactoring (for IsCapCategoryObject, IsList)

- ▷ `LeftDistributivityFactoring(a, L)` (operation)
Returns: a morphism in $\text{Hom}((a \otimes b_1) \oplus \cdots \oplus (a \otimes b_n), a \otimes (b_1 \oplus \cdots \oplus b_n))$
 The arguments are an object a and a list of objects $L = (b_1, \dots, b_n)$. The output is the left distributivity morphism $(a \otimes b_1) \oplus \cdots \oplus (a \otimes b_n) \rightarrow a \otimes (b_1 \oplus \cdots \oplus b_n)$.

1.2.4 LeftDistributivityFactoringWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsList, IsCapCategoryObject)

- ▷ `LeftDistributivityFactoringWithGivenObjects(s, a, L, r)` (operation)
Returns: a morphism in $\text{Hom}(s, r)$
 The arguments are an object $s = (a \otimes b_1) \oplus \cdots \oplus (a \otimes b_n)$, an object a , a list of objects $L = (b_1, \dots, b_n)$, and an object $r = a \otimes (b_1 \oplus \cdots \oplus b_n)$. The output is the left distributivity morphism $s \rightarrow r$.

1.2.5 RightDistributivityExpanding (for IsList, IsCapCategoryObject)

▷ RightDistributivityExpanding(L, a) (operation)

Returns: a morphism in $\text{Hom}((b_1 \oplus \dots \oplus b_n) \otimes a, (b_1 \otimes a) \oplus \dots \oplus (b_n \otimes a))$

The arguments are a list of objects $L = (b_1, \dots, b_n)$ and an object a . The output is the right distributivity morphism $(b_1 \oplus \dots \oplus b_n) \otimes a \rightarrow (b_1 \otimes a) \oplus \dots \oplus (b_n \otimes a)$.

1.2.6 RightDistributivityExpandingWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject, IsCapCategoryObject)

▷ RightDistributivityExpandingWithGivenObjects(s, L, a, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$

The arguments are an object $s = (b_1 \oplus \dots \oplus b_n) \otimes a$, a list of objects $L = (b_1, \dots, b_n)$, an object a , and an object $r = (b_1 \otimes a) \oplus \dots \oplus (b_n \otimes a)$. The output is the right distributivity morphism $s \rightarrow r$.

1.2.7 RightDistributivityFactoring (for IsList, IsCapCategoryObject)

▷ RightDistributivityFactoring(L, a) (operation)

Returns: a morphism in $\text{Hom}((b_1 \otimes a) \oplus \dots \oplus (b_n \otimes a), (b_1 \oplus \dots \oplus b_n) \otimes a)$

The arguments are a list of objects $L = (b_1, \dots, b_n)$ and an object a . The output is the right distributivity morphism $(b_1 \otimes a) \oplus \dots \oplus (b_n \otimes a) \rightarrow (b_1 \oplus \dots \oplus b_n) \otimes a$.

1.2.8 RightDistributivityFactoringWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject, IsCapCategoryObject)

▷ RightDistributivityFactoringWithGivenObjects(s, L, a, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$

The arguments are an object $s = (b_1 \otimes a) \oplus \dots \oplus (b_n \otimes a)$, a list of objects $L = (b_1, \dots, b_n)$, an object a , and an object $r = (b_1 \oplus \dots \oplus b_n) \otimes a$. The output is the right distributivity morphism $s \rightarrow r$.

1.3 Braided Monoidal Categories

A monoidal category \mathbf{C} equipped with a natural isomorphism $B_{a,b} : a \otimes b \cong b \otimes a$ is called a *braided monoidal category* if

- $\lambda_a \circ B_{a,1} \sim \rho_a$,
- $(B_{c,a} \otimes \text{id}_b) \circ \alpha_{c,a,b} \circ B_{a \otimes b, c} \sim \alpha_{a,c,b} \circ (\text{id}_a \otimes B_{b,c}) \circ \alpha_{a,b,c}^{-1}$,
- $(\text{id}_b \otimes B_{c,a}) \circ \alpha_{b,c,a}^{-1} \circ B_{a,b \otimes c} \sim \alpha_{b,a,c}^{-1} \circ (B_{a,b} \otimes \text{id}_c) \circ \alpha_{a,b,c}$.

The corresponding GAP property is given by IsBraidedMonoidalCategory.

1.3.1 Braiding (for IsCapCategoryObject, IsCapCategoryObject)

▷ Braiding(a, b) (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, b \otimes a)$.

The arguments are two objects a, b . The output is the braiding $B_{a,b} : a \otimes b \rightarrow b \otimes a$.

1.3.2 BraidingWithGivenTensorProducts (for IsCapCategoryObject, IsCapCategory-Object, IsCapCategoryObject, IsCapCategoryObject)

▷ BraidingWithGivenTensorProducts(s, a, b, r) (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, b \otimes a)$.

The arguments are an object $s = a \otimes b$, two objects a, b , and an object $r = b \otimes a$. The output is the braiding $B_{a,b} : a \otimes b \rightarrow b \otimes a$.

1.3.3 BraidingInverse (for IsCapCategoryObject, IsCapCategoryObject)

▷ BraidingInverse(a, b) (operation)

Returns: a morphism in $\text{Hom}(b \otimes a, a \otimes b)$.

The arguments are two objects a, b . The output is the inverse braiding $B_{a,b}^{-1} : b \otimes a \rightarrow a \otimes b$.

1.3.4 BraidingInverseWithGivenTensorProducts (for IsCapCategoryObject, IsCap-CategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ BraidingInverseWithGivenTensorProducts(s, a, b, r) (operation)

Returns: a morphism in $\text{Hom}(b \otimes a, a \otimes b)$.

The arguments are an object $s = b \otimes a$, two objects a, b , and an object $r = a \otimes b$. The output is the inverse braiding $B_{a,b}^{-1} : b \otimes a \rightarrow a \otimes b$.

1.4 Symmetric Monoidal Categories

A braided monoidal category \mathbf{C} is called *symmetric monoidal category* if $B_{a,b}^{-1} \sim B_{b,a}$. The corresponding GAP property is given by `IsSymmetricMonoidalCategory`.

1.5 Left Closed Monoidal Categories

A monoidal category \mathbf{C} which has for each functor $- \otimes b : \mathbf{C} \rightarrow \mathbf{C}$ a right adjoint (denoted by $\underline{\text{Hom}}_\ell(b, -)$) is called a *left closed monoidal category*.

If no operations involving left duals are installed manually, the left dual objects will be derived as $a^\vee := \underline{\text{Hom}}_\ell(a, 1)$.

The corresponding GAP property is called `IsLeftClosedMonoidalCategory`.

1.5.1 LeftInternalHomOnObjects (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftInternalHomOnObjects(a, b) (operation)

Returns: an object

The arguments are two objects a, b . The output is the internal hom object $\underline{\text{Hom}}_\ell(a, b)$.

1.5.2 LeftInternalHomOnMorphisms (for IsCapCategoryMorphism, IsCapCategory-Morphism)

▷ LeftInternalHomOnMorphisms(α, β) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(a', b), \underline{\text{Hom}}_\ell(a, b'))$

The arguments are two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$. The output is the internal hom morphism $\underline{\text{Hom}}_\ell(\alpha, \beta) : \underline{\text{Hom}}_\ell(a', b) \rightarrow \underline{\text{Hom}}_\ell(a, b')$.

1.5.3 LeftInternalHomOnMorphismsWithGivenLeftInternalHoms (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryMorphism, IsCapCategoryObject)

▷ LeftInternalHomOnMorphismsWithGivenLeftInternalHoms(s, α, β, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$

The arguments are an object $s = \underline{\text{Hom}}_\ell(a', b)$, two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$, and an object $r = \underline{\text{Hom}}_\ell(a, b')$. The output is the internal hom morphism $\underline{\text{Hom}}_\ell(\alpha, \beta) : \underline{\text{Hom}}_\ell(a', b) \rightarrow \underline{\text{Hom}}_\ell(a, b')$.

1.5.4 LeftClosedMonoidalEvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalEvaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(a, b) \otimes a, b)$.

The arguments are two objects a, b . The output is the evaluation morphism $\text{ev}_{a,b} : \underline{\text{Hom}}_\ell(a, b) \otimes a \rightarrow b$, i.e., the counit of the tensor hom adjunction.

1.5.5 LeftClosedMonoidalEvaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalEvaluationMorphismWithGivenSource(a, b, s) (operation)

Returns: a morphism in $\text{Hom}(s, b)$.

The arguments are two objects a, b and an object $s = \underline{\text{Hom}}_\ell(a, b) \otimes a$. The output is the evaluation morphism $\text{ev}_{a,b} : \underline{\text{Hom}}_\ell(a, b) \otimes a \rightarrow b$, i.e., the counit of the tensor hom adjunction.

1.5.6 LeftClosedMonoidalCoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalCoevaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(b, \underline{\text{Hom}}_\ell(a, b \otimes a))$.

The arguments are two objects a, b . The output is the coevaluation morphism $\text{coev}_{a,b} : b \rightarrow \underline{\text{Hom}}_\ell(a, b \otimes a)$, i.e., the unit of the tensor hom adjunction.

1.5.7 LeftClosedMonoidalCoevaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalCoevaluationMorphismWithGivenRange(a, b, r) (operation)

Returns: a morphism in $\text{Hom}(b, r)$.

The arguments are two objects a, b and an object $r = \underline{\text{Hom}}_\ell(a, b \otimes a)$. The output is the coevaluation morphism $\text{coev}_{a,b} : b \rightarrow \underline{\text{Hom}}_\ell(a, b \otimes a)$, i.e., the unit of the tensor hom adjunction.

1.5.8 TensorProductToLeftInternalHomAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `TensorProductToLeftInternalHomAdjunctMorphism(a, b, f)` (operation)

Returns: a morphism in $\text{Hom}(a, \underline{\text{Hom}}_\ell(b, c))$.

The arguments are two objects a, b and a morphism $f : a \otimes b \rightarrow c$. The output is a morphism $g : a \rightarrow \underline{\text{Hom}}_\ell(b, c)$ corresponding to f under the tensor hom adjunction.

1.5.9 TensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ `TensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom(a, b, f, i)` (operation)

Returns: a morphism in $\text{Hom}(a, i)$.

The arguments are two objects a, b , a morphism $f : a \otimes b \rightarrow c$ and an object $i = \underline{\text{Hom}}_\ell(b, c)$. The output is a morphism $g : a \rightarrow \underline{\text{Hom}}_\ell(b, c)$ corresponding to f under the tensor hom adjunction.

1.5.10 LeftInternalHomToTensorProductAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `LeftInternalHomToTensorProductAdjunctMorphism(b, c, g)` (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, c)$.

The arguments are two objects b, c and a morphism $g : a \rightarrow \underline{\text{Hom}}_\ell(b, c)$. The output is a morphism $f : a \otimes b \rightarrow c$ corresponding to g under the tensor hom adjunction.

1.5.11 LeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ `LeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct(b, c, g, t)` (operation)

Returns: a morphism in $\text{Hom}(t, c)$.

The arguments are two objects b, c , a morphism $g : a \rightarrow \underline{\text{Hom}}_\ell(b, c)$ and an object $t = a \otimes b$. The output is a morphism $f : a \otimes b \rightarrow c$ corresponding to g under the tensor hom adjunction.

1.5.12 LeftClosedMonoidalPreComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `LeftClosedMonoidalPreComposeMorphism(a, b, c)` (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(a, b) \otimes \underline{\text{Hom}}_\ell(b, c), \underline{\text{Hom}}_\ell(a, c))$.

The arguments are three objects a, b, c . The output is the precomposition morphism $\text{LeftClosedMonoidalPreComposeMorphism}_{a,b,c} : \underline{\text{Hom}}_\ell(a, b) \otimes \underline{\text{Hom}}_\ell(b, c) \rightarrow \underline{\text{Hom}}_\ell(a, c)$.

1.5.13 LeftClosedMonoidalPreComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalPreComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{Hom}}_\ell(a, b) \otimes \underline{\text{Hom}}_\ell(b, c)$, three objects a, b, c , and an object $r = \underline{\text{Hom}}_\ell(a, c)$. The output is the precomposition morphism $\text{LeftClosedMonoidalPreComposeMorphismWithGivenObjects}_{a,b,c} : \underline{\text{Hom}}_\ell(a, b) \otimes \underline{\text{Hom}}_\ell(b, c) \rightarrow \underline{\text{Hom}}_\ell(a, c)$.

1.5.14 LeftClosedMonoidalPostComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalPostComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(b, c) \otimes \underline{\text{Hom}}_\ell(a, b), \underline{\text{Hom}}_\ell(a, c))$.

The arguments are three objects a, b, c . The output is the postcomposition morphism $\text{LeftClosedMonoidalPostComposeMorphism}_{a,b,c} : \underline{\text{Hom}}_\ell(b, c) \otimes \underline{\text{Hom}}_\ell(a, b) \rightarrow \underline{\text{Hom}}_\ell(a, c)$.

1.5.15 LeftClosedMonoidalPostComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalPostComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{Hom}}_\ell(b, c) \otimes \underline{\text{Hom}}_\ell(a, b)$, three objects a, b, c , and an object $r = \underline{\text{Hom}}_\ell(a, c)$. The output is the postcomposition morphism $\text{LeftClosedMonoidalPostComposeMorphismWithGivenObjects}_{a,b,c} : \underline{\text{Hom}}_\ell(b, c) \otimes \underline{\text{Hom}}_\ell(a, b) \rightarrow \underline{\text{Hom}}_\ell(a, c)$.

1.5.16 LeftDualOnObjects (for IsCapCategoryObject)

▷ LeftDualOnObjects(a) (attribute)

Returns: an object

The argument is an object a . The output is its dual object a^\vee .

1.5.17 LeftDualOnMorphisms (for IsCapCategoryMorphism)

▷ LeftDualOnMorphisms(α) (attribute)

Returns: a morphism in $\text{Hom}(b^\vee, a^\vee)$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is its dual morphism $\alpha^\vee : b^\vee \rightarrow a^\vee$.

1.5.18 LeftDualOnMorphismsWithGivenLeftDuals (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ LeftDualOnMorphismsWithGivenLeftDuals(s, α, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The argument is an object $s = b^\vee$, a morphism $\alpha : a \rightarrow b$, and an object $r = a^\vee$. The output is the dual morphism $\alpha^\vee : b^\vee \rightarrow a^\vee$.

1.5.19 LeftClosedMonoidalEvaluationForLeftDual (for IsCapCategoryObject)

▷ LeftClosedMonoidalEvaluationForLeftDual(a) (attribute)

Returns: a morphism in $\text{Hom}(a^\vee \otimes a, 1)$.

The argument is an object a . The output is the evaluation morphism $\text{ev}_a : a^\vee \otimes a \rightarrow 1$.

1.5.20 LeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct(s, a, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = a^\vee \otimes a$, an object a , and an object $r = 1$. The output is the evaluation morphism $\text{ev}_a : a^\vee \otimes a \rightarrow 1$.

1.5.21 MorphismToLeftBidual (for IsCapCategoryObject)

▷ MorphismToLeftBidual(a) (attribute)

Returns: a morphism in $\text{Hom}(a, (a^\vee)^\vee)$.

The argument is an object a . The output is the morphism to the bidual $a \rightarrow (a^\vee)^\vee$.

1.5.22 MorphismToLeftBidualWithGivenLeftBidual (for IsCapCategoryObject, IsCapCategoryObject)

▷ MorphismToLeftBidualWithGivenLeftBidual(a, r) (operation)

Returns: a morphism in $\text{Hom}(a, r)$.

The arguments are an object a , and an object $r = (a^\vee)^\vee$. The output is the morphism to the bidual $a \rightarrow (a^\vee)^\vee$.

1.5.23 TensorProductLeftInternalHomCompatibilityMorphism (for IsList)

▷ TensorProductLeftInternalHomCompatibilityMorphism($list$) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(a, a') \otimes \underline{\text{Hom}}_\ell(b, b'), \underline{\text{Hom}}_\ell(a \otimes b, a' \otimes b'))$.

The argument is a list of four objects $[a, a', b, b']$. The output is the natural morphism $\text{TensorProductLeftInternalHomCompatibilityMorphism}_{a, a', b, b'} : \underline{\text{Hom}}_\ell(a, a') \otimes \underline{\text{Hom}}_\ell(b, b') \rightarrow \underline{\text{Hom}}_\ell(a \otimes b, a' \otimes b')$.

1.5.24 TensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject)

▷ TensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects($s, list, r$) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are a list of four objects $[a, a', b, b']$, and two objects $s = \underline{\text{Hom}}_\ell(a, a') \otimes \underline{\text{Hom}}_\ell(b, b')$ and $r = \underline{\text{Hom}}_\ell(a \otimes b, a' \otimes b')$. The output is the natural morphism

$\text{TensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects}_{a,a',b,b'} : \underline{\text{Hom}}_\ell(a,a') \otimes \underline{\text{Hom}}_\ell(b,b') \rightarrow \underline{\text{Hom}}_\ell(a \otimes b, a' \otimes b')$.

1.5.25 TensorProductLeftDualityCompatibilityMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{TensorProductLeftDualityCompatibilityMorphism}(a, b)$ (operation)

Returns: a morphism in $\text{Hom}(a^\vee \otimes b^\vee, (a \otimes b)^\vee)$.

The arguments are two objects a, b . The output is the natural morphism $\text{TensorProductLeftDualityCompatibilityMorphism} : a^\vee \otimes b^\vee \rightarrow (a \otimes b)^\vee$.

1.5.26 TensorProductLeftDualityCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{TensorProductLeftDualityCompatibilityMorphismWithGivenObjects}(s, a, b, r)$ (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = a^\vee \otimes b^\vee$, two objects a, b , and an object $r = (a \otimes b)^\vee$. The output is the natural morphism $\text{TensorProductLeftDualityCompatibilityMorphismWithGivenObjects}_{a,b} : a^\vee \otimes b^\vee \rightarrow (a \otimes b)^\vee$.

1.5.27 MorphismFromTensorProductToLeftInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{MorphismFromTensorProductToLeftInternalHom}(a, b)$ (operation)

Returns: a morphism in $\text{Hom}(a^\vee \otimes b, \underline{\text{Hom}}_\ell(a, b))$.

The arguments are two objects a, b . The output is the natural morphism $\text{MorphismFromTensorProductToLeftInternalHom}_{a,b} : a^\vee \otimes b \rightarrow \underline{\text{Hom}}_\ell(a, b)$.

1.5.28 MorphismFromTensorProductToLeftInternalHomWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{MorphismFromTensorProductToLeftInternalHomWithGivenObjects}(s, a, b, r)$ (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = a^\vee \otimes b$, two objects a, b , and an object $r = \underline{\text{Hom}}_\ell(a, b)$. The output is the natural morphism $\text{MorphismFromTensorProductToLeftInternalHomWithGivenObjects}_{a,b} : a^\vee \otimes b \rightarrow \underline{\text{Hom}}_\ell(a, b)$.

1.5.29 IsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit (for IsCapCategoryObject)

▷ $\text{IsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit}(a)$ (attribute)

Returns: a morphism in $\text{Hom}(a^\vee, \underline{\text{Hom}}_\ell(a, 1))$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit}_a : a^\vee \rightarrow \underline{\text{Hom}}_\ell(a, 1)$.

1.5.30 IsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject (for IsCapCategoryObject)

▷ IsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject(a) (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(a, 1), a^\vee)$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject}_a : \underline{\text{Hom}}_\ell(a, 1) \rightarrow a^\vee$.

1.5.31 UniversalPropertyOfLeftDual (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ UniversalPropertyOfLeftDual(t, a, alpha) (operation)

Returns: a morphism in $\text{Hom}(t, a^\vee)$.

The arguments are two objects t, a , and a morphism $\alpha : t \otimes a \rightarrow 1$. The output is the morphism $t \rightarrow a^\vee$ given by the universal property of a^\vee .

1.5.32 LeftClosedMonoidalLambdaIntroduction (for IsCapCategoryMorphism)

▷ LeftClosedMonoidalLambdaIntroduction(alpha) (attribute)

Returns: a morphism in $\text{Hom}(1, \underline{\text{Hom}}_\ell(a, b))$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is the corresponding morphism $1 \rightarrow \underline{\text{Hom}}_\ell(a, b)$ under the tensor hom adjunction.

1.5.33 LeftClosedMonoidalLambdaElimination (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ LeftClosedMonoidalLambdaElimination(a, b, alpha) (operation)

Returns: a morphism in $\text{Hom}(a, b)$.

The arguments are two objects a, b , and a morphism $\alpha : 1 \rightarrow \underline{\text{Hom}}_\ell(a, b)$. The output is a morphism $a \rightarrow b$ corresponding to α under the tensor hom adjunction.

1.5.34 IsomorphismFromObjectToLeftInternalHom (for IsCapCategoryObject)

▷ IsomorphismFromObjectToLeftInternalHom(a) (attribute)

Returns: a morphism in $\text{Hom}(a, \underline{\text{Hom}}_\ell(1, a))$.

The argument is an object a . The output is the natural isomorphism $a \rightarrow \underline{\text{Hom}}_\ell(1, a)$.

1.5.35 IsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ IsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom(a, r) (operation)

Returns: a morphism in $\text{Hom}(a, r)$.

The argument is an object a , and an object $r = \underline{\text{Hom}}_\ell(1, a)$. The output is the natural isomorphism $a \rightarrow \underline{\text{Hom}}_\ell(1, a)$.

1.5.36 IsomorphismFromLeftInternalHomToObject (for IsCapCategoryObject)

▷ `IsomorphismFromLeftInternalHomToObject(a)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}_\ell(1, a), a)$.

The argument is an object a . The output is the natural isomorphism $\underline{\text{Hom}}_\ell(1, a) \rightarrow a$.

1.5.37 IsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom(a, s)` (operation)

Returns: a morphism in $\text{Hom}(s, a)$.

The argument is an object a , and an object $s = \underline{\text{Hom}}_\ell(1, a)$. The output is the natural isomorphism $\underline{\text{Hom}}_\ell(1, a) \rightarrow a$.

1.6 Closed Monoidal Categories

A monoidal category \mathbf{C} which has for each functor $- \otimes b : \mathbf{C} \rightarrow \mathbf{C}$ a right adjoint (denoted by $\underline{\text{Hom}}_\ell(b, -)$) is called a *closed monoidal category*.

If no operations involving duals are installed manually, the dual objects will be derived as $a^\vee := \underline{\text{Hom}}_\ell(a, 1)$.

The corresponding GAP property is called `IsClosedMonoidalCategory`.

1.6.1 InternalHomOnObjects (for IsCapCategoryObject, IsCapCategoryObject)

▷ `InternalHomOnObjects(a, b)` (operation)

Returns: an object

The arguments are two objects a, b . The output is the internal hom object $\underline{\text{Hom}}(a, b)$.

1.6.2 InternalHomOnMorphisms (for IsCapCategoryMorphism, IsCapCategoryMorphism)

▷ `InternalHomOnMorphisms(alpha, beta)` (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a', b), \underline{\text{Hom}}(a, b'))$

The arguments are two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$. The output is the internal hom morphism $\underline{\text{Hom}}(\alpha, \beta) : \underline{\text{Hom}}(a', b) \rightarrow \underline{\text{Hom}}(a, b')$.

1.6.3 InternalHomOnMorphismsWithGivenInternalHoms (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryMorphism, IsCapCategoryObject)

▷ `InternalHomOnMorphismsWithGivenInternalHoms(s, alpha, beta, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$

The arguments are an object $s = \underline{\text{Hom}}(a', b)$, two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$, and an object $r = \underline{\text{Hom}}(a, b')$. The output is the internal hom morphism $\underline{\text{Hom}}(\alpha, \beta) : \underline{\text{Hom}}(a', b) \rightarrow \underline{\text{Hom}}(a, b')$.

1.6.4 ClosedMonoidalRightEvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalRightEvaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(a \otimes \underline{\text{Hom}}(a, b), b)$.

The arguments are two objects a, b . The output is the right evaluation morphism $\text{ev}_{a,b} : a \otimes \underline{\text{Hom}}(a, b) \rightarrow b$, i.e., the counit of the tensor hom adjunction.

1.6.5 ClosedMonoidalRightEvaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalRightEvaluationMorphismWithGivenSource(a, b, s) (operation)

Returns: a morphism in $\text{Hom}(s, b)$.

The arguments are two objects a, b and an object $s = a \otimes \underline{\text{Hom}}(a, b)$. The output is the right evaluation morphism $\text{ev}_{a,b} : a \otimes \underline{\text{Hom}}(a, b) \rightarrow b$, i.e., the counit of the tensor hom adjunction.

1.6.6 ClosedMonoidalRightCoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalRightCoevaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(b, \underline{\text{Hom}}(a, a \otimes b))$.

The arguments are two objects a, b . The output is the right coevaluation morphism $\text{coev}_{a,b} : b \rightarrow \underline{\text{Hom}}(a, a \otimes b)$, i.e., the unit of the tensor hom adjunction.

1.6.7 ClosedMonoidalRightCoevaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalRightCoevaluationMorphismWithGivenRange(a, b, r) (operation)

Returns: a morphism in $\text{Hom}(b, r)$.

The arguments are two objects a, b and an object $r = \underline{\text{Hom}}(a, a \otimes b)$. The output is the right coevaluation morphism $\text{coev}_{a,b} : b \rightarrow \underline{\text{Hom}}(a, a \otimes b)$, i.e., the unit of the tensor hom adjunction.

1.6.8 TensorProductToInternalHomRightAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ TensorProductToInternalHomRightAdjunctMorphism(a, b, f) (operation)

Returns: a morphism in $\text{Hom}(b, \underline{\text{Hom}}(a, c))$.

The arguments are two objects a, b and a morphism $f : a \otimes b \rightarrow c$. The output is a morphism $g : b \rightarrow \underline{\text{Hom}}(a, c)$ corresponding to f under the tensor hom adjunction.

1.6.9 TensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ TensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom(a, b, f, i) (operation)

Returns: a morphism in $\text{Hom}(b, i)$.

The arguments are two objects a, b , a morphism $f : a \otimes b \rightarrow c$ and an object $i = \underline{\text{Hom}}(a, c)$. The output is a morphism $g : b \rightarrow i$ corresponding to f under the tensor hom adjunction.

1.6.10 TensorProductToInternalHomRightAdjunctionIsomorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ TensorProductToInternalHomRightAdjunctionIsomorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(H(a \otimes b, c), H(b, \underline{\text{Hom}}(a, c)))$.

The arguments are three objects a, b, c . The output is the tri-natural isomorphism $H(a \otimes b, c) \rightarrow H(b, \underline{\text{Hom}}(a, c))$ in the range category of the homomorphism structure H .

1.6.11 TensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ TensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are five objects s, a, b, c, r where $s = H(a \otimes b, c)$ and $r = H(b, \underline{\text{Hom}}(a, c))$. The output is the tri-natural isomorphism $s \rightarrow r$ in the range category of the homomorphism structure H .

1.6.12 InternalHomToTensorProductRightAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ InternalHomToTensorProductRightAdjunctMorphism(a, c, g) (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, c)$.

The arguments are two objects a, c and a morphism $g : b \rightarrow \underline{\text{Hom}}(a, c)$. The output is a morphism $f : a \otimes b \rightarrow c$ corresponding to g under the tensor hom adjunction.

1.6.13 InternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ InternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct(a, c, g, s) (operation)

Returns: a morphism in $\text{Hom}(s, c)$.

The arguments are two objects a, c , a morphism $g : b \rightarrow \underline{\text{Hom}}(a, c)$ and an object $s = a \otimes b$. The output is a morphism $f : s \rightarrow c$ corresponding to g under the tensor hom adjunction.

1.6.14 InternalHomToTensorProductRightAdjunctionIsomorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ InternalHomToTensorProductRightAdjunctionIsomorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(H(b, \underline{\text{Hom}}(a, c)), H(a \otimes b, c))$.

The arguments are three objects a, b, c . The output is the tri-natural isomorphism $H(b, \underline{\text{Hom}}(a, c)) \rightarrow H(a \otimes b, c)$ in the range category of the homomorphism structure H .

1.6.15 InternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ InternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are five objects s, a, b, c, r where $s = H(b, \underline{\text{Hom}}(a, c))$ and $r = H(a \otimes b, c)$. The output is the tri-natural isomorphism $s \rightarrow r$ in the range category of the homomorphism structure H .

1.6.16 ClosedMonoidalLeftEvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalLeftEvaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, b) \otimes a, b)$.

The arguments are two objects a, b . The output is the left evaluation morphism $\text{ev}_{a,b} : \underline{\text{Hom}}(a, b) \otimes a \rightarrow b$, i.e., the counit of the tensor hom adjunction.

1.6.17 ClosedMonoidalLeftEvaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalLeftEvaluationMorphismWithGivenSource(a, b, s) (operation)

Returns: a morphism in $\text{Hom}(s, b)$.

The arguments are two objects a, b and an object $s = \underline{\text{Hom}}(a, b) \otimes a$. The output is the left evaluation morphism $\text{ev}_{a,b} : \underline{\text{Hom}}(a, b) \otimes a \rightarrow b$, i.e., the counit of the tensor hom adjunction.

1.6.18 ClosedMonoidalLeftCoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalLeftCoevaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(b, \underline{\text{Hom}}(a, b \otimes a))$.

The arguments are two objects a, b . The output is the left coevaluation morphism $\text{coev}_{a,b} : b \rightarrow \underline{\text{Hom}}(a, b \otimes a)$, i.e., the unit of the tensor hom adjunction.

1.6.19 ClosedMonoidalLeftCoevaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ ClosedMonoidalLeftCoevaluationMorphismWithGivenRange(a, b, r) (operation)

Returns: a morphism in $\text{Hom}(b, r)$.

The arguments are two objects a, b and an object $r = \underline{\text{Hom}}(a, b \otimes a)$. The output is the left coevaluation morphism $\text{coev}_{a,b} : b \rightarrow \underline{\text{Hom}}(a, b \otimes a)$, i.e., the unit of the tensor hom adjunction.

1.6.20 TensorProductToInternalHomLeftAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ TensorProductToInternalHomLeftAdjunctMorphism(a, b, f) (operation)

Returns: a morphism in $\text{Hom}(a, \underline{\text{Hom}}(b, c))$.

The arguments are two objects a, b and a morphism $f : a \otimes b \rightarrow c$. The output is a morphism $g : a \rightarrow \underline{\text{Hom}}(b, c)$ corresponding to f under the tensor hom adjunction.

1.6.21 **TensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom** (for **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryMorphism**, **IsCapCategoryObject**)

▷ **TensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom**(a, b, f, i) (operation)

Returns: a morphism in $\text{Hom}(a, i)$.

The arguments are two objects a, b , a morphism $f : a \otimes b \rightarrow c$ and an object $i = \underline{\text{Hom}}(b, c)$. The output is a morphism $g : a \rightarrow i$ corresponding to f under the tensor hom adjunction.

1.6.22 **TensorProductToInternalHomLeftAdjunctionIsomorphism** (for **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryObject**)

▷ **TensorProductToInternalHomLeftAdjunctionIsomorphism**(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(H(a \otimes b, c), H(a, \underline{\text{Hom}}(b, c)))$.

The arguments are three objects a, b, c . The output is the tri-natural isomorphism $H(a \otimes b, c) \rightarrow H(a, \underline{\text{Hom}}(b, c))$ in the range category of the homomorphism structure H .

1.6.23 **TensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects** (for **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryObject**)

▷ **TensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects**(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are five objects s, a, b, c, r where $s = H(a \otimes b, c)$ and $r = H(a, \underline{\text{Hom}}(b, c))$. The output is the tri-natural isomorphism $s \rightarrow r$ in the range category of the homomorphism structure H .

1.6.24 **InternalHomToTensorProductLeftAdjunctMorphism** (for **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryMorphism**)

▷ **InternalHomToTensorProductLeftAdjunctMorphism**(b, c, g) (operation)

Returns: a morphism in $\text{Hom}(a \otimes b, c)$.

The arguments are two objects b, c and a morphism $g : a \rightarrow \underline{\text{Hom}}(b, c)$. The output is a morphism $f : a \otimes b \rightarrow c$ corresponding to g under the tensor hom adjunction.

1.6.25 **InternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct** (for **IsCapCategoryObject**, **IsCapCategoryObject**, **IsCapCategoryMorphism**, **IsCapCategoryObject**)

▷ **InternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct**(b, c, g, s) (operation)

Returns: a morphism in $\text{Hom}(s, c)$.

The arguments are two objects b, c , a morphism $g : a \rightarrow \underline{\text{Hom}}(b, c)$ and an object $s = a \otimes b$. The output is a morphism $f : s \rightarrow c$ corresponding to g under the tensor hom adjunction.

1.6.26 InternalHomToTensorProductLeftAdjunctionIsomorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ InternalHomToTensorProductLeftAdjunctionIsomorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(H(a, \underline{\text{Hom}}(b, c)), H(a \otimes b, c))$.

The arguments are three objects a, b, c . The output is the tri-natural isomorphism $H(a, \underline{\text{Hom}}(b, c)) \rightarrow H(a \otimes b, c)$ in the range category of the homomorphism structure H .

1.6.27 InternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ InternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are five objects s, a, b, c, r where $s = H(a, \underline{\text{Hom}}(b, c))$ and $r = H(a \otimes b, c)$. The output is the tri-natural isomorphism $s \rightarrow r$ in the range category of the homomorphism structure H .

1.6.28 MonoidalPreComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPreComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, b) \otimes \underline{\text{Hom}}(b, c), \underline{\text{Hom}}(a, c))$.

The arguments are three objects a, b, c . The output is the precomposition morphism $\text{MonoidalPreComposeMorphism}_{a,b,c} : \underline{\text{Hom}}(a, b) \otimes \underline{\text{Hom}}(b, c) \rightarrow \underline{\text{Hom}}(a, c)$.

1.6.29 MonoidalPreComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPreComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{Hom}}(a, b) \otimes \underline{\text{Hom}}(b, c)$, three objects a, b, c , and an object $r = \underline{\text{Hom}}(a, c)$. The output is the precomposition morphism $\text{MonoidalPreComposeMorphismWithGivenObjects}_{a,b,c} : \underline{\text{Hom}}(a, b) \otimes \underline{\text{Hom}}(b, c) \rightarrow \underline{\text{Hom}}(a, c)$.

1.6.30 MonoidalPostComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPostComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(b, c) \otimes \underline{\text{Hom}}(a, b), \underline{\text{Hom}}(a, c))$.

The arguments are three objects a, b, c . The output is the postcomposition morphism $\text{MonoidalPostComposeMorphism}_{a,b,c} : \underline{\text{Hom}}(b, c) \otimes \underline{\text{Hom}}(a, b) \rightarrow \underline{\text{Hom}}(a, c)$.

1.6.31 MonoidalPostComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPostComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{Hom}}(b, c) \otimes \underline{\text{Hom}}(a, b)$, three objects a, b, c , and an object $r = \underline{\text{Hom}}(a, c)$. The output is the postcomposition morphism $\text{MonoidalPostComposeMorphismWithGivenObjects}_{a,b,c} : \underline{\text{Hom}}(b, c) \otimes \underline{\text{Hom}}(a, b) \rightarrow \underline{\text{Hom}}(a, c)$.

1.6.32 DualOnObjects (for IsCapCategoryObject)

▷ DualOnObjects(a) (attribute)

Returns: an object

The argument is an object a . The output is its dual object a^\vee .

1.6.33 DualOnMorphisms (for IsCapCategoryMorphism)

▷ DualOnMorphisms(α) (attribute)

Returns: a morphism in $\text{Hom}(b^\vee, a^\vee)$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is its dual morphism $\alpha^\vee : b^\vee \rightarrow a^\vee$.

1.6.34 DualOnMorphismsWithGivenDuals (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ DualOnMorphismsWithGivenDuals(s, α, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The argument is an object $s = b^\vee$, a morphism $\alpha : a \rightarrow b$, and an object $r = a^\vee$. The output is the dual morphism $\alpha^\vee : b^\vee \rightarrow a^\vee$.

1.6.35 EvaluationForDual (for IsCapCategoryObject)

▷ EvaluationForDual(a) (attribute)

Returns: a morphism in $\text{Hom}(a^\vee \otimes a, 1)$.

The argument is an object a . The output is the evaluation morphism $\text{ev}_a : a^\vee \otimes a \rightarrow 1$.

1.6.36 EvaluationForDualWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ EvaluationForDualWithGivenTensorProduct(s, a, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = a^\vee \otimes a$, an object a , and an object $r = 1$. The output is the evaluation morphism $\text{ev}_a : a^\vee \otimes a \rightarrow 1$.

1.6.37 MorphismToBidual (for IsCapCategoryObject)

▷ MorphismToBidual(a) (attribute)

Returns: a morphism in $\text{Hom}(a, (a^\vee)^\vee)$.

The argument is an object a . The output is the morphism to the bidual $a \rightarrow (a^\vee)^\vee$.

1.6.38 MorphismToBidualWithGivenBidual (for IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismToBidualWithGivenBidual(a, r)` (operation)

Returns: a morphism in $\text{Hom}(a, r)$.

The arguments are an object a , and an object $r = (a^\vee)^\vee$. The output is the morphism to the bidual $a \rightarrow (a^\vee)^\vee$.

1.6.39 TensorProductInternalHomCompatibilityMorphism (for IsList)

▷ `TensorProductInternalHomCompatibilityMorphism(list)` (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b'), \underline{\text{Hom}}(a \otimes b, a' \otimes b'))$.

The argument is a list of four objects $[a, a', b, b']$. The output is the natural morphism $\text{TensorProductInternalHomCompatibilityMorphism}_{a, a', b, b'} : \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b') \rightarrow \underline{\text{Hom}}(a \otimes b, a' \otimes b')$.

1.6.40 TensorProductInternalHomCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject)

▷ `TensorProductInternalHomCompatibilityMorphismWithGivenObjects(s, list, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are a list of four objects $[a, a', b, b']$, and two objects $s = \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b')$ and $r = \underline{\text{Hom}}(a \otimes b, a' \otimes b')$. The output is the natural morphism $\text{TensorProductInternalHomCompatibilityMorphismWithGivenObjects}_{a, a', b, b'} : \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b') \rightarrow \underline{\text{Hom}}(a \otimes b, a' \otimes b')$.

1.6.41 TensorProductDualityCompatibilityMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ `TensorProductDualityCompatibilityMorphism(a, b)` (operation)

Returns: a morphism in $\text{Hom}(a^\vee \otimes b^\vee, (a \otimes b)^\vee)$.

The arguments are two objects a, b . The output is the natural morphism $\text{TensorProductDualityCompatibilityMorphism} : a^\vee \otimes b^\vee \rightarrow (a \otimes b)^\vee$.

1.6.42 TensorProductDualityCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `TensorProductDualityCompatibilityMorphismWithGivenObjects(s, a, b, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = a^\vee \otimes b^\vee$, two objects a, b , and an object $r = (a \otimes b)^\vee$. The output is the natural morphism $\text{TensorProductDualityCompatibilityMorphismWithGivenObjects}_{a, b} : a^\vee \otimes b^\vee \rightarrow (a \otimes b)^\vee$.

1.6.43 MorphismFromTensorProductToInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismFromTensorProductToInternalHom(a, b)` (operation)

Returns: a morphism in $\text{Hom}(a^\vee \otimes b, \underline{\text{Hom}}(a, b))$.

The arguments are two objects a, b . The output is the natural morphism $\text{MorphismFromTensorProductToInternalHom}_{a,b} : a^\vee \otimes b \rightarrow \underline{\text{Hom}}(a, b)$.

1.6.44 MorphismFromTensorProductToInternalHomWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismFromTensorProductToInternalHomWithGivenObjects(s, a, b, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = a^\vee \otimes b$, two objects a, b , and an object $r = \underline{\text{Hom}}(a, b)$. The output is the natural morphism $\text{MorphismFromTensorProductToInternalHomWithGivenObjects}_{a,b} : a^\vee \otimes b \rightarrow \underline{\text{Hom}}(a, b)$.

1.6.45 IsomorphismFromDualObjectToInternalHomIntoTensorUnit (for IsCapCategoryObject)

▷ `IsomorphismFromDualObjectToInternalHomIntoTensorUnit(a)` (attribute)

Returns: a morphism in $\text{Hom}(a^\vee, \underline{\text{Hom}}(a, 1))$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromDualObjectToInternalHomIntoTensorUnit}_a : a^\vee \rightarrow \underline{\text{Hom}}(a, 1)$.

1.6.46 IsomorphismFromInternalHomIntoTensorUnitToDualObject (for IsCapCategoryObject)

▷ `IsomorphismFromInternalHomIntoTensorUnitToDualObject(a)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, 1), a^\vee)$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromInternalHomIntoTensorUnitToDualObject}_a : \underline{\text{Hom}}(a, 1) \rightarrow a^\vee$.

1.6.47 UniversalPropertyOfDual (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `UniversalPropertyOfDual(t, a, alpha)` (operation)

Returns: a morphism in $\text{Hom}(t, a^\vee)$.

The arguments are two objects t, a , and a morphism $\alpha : t \otimes a \rightarrow 1$. The output is the morphism $t \rightarrow a^\vee$ given by the universal property of a^\vee .

1.6.48 LambdaIntroduction (for IsCapCategoryMorphism)

▷ `LambdaIntroduction(alpha)` (attribute)

Returns: a morphism in $\text{Hom}(1, \underline{\text{Hom}}(a, b))$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is the corresponding morphism $1 \rightarrow \underline{\text{Hom}}(a, b)$ under the tensor hom adjunction.

1.6.49 LambdaElimination (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `LambdaElimination(a, b, alpha)` (operation)

Returns: a morphism in $\text{Hom}(a, b)$.

The arguments are two objects a, b , and a morphism $\alpha : 1 \rightarrow \underline{\text{Hom}}(a, b)$. The output is a morphism $a \rightarrow b$ corresponding to α under the tensor hom adjunction.

1.6.50 IsomorphismFromObjectToInternalHom (for IsCapCategoryObject)

▷ `IsomorphismFromObjectToInternalHom(a)` (attribute)

Returns: a morphism in $\text{Hom}(a, \underline{\text{Hom}}(1, a))$.

The argument is an object a . The output is the natural isomorphism $a \rightarrow \underline{\text{Hom}}(1, a)$.

1.6.51 IsomorphismFromObjectToInternalHomWithGivenInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromObjectToInternalHomWithGivenInternalHom(a, r)` (operation)

Returns: a morphism in $\text{Hom}(a, r)$.

The argument is an object a , and an object $r = \underline{\text{Hom}}(1, a)$. The output is the natural isomorphism $a \rightarrow \underline{\text{Hom}}(1, a)$.

1.6.52 IsomorphismFromInternalHomToObject (for IsCapCategoryObject)

▷ `IsomorphismFromInternalHomToObject(a)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(1, a), a)$.

The argument is an object a . The output is the natural isomorphism $\underline{\text{Hom}}(1, a) \rightarrow a$.

1.6.53 IsomorphismFromInternalHomToObjectWithGivenInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromInternalHomToObjectWithGivenInternalHom(a, s)` (operation)

Returns: a morphism in $\text{Hom}(s, a)$.

The argument is an object a , and an object $s = \underline{\text{Hom}}(1, a)$. The output is the natural isomorphism $\underline{\text{Hom}}(1, a) \rightarrow a$.

1.7 Left Coclosed Monoidal Categories

A monoidal category \mathbf{C} which has for each functor $- \otimes b : \mathbf{C} \rightarrow \mathbf{C}$ a left adjoint (denoted by $\underline{\text{coHom}}(-, b)$) is called a *left coclosed monoidal category*.

If no operations involving left coduals are installed manually, the left codual objects will be derived as $a_\vee := \underline{\text{coHom}}(1, a)$.

The corresponding GAP property is called `IsLeftCoclosedMonoidalCategory`.

1.7.1 LeftInternalCoHomOnObjects (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftInternalCoHomOnObjects(a, b) (operation)

Returns: an object

The arguments are two objects a, b . The output is the internal cohom object $\underline{\text{coHom}}_\ell(a, b)$.

1.7.2 LeftInternalCoHomOnMorphisms (for IsCapCategoryMorphism, IsCapCategoryMorphism)

▷ LeftInternalCoHomOnMorphisms(α, β) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(a, b'), \underline{\text{coHom}}_\ell(a', b))$

The arguments are two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$. The output is the internal cohom morphism $\underline{\text{coHom}}_\ell(\alpha, \beta) : \underline{\text{coHom}}_\ell(a, b') \rightarrow \underline{\text{coHom}}_\ell(a', b)$.

1.7.3 LeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryMorphism, IsCapCategoryObject)

▷ LeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms(s, α, β, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$

The arguments are an object $s = \underline{\text{coHom}}_\ell(a, b')$, two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$, and an object $r = \underline{\text{coHom}}_\ell(a', b)$. The output is the internal cohom morphism $\underline{\text{coHom}}_\ell(\alpha, \beta) : \underline{\text{coHom}}_\ell(a, b') \rightarrow \underline{\text{coHom}}_\ell(a', b)$.

1.7.4 LeftCoclosedMonoidalEvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalEvaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(b, \underline{\text{coHom}}_\ell(b, a) \otimes a)$.

The arguments are two objects a, b . The output is the coclosed evaluation morphism $\text{coclev}_{a,b} : b \rightarrow \underline{\text{coHom}}_\ell(b, a) \otimes a$, i.e., the unit of the cohom tensor adjunction.

1.7.5 LeftCoclosedMonoidalEvaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalEvaluationMorphismWithGivenRange(a, b, r) (operation)

Returns: a morphism in $\text{Hom}(b, r)$.

The arguments are two objects a, b and an object $r = \underline{\text{coHom}}_\ell(b, a) \otimes a$. The output is the coclosed evaluation morphism $\text{coclev}_{a,b} : b \rightarrow \underline{\text{coHom}}_\ell(b, a) \otimes a$, i.e., the unit of the cohom tensor adjunction.

1.7.6 LeftCoclosedMonoidalCoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalCoevaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(b \otimes a, a), b)$.

The arguments are two objects a, b . The output is the coclosed coevaluation morphism $\text{coclcoev}_{a,b} : \underline{\text{coHom}}_\ell(b \otimes a, a) \rightarrow b$, i.e., the counit of the cohom tensor adjunction.

1.7.7 LeftCoclosedMonoidalCoevaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `LeftCoclosedMonoidalCoevaluationMorphismWithGivenSource(a, b, s)` (operation)
Returns: a morphism in $\text{Hom}(s, b)$.

The arguments are two objects a, b and an object $s = \underline{\text{coHom}}_\ell(b \otimes a, a)$. The output is the coclosed coevaluation morphism $\text{coclcoev}_{a,b} : \underline{\text{coHom}}_\ell(b \otimes a, a) \rightarrow b$, i.e., the unit of the cohom tensor adjunction.

1.7.8 TensorProductToLeftInternalCoHomAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `TensorProductToLeftInternalCoHomAdjunctMorphism(b, c, g)` (operation)
Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(a, c), b)$.

The arguments are two objects b, c and a morphism $g : a \rightarrow b \otimes c$. The output is a morphism $f : \underline{\text{coHom}}_\ell(a, c) \rightarrow b$ corresponding to g under the cohom tensor adjunction.

1.7.9 TensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ `TensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom(b, c, g, i)` (operation)
Returns: a morphism in $\text{Hom}(i, b)$.

The arguments are two objects b, c , a morphism $g : a \rightarrow b \otimes c$ and an object $i = \underline{\text{coHom}}_\ell(a, c)$. The output is a morphism $f : \underline{\text{coHom}}_\ell(a, c) \rightarrow b$ corresponding to g under the cohom tensor adjunction.

1.7.10 LeftInternalCoHomToTensorProductAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `LeftInternalCoHomToTensorProductAdjunctMorphism(a, c, f)` (operation)
Returns: a morphism in $\text{Hom}(a, b \otimes c)$.

The arguments are two objects a, c and a morphism $f : \underline{\text{coHom}}_\ell(a, c) \rightarrow b$. The output is a morphism $g : a \rightarrow b \otimes c$ corresponding to f under the cohom tensor adjunction.

1.7.11 LeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ `LeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct(a, c, f, t)` (operation)
Returns: a morphism in $\text{Hom}(a, t)$.

The arguments are two objects a, c , a morphism $f : \underline{\text{coHom}}_\ell(a, c) \rightarrow b$ and an object $t = b \otimes c$. The output is a morphism $g : a \rightarrow b \otimes c$ corresponding to f under the cohom tensor adjunction.

1.7.12 LeftCoclosedMonoidalPreCoComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalPreCoComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\text{coHom}_\ell(a, c), \text{coHom}_\ell(b, c) \otimes \text{coHom}_\ell(a, b))$.

The arguments are three objects a, b, c . The output is the precocomposition morphism $\text{LeftCoclosedMonoidalPreCoComposeMorphism}_{a,b,c} : \text{coHom}_\ell(a, c) \rightarrow \text{coHom}_\ell(b, c) \otimes \text{coHom}_\ell(a, b)$.

1.7.13 LeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \text{coHom}_\ell(a, c)$, three objects a, b, c , and an object $r = \text{coHom}_\ell(a, b) \otimes \text{coHom}_\ell(b, c)$. The output is the precocomposition morphism $\text{LeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects}_{a,b,c} : \text{coHom}_\ell(a, c) \rightarrow \text{coHom}_\ell(b, c) \otimes \text{coHom}_\ell(a, b)$.

1.7.14 LeftCoclosedMonoidalPostCoComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalPostCoComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\text{coHom}_\ell(a, c), \text{coHom}_\ell(a, b) \otimes \text{coHom}_\ell(b, c))$.

The arguments are three objects a, b, c . The output is the postcocomposition morphism $\text{LeftCoclosedMonoidalPostCoComposeMorphism}_{a,b,c} : \text{coHom}_\ell(a, c) \rightarrow \text{coHom}_\ell(a, b) \otimes \text{coHom}_\ell(b, c)$.

1.7.15 LeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ LeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \text{coHom}_\ell(a, c)$, three objects a, b, c , and an object $r = \text{coHom}_\ell(b, c) \otimes \text{coHom}_\ell(a, b)$. The output is the postcocomposition morphism $\text{LeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects}_{a,b,c} : \text{coHom}_\ell(a, c) \rightarrow \text{coHom}_\ell(a, b) \otimes \text{coHom}_\ell(b, c)$.

1.7.16 LeftCoDualOnObjects (for IsCapCategoryObject)

▷ LeftCoDualOnObjects(a) (attribute)

Returns: an object

The argument is an object a . The output is its codual object a_\vee .

1.7.17 LeftCoDualOnMorphisms (for IsCapCategoryMorphism)

▷ `LeftCoDualOnMorphisms(alpha)` (attribute)

Returns: a morphism in $\text{Hom}(b_\vee, a_\vee)$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is its codual morphism $\alpha_\vee : b_\vee \rightarrow a_\vee$.

1.7.18 LeftCoDualOnMorphismsWithGivenLeftCoDuals (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ `LeftCoDualOnMorphismsWithGivenLeftCoDuals(s, alpha, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The argument is an object $s = b_\vee$, a morphism $\alpha : a \rightarrow b$, and an object $r = a_\vee$. The output is the dual morphism $\alpha_\vee : b^\vee \rightarrow a^\vee$.

1.7.19 LeftCoclosedMonoidalEvaluationForLeftCoDual (for IsCapCategoryObject)

▷ `LeftCoclosedMonoidalEvaluationForLeftCoDual(a)` (attribute)

Returns: a morphism in $\text{Hom}(1, a_\vee \otimes a)$.

The argument is an object a . The output is the coclosed evaluation morphism $\text{coclev}_a : 1 \rightarrow a_\vee \otimes a$.

1.7.20 LeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `LeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct(s, a, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = 1$, an object a , and an object $r = a_\vee \otimes a$. The output is the coclosed evaluation morphism $\text{coclev}_a : 1 \rightarrow a_\vee \otimes a$.

1.7.21 MorphismFromLeftCoBidual (for IsCapCategoryObject)

▷ `MorphismFromLeftCoBidual(a)` (attribute)

Returns: a morphism in $\text{Hom}((a_\vee)_\vee, a)$.

The argument is an object a . The output is the morphism from the cobidual $(a_\vee)_\vee \rightarrow a$.

1.7.22 MorphismFromLeftCoBidualWithGivenLeftCoBidual (for IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismFromLeftCoBidualWithGivenLeftCoBidual(a, s)` (operation)

Returns: a morphism in $\text{Hom}(s, a)$.

The arguments are an object a , and an object $s = (a_\vee)_\vee$. The output is the morphism from the cobidual $(a_\vee)_\vee \rightarrow a$.

1.7.23 LeftInternalCoHomTensorProductCompatibilityMorphism (for IsList)

▷ `LeftInternalCoHomTensorProductCompatibilityMorphism(list)` (operation)

Returns: a morphism in $\text{Hom}(\text{coHom}_\ell(a \otimes a', b \otimes b'), \text{coHom}_\ell(a, b) \otimes \text{coHom}_\ell(a', b'))$.

The argument is a list of four objects $[a, a', b, b']$. The output is the natural morphism $\text{LeftInternalCoHomTensorProductCompatibilityMorphism}_{a, a', b, b'} : \underline{\text{coHom}}_\ell(a \otimes a', b \otimes b') \rightarrow \underline{\text{coHom}}_\ell(a, b) \otimes \underline{\text{coHom}}_\ell(a', b')$.

1.7.24 LeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject)

▷ $\text{LeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects}(s, \text{list}, r)$ (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are a list of four objects $[a, a', b, b']$, and two objects $s = \underline{\text{coHom}}_\ell(a \otimes a', b \otimes b')$ and $r = \underline{\text{coHom}}_\ell(a, b) \otimes \underline{\text{coHom}}_\ell(a', b')$. The output is the natural morphism $\text{LeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects}_{a, a', b, b'} : \underline{\text{coHom}}_\ell(a \otimes a', b \otimes b') \rightarrow \underline{\text{coHom}}_\ell(a, b) \otimes \underline{\text{coHom}}_\ell(a', b')$.

1.7.25 LeftCoDualityTensorProductCompatibilityMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{LeftCoDualityTensorProductCompatibilityMorphism}(a, b)$ (operation)

Returns: a morphism in $\text{Hom}((a \otimes b)_\vee, a_\vee \otimes b_\vee)$.

The arguments are two objects a, b . The output is the natural morphism $\text{LeftCoDualityTensorProductCompatibilityMorphism} : (a \otimes b)_\vee \rightarrow a_\vee \otimes b_\vee$.

1.7.26 LeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{LeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects}(s, a, b, r)$ (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = (a \otimes b)_\vee$, two objects a, b , and an object $r = a_\vee \otimes b_\vee$. The output is the natural morphism $\text{LeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects}_{a, b} : (a \otimes b)_\vee \rightarrow a_\vee \otimes b_\vee$.

1.7.27 MorphismFromLeftInternalCoHomToTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{MorphismFromLeftInternalCoHomToTensorProduct}(a, b)$ (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(a, b), b_\vee \otimes a)$.

The arguments are two objects a, b . The output is the natural morphism $\text{MorphismFromLeftInternalCoHomToTensorProduct}_{a, b} : \underline{\text{coHom}}_\ell(a, b) \rightarrow b_\vee \otimes a$.

1.7.28 MorphismFromLeftInternalCoHomToTensorProductWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{MorphismFromLeftInternalCoHomToTensorProductWithGivenObjects}(s, a, b, r)$ (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{coHom}}_\ell(a, b)$, two objects a, b , and an object $r = b_\vee \otimes a$. The output is the natural morphism $\text{MorphismFromLeftInternalCoHomToTensorProductWithGivenObjects}_{a,b} : \underline{\text{coHom}}_\ell(a, b) \rightarrow a \otimes b_\vee$.

1.7.29 IsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit (for IsCapCategoryObject)

▷ `IsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit(a)` (attribute)

Returns: a morphism in $\text{Hom}(a_\vee, \underline{\text{coHom}}_\ell(1, a))$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit}_a : a_\vee \rightarrow \underline{\text{coHom}}_\ell(1, a)$.

1.7.30 IsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject (for IsCapCategoryObject)

▷ `IsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject(a)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(1, a), a_\vee)$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject}_a : \underline{\text{coHom}}_\ell(1, a) \rightarrow a_\vee$.

1.7.31 UniversalPropertyOfLeftCoDual (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `UniversalPropertyOfLeftCoDual(t, a, alpha)` (operation)

Returns: a morphism in $\text{Hom}(a_\vee, t)$.

The arguments are two objects t, a , and a morphism $\alpha : 1 \rightarrow t \otimes a$. The output is the morphism $a_\vee \rightarrow t$ given by the universal property of a_\vee .

1.7.32 LeftCoclosedMonoidalLambdaIntroduction (for IsCapCategoryMorphism)

▷ `LeftCoclosedMonoidalLambdaIntroduction(alpha)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(a, b), 1)$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is the corresponding morphism $\underline{\text{coHom}}_\ell(a, b) \rightarrow 1$ under the cohom tensor adjunction.

1.7.33 LeftCoclosedMonoidalLambdaElimination (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `LeftCoclosedMonoidalLambdaElimination(a, b, alpha)` (operation)

Returns: a morphism in $\text{Hom}(a, b)$.

The arguments are two objects a, b , and a morphism $\alpha : \underline{\text{coHom}}_\ell(a, b) \rightarrow 1$. The output is a morphism $a \rightarrow b$ corresponding to α under the cohom tensor adjunction.

1.7.34 IsomorphismFromObjectToLeftInternalCoHom (for IsCapCategoryObject)

▷ `IsomorphismFromObjectToLeftInternalCoHom(a)` (attribute)

Returns: a morphism in $\text{Hom}(a, \underline{\text{coHom}}_\ell(a, 1))$.

The argument is an object a . The output is the natural isomorphism $a \rightarrow \underline{\text{coHom}}_\ell(a, 1)$.

1.7.35 IsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom(a, r)` (operation)

Returns: a morphism in $\text{Hom}(a, r)$.

The argument is an object a , and an object $r = \underline{\text{coHom}}_\ell(a, 1)$. The output is the natural isomorphism $a \rightarrow \underline{\text{coHom}}_\ell(a, 1)$.

1.7.36 IsomorphismFromLeftInternalCoHomToObject (for IsCapCategoryObject)

▷ `IsomorphismFromLeftInternalCoHomToObject(a)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}_\ell(a, 1), a)$.

The argument is an object a . The output is the natural isomorphism $\underline{\text{coHom}}_\ell(a, 1) \rightarrow a$.

1.7.37 IsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom(a, s)` (operation)

Returns: a morphism in $\text{Hom}(s, a)$.

The argument is an object a , and an object $s = \underline{\text{coHom}}_\ell(a, 1)$. The output is the natural isomorphism $\underline{\text{coHom}}_\ell(a, 1) \rightarrow a$.

1.8 Coclosed Monoidal Categories

A monoidal category \mathbf{C} which has for each functor $- \otimes b : \mathbf{C} \rightarrow \mathbf{C}$ a left adjoint (denoted by $\underline{\text{coHom}}(-, b)$) is called a *coclosed monoidal category*.

If no operations involving coduals are installed manually, the codual objects will be derived as $a_\vee := \underline{\text{coHom}}(1, a)$.

The corresponding GAP property is called `IsCoclosedMonoidalCategory`.

1.8.1 InternalCoHomOnObjects (for IsCapCategoryObject, IsCapCategoryObject)

▷ `InternalCoHomOnObjects(a, b)` (operation)

Returns: an object

The arguments are two objects a, b . The output is the internal cohom object $\underline{\text{coHom}}(a, b)$.

1.8.2 InternalCoHomOnMorphisms (for IsCapCategoryMorphism, IsCapCategoryMorphism)

▷ `InternalCoHomOnMorphisms(alpha, beta)` (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, b'), \underline{\text{coHom}}(a', b))$

The arguments are two morphisms $\alpha : a \rightarrow a', \beta : b \rightarrow b'$. The output is the internal cohom morphism $\underline{\text{coHom}}(\alpha, \beta) : \underline{\text{coHom}}(a, b') \rightarrow \underline{\text{coHom}}(a', b)$.

1.8.3 InternalCoHomOnMorphismsWithGivenInternalCoHoms (for IsCapCategory-Object, IsCapCategoryMorphism, IsCapCategoryMorphism, IsCapCategory-Object)

▷ InternalCoHomOnMorphismsWithGivenInternalCoHoms(s , α , β , r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$

The arguments are an object $s = \underline{\text{coHom}}(a, b')$, two morphisms $\alpha : a \rightarrow a'$, $\beta : b \rightarrow b'$, and an object $r = \underline{\text{coHom}}(a', b)$. The output is the internal cohom morphism $\underline{\text{coHom}}(\alpha, \beta) : \underline{\text{coHom}}(a, b') \rightarrow \underline{\text{coHom}}(a', b)$.

1.8.4 CoclosedMonoidalRightEvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalRightEvaluationMorphism(a , b) (operation)

Returns: a morphism in $\text{Hom}(b, a \otimes \underline{\text{coHom}}(b, a))$.

The arguments are two objects a, b . The output is the coclosed right evaluation morphism $\text{coclev}_{a,b} : b \rightarrow a \otimes \underline{\text{coHom}}(b, a)$, i.e., the unit of the cohom tensor adjunction.

1.8.5 CoclosedMonoidalRightEvaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalRightEvaluationMorphismWithGivenRange(a , b , r) (operation)

Returns: a morphism in $\text{Hom}(b, r)$.

The arguments are two objects a, b and an object $r = a \otimes \underline{\text{coHom}}(b, a)$. The output is the coclosed right evaluation morphism $\text{coclev}_{a,b} : b \rightarrow a \otimes \underline{\text{coHom}}(b, a)$, i.e., the unit of the cohom tensor adjunction.

1.8.6 CoclosedMonoidalRightCoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalRightCoevaluationMorphism(a , b) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a \otimes b, a), b)$.

The arguments are two objects a, b . The output is the coclosed right coevaluation morphism $\text{coclcov}_{a,b} : \underline{\text{coHom}}(a \otimes b, a) \rightarrow b$, i.e., the counit of the cohom tensor adjunction.

1.8.7 CoclosedMonoidalRightCoevaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalRightCoevaluationMorphismWithGivenSource(a , b , s) (operation)

Returns: a morphism in $\text{Hom}(s, b)$.

The arguments are two objects a, b and an object $s = \underline{\text{coHom}}(a \otimes b, a)$. The output is the coclosed right coevaluation morphism $\text{coclcov}_{a,b} : \underline{\text{coHom}}(a \otimes b, a) \rightarrow b$, i.e., the unit of the cohom tensor adjunction.

1.8.8 TensorProductToInternalCoHomRightAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ TensorProductToInternalCoHomRightAdjunctMorphism(b, c, g) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, b), c)$.

The arguments are two objects b, c and a morphism $g : a \rightarrow b \otimes c$. The output is a morphism $f : \underline{\text{coHom}}(a, b) \rightarrow c$ corresponding to g under the cohom tensor adjunction.

1.8.9 TensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ TensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom(b, c, g, i) (operation)

Returns: a morphism in $\text{Hom}(i, c)$.

The arguments are two objects b, c , a morphism $g : a \rightarrow b \otimes c$ and an object $i = \underline{\text{coHom}}(a, b)$. The output is a morphism $f : \underline{\text{coHom}}(a, b) \rightarrow c$ corresponding to g under the cohom tensor adjunction.

1.8.10 InternalCoHomToTensorProductRightAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ InternalCoHomToTensorProductRightAdjunctMorphism(a, b, f) (operation)

Returns: a morphism in $\text{Hom}(a, b \otimes c)$.

The arguments are two objects a, b and a morphism $f : \underline{\text{coHom}}(a, b) \rightarrow c$. The output is a morphism $g : a \rightarrow b \otimes c$ corresponding to f under the cohom tensor adjunction.

1.8.11 InternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ InternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct(a, b, f, t) (operation)

Returns: a morphism in $\text{Hom}(a, t)$.

The arguments are two objects a, b , a morphism $f : \underline{\text{coHom}}(a, b) \rightarrow c$ and an object $t = b \otimes c$. The output is a morphism $g : a \rightarrow t$ corresponding to f under the cohom tensor adjunction.

1.8.12 CoclosedMonoidalLeftEvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalLeftEvaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(b, \underline{\text{coHom}}(b, a) \otimes a)$.

The arguments are two objects a, b . The output is the coclosed left evaluation morphism $\text{coclev}_{a,b} : b \rightarrow \underline{\text{coHom}}(b, a) \otimes a$, i.e., the unit of the cohom tensor adjunction.

1.8.13 CoclosedMonoidalLeftEvaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalLeftEvaluationMorphismWithGivenRange(a, b, r) (operation)

Returns: a morphism in $\text{Hom}(b, r)$.

The arguments are two objects a, b and an object $r = \underline{\text{coHom}}(b, a) \otimes a$. The output is the coclosed left evaluation morphism $\text{coclev}_{a,b} : b \rightarrow \underline{\text{coHom}}(b, a) \otimes a$, i.e., the unit of the cohom tensor adjunction.

1.8.14 CoclosedMonoidalLeftCoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalLeftCoevaluationMorphism(a, b) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(b \otimes a, a), b)$.

The arguments are two objects a, b . The output is the coclosed left coevaluation morphism $\text{coclcov}_{a,b} : \underline{\text{coHom}}(b \otimes a, a) \rightarrow b$, i.e., the counit of the cohom tensor adjunction.

1.8.15 CoclosedMonoidalLeftCoevaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedMonoidalLeftCoevaluationMorphismWithGivenSource(a, b, s) (operation)

Returns: a morphism in $\text{Hom}(s, b)$.

The arguments are two objects a, b and an object $s = \underline{\text{coHom}}(b \otimes a, a)$. The output is the coclosed left coevaluation morphism $\text{coclcov}_{a,b} : \underline{\text{coHom}}(b \otimes a, a) \rightarrow b$, i.e., the unit of the cohom tensor adjunction.

1.8.16 TensorProductToInternalCoHomLeftAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ TensorProductToInternalCoHomLeftAdjunctMorphism(b, c, g) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, c), b)$.

The arguments are two objects b, c and a morphism $g : a \rightarrow b \otimes c$. The output is a morphism $f : \underline{\text{coHom}}(a, c) \rightarrow b$ corresponding to g under the cohom tensor adjunction.

1.8.17 TensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ TensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom(b, c, g, i) (operation)

Returns: a morphism in $\text{Hom}(i, b)$.

The arguments are two objects b, c , a morphism $g : a \rightarrow b \otimes c$ and an object $i = \underline{\text{coHom}}(a, c)$. The output is a morphism $f : \underline{\text{coHom}}(a, c) \rightarrow b$ corresponding to g under the cohom tensor adjunction.

1.8.18 InternalCoHomToTensorProductLeftAdjunctMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ InternalCoHomToTensorProductLeftAdjunctMorphism(a, c, f) (operation)

Returns: a morphism in $\text{Hom}(a, b \otimes c)$.

The arguments are two objects a, c and a morphism $f : \underline{\text{coHom}}(a, c) \rightarrow b$. The output is a morphism $g : a \rightarrow b \otimes c$ corresponding to f under the cohom tensor adjunction.

1.8.19 InternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ InternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct(a, c, f, t) (operation)

Returns: a morphism in $\text{Hom}(a, t)$.

The arguments are two objects a, c , a morphism $f : \underline{\text{coHom}}(a, c) \rightarrow b$ and an object $t = b \otimes c$. The output is a morphism $g : a \rightarrow t$ corresponding to f under the cohom tensor adjunction.

1.8.20 MonoidalPreCoComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPreCoComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, c), \underline{\text{coHom}}(b, c) \otimes \underline{\text{coHom}}(a, b))$.

The arguments are three objects a, b, c . The output is the precocomposition morphism $\text{MonoidalPreCoComposeMorphism}_{a,b,c} : \underline{\text{coHom}}(a, c) \rightarrow \underline{\text{coHom}}(b, c) \otimes \underline{\text{coHom}}(a, b)$.

1.8.21 MonoidalPreCoComposeMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPreCoComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{coHom}}(a, c)$, three objects a, b, c , and an object $r = \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(b, c)$. The output is the precocomposition morphism $\text{MonoidalPreCoComposeMorphismWithGivenObjects}_{a,b,c} : \underline{\text{coHom}}(a, c) \rightarrow \underline{\text{coHom}}(b, c) \otimes \underline{\text{coHom}}(a, b)$.

1.8.22 MonoidalPostCoComposeMorphism (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPostCoComposeMorphism(a, b, c) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, c), \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(b, c))$.

The arguments are three objects a, b, c . The output is the postcocomposition morphism $\text{MonoidalPostCoComposeMorphism}_{a,b,c} : \underline{\text{coHom}}(a, c) \rightarrow \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(b, c)$.

1.8.23 MonoidalPostCoComposeMorphismWithGivenObjects (for IsCapCategory-Object, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MonoidalPostCoComposeMorphismWithGivenObjects(s, a, b, c, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \underline{\text{coHom}}(a, c)$, three objects a, b, c , and an object $r = \underline{\text{coHom}}(b, c) \otimes \underline{\text{coHom}}(a, b)$. The output is the postcomposition morphism $\text{MonoidalPostCoComposeMorphismWithGivenObjects}_{a,b,c} : \underline{\text{coHom}}(a, c) \rightarrow \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(b, c)$.

1.8.24 CoDualOnObjects (for IsCapCategoryObject)

▷ CoDualOnObjects(a) (attribute)

Returns: an object

The argument is an object a . The output is its codual object a_\vee .

1.8.25 CoDualOnMorphisms (for IsCapCategoryMorphism)

▷ CoDualOnMorphisms(α) (attribute)

Returns: a morphism in $\text{Hom}(b_\vee, a_\vee)$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is its codual morphism $\alpha_\vee : b_\vee \rightarrow a_\vee$.

1.8.26 CoDualOnMorphismsWithGivenCoDuals (for IsCapCategoryObject, IsCapCategoryMorphism, IsCapCategoryObject)

▷ CoDualOnMorphismsWithGivenCoDuals(s, α, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The argument is an object $s = b_\vee$, a morphism $\alpha : a \rightarrow b$, and an object $r = a_\vee$. The output is the dual morphism $\alpha_\vee : b^\vee \rightarrow a^\vee$.

1.8.27 CoclosedEvaluationForCoDual (for IsCapCategoryObject)

▷ CoclosedEvaluationForCoDual(a) (attribute)

Returns: a morphism in $\text{Hom}(1, a_\vee \otimes a)$.

The argument is an object a . The output is the coclosed evaluation morphism $\text{coclev}_a : 1 \rightarrow a_\vee \otimes a$.

1.8.28 CoclosedEvaluationForCoDualWithGivenTensorProduct (for IsCapCategory-Object, IsCapCategoryObject, IsCapCategoryObject)

▷ CoclosedEvaluationForCoDualWithGivenTensorProduct(s, a, r) (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = 1$, an object a , and an object $r = a_\vee \otimes a$. The output is the coclosed evaluation morphism $\text{coclev}_a : 1 \rightarrow a_\vee \otimes a$.

1.8.29 MorphismFromCoBidual (for IsCapCategoryObject)

▷ `MorphismFromCoBidual(a)` (attribute)

Returns: a morphism in $\text{Hom}((a_V)_V, a)$.

The argument is an object a . The output is the morphism from the cobidual $(a_V)_V \rightarrow a$.

1.8.30 MorphismFromCoBidualWithGivenCoBidual (for IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismFromCoBidualWithGivenCoBidual(a, s)` (operation)

Returns: a morphism in $\text{Hom}(s, a)$.

The arguments are an object a , and an object $s = (a_V)_V$. The output is the morphism from the cobidual $(a_V)_V \rightarrow a$.

1.8.31 InternalCoHomTensorProductCompatibilityMorphism (for IsList)

▷ `InternalCoHomTensorProductCompatibilityMorphism(list)` (operation)

Returns: a morphism in $\text{Hom}(\text{coHom}(a \otimes a', b \otimes b'), \text{coHom}(a, b) \otimes \text{coHom}(a', b'))$.

The argument is a list of four objects $[a, a', b, b']$. The output is the natural morphism $\text{InternalCoHomTensorProductCompatibilityMorphism}_{a, a', b, b'} : \text{coHom}(a \otimes a', b \otimes b') \rightarrow \text{coHom}(a, b) \otimes \text{coHom}(a', b')$.

1.8.32 InternalCoHomTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject)

▷ `InternalCoHomTensorProductCompatibilityMorphismWithGivenObjects(s, list, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are a list of four objects $[a, a', b, b']$, and two objects $s = \text{coHom}(a \otimes a', b \otimes b')$ and $r = \text{coHom}(a, b) \otimes \text{coHom}(a', b')$. The output is the natural morphism $\text{InternalCoHomTensorProductCompatibilityMorphismWithGivenObjects}_{a, a', b, b'} : \text{coHom}(a \otimes a', b \otimes b') \rightarrow \text{coHom}(a, b) \otimes \text{coHom}(a', b')$.

1.8.33 CoDualityTensorProductCompatibilityMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ `CoDualityTensorProductCompatibilityMorphism(a, b)` (operation)

Returns: a morphism in $\text{Hom}((a \otimes b)_V, a_V \otimes b_V)$.

The arguments are two objects a, b . The output is the natural morphism $\text{CoDualityTensorProductCompatibilityMorphism} : (a \otimes b)_V \rightarrow a_V \otimes b_V$.

1.8.34 CoDualityTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `CoDualityTensorProductCompatibilityMorphismWithGivenObjects(s, a, b, r)` (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = (a \otimes b)_V$, two objects a, b , and an object $r = a_V \otimes b_V$. The output is the natural morphism $\text{CoDualityTensorProductCompatibilityMorphismWithGivenObjects}_{a,b} : (a \otimes b)_V \rightarrow a_V \otimes b_V$.

1.8.35 MorphismFromInternalCoHomToTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{MorphismFromInternalCoHomToTensorProduct}(a, b)$ (operation)

Returns: a morphism in $\text{Hom}(\text{coHom}(a, b), b_V \otimes a)$.

The arguments are two objects a, b . The output is the natural morphism $\text{MorphismFromInternalCoHomToTensorProduct}_{a,b} : \text{coHom}(a, b) \rightarrow b_V \otimes a$.

1.8.36 MorphismFromInternalCoHomToTensorProductWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ $\text{MorphismFromInternalCoHomToTensorProductWithGivenObjects}(s, a, b, r)$ (operation)

Returns: a morphism in $\text{Hom}(s, r)$.

The arguments are an object $s = \text{coHom}(a, b)$, two objects a, b , and an object $r = b_V \otimes a$. The output is the natural morphism $\text{MorphismFromInternalCoHomToTensorProductWithGivenObjects}_{a,b} : \text{coHom}(a, b) \rightarrow a \otimes b_V$.

1.8.37 IsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit (for IsCapCategoryObject)

▷ $\text{IsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit}(a)$ (attribute)

Returns: a morphism in $\text{Hom}(a_V, \text{coHom}(1, a))$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit}_a : a_V \rightarrow \text{coHom}(1, a)$.

1.8.38 IsomorphismFromInternalCoHomFromTensorUnitToCoDualObject (for IsCapCategoryObject)

▷ $\text{IsomorphismFromInternalCoHomFromTensorUnitToCoDualObject}(a)$ (attribute)

Returns: a morphism in $\text{Hom}(\text{coHom}(1, a), a_V)$.

The argument is an object a . The output is the isomorphism $\text{IsomorphismFromInternalCoHomFromTensorUnitToCoDualObject}_a : \text{coHom}(1, a) \rightarrow a_V$.

1.8.39 UniversalPropertyOfCoDual (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ $\text{UniversalPropertyOfCoDual}(t, a, \alpha)$ (operation)

Returns: a morphism in $\text{Hom}(a_V, t)$.

The arguments are two objects t, a , and a morphism $\alpha : 1 \rightarrow t \otimes a$. The output is the morphism $a_V \rightarrow t$ given by the universal property of a_V .

1.8.40 CoLambdaIntroduction (for IsCapCategoryMorphism)

▷ `CoLambdaIntroduction(alpha)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, b), 1)$.

The argument is a morphism $\alpha : a \rightarrow b$. The output is the corresponding morphism $\underline{\text{coHom}}(a, b) \rightarrow 1$ under the cohom tensor adjunction.

1.8.41 CoLambdaElimination (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryMorphism)

▷ `CoLambdaElimination(a, b, alpha)` (operation)

Returns: a morphism in $\text{Hom}(a, b)$.

The arguments are two objects a, b , and a morphism $\alpha : \underline{\text{coHom}}(a, b) \rightarrow 1$. The output is a morphism $a \rightarrow b$ corresponding to α under the cohom tensor adjunction.

1.8.42 IsomorphismFromObjectToInternalCoHom (for IsCapCategoryObject)

▷ `IsomorphismFromObjectToInternalCoHom(a)` (attribute)

Returns: a morphism in $\text{Hom}(a, \underline{\text{coHom}}(a, 1))$.

The argument is an object a . The output is the natural isomorphism $a \rightarrow \underline{\text{coHom}}(a, 1)$.

1.8.43 IsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom(a, r)` (operation)

Returns: a morphism in $\text{Hom}(a, r)$.

The argument is an object a , and an object $r = \underline{\text{coHom}}(a, 1)$. The output is the natural isomorphism $a \rightarrow \underline{\text{coHom}}(a, 1)$.

1.8.44 IsomorphismFromInternalCoHomToObject (for IsCapCategoryObject)

▷ `IsomorphismFromInternalCoHomToObject(a)` (attribute)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, 1), a)$.

The argument is an object a . The output is the natural isomorphism $\underline{\text{coHom}}(a, 1) \rightarrow a$.

1.8.45 IsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom(a, s)` (operation)

Returns: a morphism in $\text{Hom}(s, a)$.

The argument is an object a , and an object $s = \underline{\text{coHom}}(a, 1)$. The output is the natural isomorphism $\underline{\text{coHom}}(a, 1) \rightarrow a$.

1.9 Symmetric Closed Monoidal Categories

A monoidal category \mathbf{C} which is symmetric and closed is called a *symmetric closed monoidal category*.

The corresponding GAP property is given by `IsSymmetricClosedMonoidalCategory`.

1.10 Symmetric Coclosed Monoidal Categories

A monoidal category \mathbf{C} which is symmetric and coclosed is called a *symmetric coclosed monoidal category*.

The corresponding GAP property is given by `IsSymmetricCoclosedMonoidalCategory`.

1.11 Rigid Symmetric Closed Monoidal Categories

A symmetric closed monoidal category \mathbf{C} satisfying

- the natural morphism

$\underline{\text{Hom}}_\ell(a, a') \otimes \underline{\text{Hom}}_\ell(b, b') \rightarrow \underline{\text{Hom}}_\ell(a \otimes b, a' \otimes b')$ is an isomorphism,

- the natural morphism

$a \rightarrow \underline{\text{Hom}}_\ell(\underline{\text{Hom}}_\ell(a, 1), 1)$ is an isomorphism is called a *rigid symmetric closed monoidal category*.

If no operations involving the closed structure are installed manually, the internal hom objects will be derived as $\underline{\text{Hom}}_\ell(a, b) := a^\vee \otimes b$ and, in particular, $\underline{\text{Hom}}_\ell(a, 1) := a^\vee \otimes 1$.

The corresponding GAP property is given by `IsRigidSymmetricClosedMonoidalCategory`.

1.11.1 IsomorphismFromTensorProductWithDualObjectToInternalHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromTensorProductWithDualObjectToInternalHom(a, b)` (operation)

Returns: a morphism in $\text{Hom}(a^\vee \otimes b, \underline{\text{Hom}}(a, b))$.

The arguments are two objects a, b . The output is the natural morphism $\text{IsomorphismFromTensorProductWithDualObjectToInternalHom}_{a,b} : a^\vee \otimes b \rightarrow \underline{\text{Hom}}(a, b)$.

1.11.2 IsomorphismFromInternalHomToTensorProductWithDualObject (for IsCapCategoryObject, IsCapCategoryObject)

▷ `IsomorphismFromInternalHomToTensorProductWithDualObject(a, b)` (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, b), a^\vee \otimes b)$.

The arguments are two objects a, b . The output is the inverse of `IsomorphismFromTensorProductWithDualObjectToInternalHom`, namely $\text{IsomorphismFromInternalHomToTensorProductWithDualObject}_{a,b} : \underline{\text{Hom}}(a, b) \rightarrow a^\vee \otimes b$.

1.11.3 MorphismFromInternalHomToTensorProduct (for IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismFromInternalHomToTensorProduct(a, b)` (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, b), a^\vee \otimes b)$.

The arguments are two objects a, b . The output is the inverse of `MorphismFromTensorProductToInternalHomWithGivenObjects`, namely $\text{MorphismFromInternalHomToTensorProductWithGivenObjects}_{a,b} : \underline{\text{Hom}}(a, b) \rightarrow a^\vee \otimes b$.

1.11.4 MorphismFromInternalHomToTensorProductWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MorphismFromInternalHomToTensorProductWithGivenObjects(s, a, b, r) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a, b), a^\vee \otimes b)$.

The arguments are an object $s = \underline{\text{Hom}}(a, b)$, two objects a, b , and an object $r = a^\vee \otimes b$. The output is the inverse of MorphismFromTensorProductToInternalHomWithGivenObjects, namely MorphismFromInternalHomToTensorProductWithGivenObjects $_{a,b} : \underline{\text{Hom}}(a, b) \rightarrow a^\vee \otimes b$.

1.11.5 TensorProductInternalHomCompatibilityMorphismInverse (for IsList)

▷ TensorProductInternalHomCompatibilityMorphismInverse($list$) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a \otimes b, a' \otimes b'), \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b'))$.

The argument is a list of four objects $[a, a', b, b']$. The output is the natural morphism TensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects $_{a,a',b,b'} : \underline{\text{Hom}}(a \otimes b, a' \otimes b') \rightarrow \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b')$.

1.11.6 TensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject)

▷ TensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects($s, list, r$) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{Hom}}(a \otimes b, a' \otimes b'), \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b'))$.

The arguments are a list of four objects $[a, a', b, b']$, and two objects $s = \underline{\text{Hom}}(a \otimes b, a' \otimes b')$ and $r = \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b')$. The output is the natural morphism TensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects $_{a,a',b,b'} : \underline{\text{Hom}}(a \otimes b, a' \otimes b') \rightarrow \underline{\text{Hom}}(a, a') \otimes \underline{\text{Hom}}(b, b')$.

1.11.7 CoevaluationForDual (for IsCapCategoryObject)

▷ CoevaluationForDual(a) (attribute)

Returns: a morphism in $\text{Hom}(1, a \otimes a^\vee)$.

The argument is an object a . The output is the coevaluation morphism $\text{coev}_a : 1 \rightarrow a \otimes a^\vee$.

1.11.8 CoevaluationForDualWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ CoevaluationForDualWithGivenTensorProduct(s, a, r) (operation)

Returns: a morphism in $\text{Hom}(1, a \otimes a^\vee)$.

The arguments are an object $s = 1$, an object a , and an object $r = a \otimes a^\vee$. The output is the coevaluation morphism $\text{coev}_a : 1 \rightarrow a \otimes a^\vee$.

1.11.9 TraceMap (for IsCapCategoryMorphism)

▷ TraceMap($alpha$) (attribute)

Returns: a morphism in $\text{Hom}(1, 1)$.

The argument is an endomorphism $\alpha : a \rightarrow a$. The output is the trace morphism $\text{trace}_\alpha : 1 \rightarrow 1$.

1.11.10 RankMorphism (for IsCapCategoryObject)

▷ RankMorphism(a) (attribute)

Returns: a morphism in $\text{Hom}(1, 1)$.

The argument is an object a . The output is the rank morphism $\text{rank}_a : 1 \rightarrow 1$.

1.11.11 MorphismFromBidual (for IsCapCategoryObject)

▷ MorphismFromBidual(a) (attribute)

Returns: a morphism in $\text{Hom}((a^\vee)^\vee, a)$.

The argument is an object a . The output is the inverse of the morphism to the bidual $(a^\vee)^\vee \rightarrow a$.

1.11.12 MorphismFromBidualWithGivenBidual (for IsCapCategoryObject, IsCapCategoryObject)

▷ MorphismFromBidualWithGivenBidual(a, s) (operation)

Returns: a morphism in $\text{Hom}((a^\vee)^\vee, a)$.

The argument is an object a , and an object $s = (a^\vee)^\vee$. The output is the inverse of the morphism to the bidual $(a^\vee)^\vee \rightarrow a$.

1.12 Rigid Symmetric Coclosed Monoidal Categories

A symmetric coclosed monoidal category \mathbf{C} satisfying

- the natural morphism

$\underline{\text{coHom}}(a \otimes a', b \otimes b') \rightarrow \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(a', b')$ is an isomorphism,

- the natural morphism

$\underline{\text{coHom}}(1, \underline{\text{coHom}}(1, a)) \rightarrow a$ is an isomorphism is called a *rigid symmetric coclosed monoidal category*.

If no operations involving the coclosed structure are installed manually, the internal cohom objects will be derived as $\underline{\text{coHom}}(a, b) := a \otimes b_\vee$ and, in particular, $\underline{\text{coHom}}(1, a) := 1 \otimes a_\vee$.

The corresponding GAP property is given by IsRigidSymmetricCoclosedMonoidalCategory.

1.12.1 IsomorphismFromInternalCoHomToTensorProductWithCoDualObject (for IsCapCategoryObject, IsCapCategoryObject)

▷ IsomorphismFromInternalCoHomToTensorProductWithCoDualObject(a, b) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, b), b_\vee \otimes a)$.

The arguments are two objects a, b . The output is the natural morphism $\text{IsomorphismFromInternalCoHomToTensorProductWithCoDualObjectWithGivenObjects}_{a,b} : \underline{\text{coHom}}(a, b) \rightarrow b_\vee \otimes a$.

1.12.2 IsomorphismFromTensorProductWithCoDualObjectToInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ IsomorphismFromTensorProductWithCoDualObjectToInternalCoHom(a, b) (operation)

Returns: a morphism in $\text{Hom}(a_{\vee} \otimes b, \underline{\text{coHom}}(b, a))$.

The arguments are two objects a, b . The output is the inverse of IsomorphismFromInternalCoHomToTensorProductWithCoDualObject, namely IsomorphismFromTensorProductWithCoDualObjectToInternalCoHom $_{a,b} : a_{\vee} \otimes b \rightarrow \underline{\text{coHom}}(b, a)$.

1.12.3 MorphismFromTensorProductToInternalCoHom (for IsCapCategoryObject, IsCapCategoryObject)

▷ MorphismFromTensorProductToInternalCoHom(a, b) (operation)

Returns: a morphism in $\text{Hom}(a_{\vee} \otimes b, \underline{\text{coHom}}(b, a))$.

The arguments are two objects a, b . The output is the inverse of MorphismFromInternalCoHomToTensorProductWithGivenObjects, namely MorphismFromTensorProductToInternalCoHomWithGivenObjects $_{a,b} : a_{\vee} \otimes b \rightarrow \underline{\text{coHom}}(b, a)$.

1.12.4 MorphismFromTensorProductToInternalCoHomWithGivenObjects (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ MorphismFromTensorProductToInternalCoHomWithGivenObjects(s, a, b, r) (operation)

Returns: a morphism in $\text{Hom}(a_{\vee} \otimes b, \underline{\text{coHom}}(b, a))$.

The arguments are an object $s_{\vee} = a \otimes b$, two objects a, b , and an object $r = \underline{\text{coHom}}(b, a)$. The output is the inverse of MorphismFromInternalCoHomToTensorProductWithGivenObjects, namely MorphismFromTensorProductToInternalCoHomWithGivenObjects $_{a,b} : a_{\vee} \otimes b \rightarrow \underline{\text{coHom}}(b, a)$.

1.12.5 InternalCoHomTensorProductCompatibilityMorphismInverse (for IsList)

▷ InternalCoHomTensorProductCompatibilityMorphismInverse($list$) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(a', b'), \underline{\text{coHom}}(a \otimes a', b \otimes b'))$.

The argument is a list of four objects $[a, a', b, b']$. The output is the natural morphism InternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects $_{a,a',b,b'} : \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(a', b') \rightarrow \underline{\text{coHom}}(a \otimes a', b \otimes b')$.

1.12.6 InternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects (for IsCapCategoryObject, IsList, IsCapCategoryObject)

▷ InternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects($s, list, r$) (operation)

Returns: a morphism in $\text{Hom}(\underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(a', b'), \underline{\text{coHom}}(a \otimes a', b \otimes b'))$.

The arguments are a list of four objects $[a, a', b, b']$, and two objects $s = \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(a', b')$ and $r = \underline{\text{coHom}}(a \otimes a', b \otimes b')$. The output is the natural morphism InternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects $_{a,a',b,b'} : \underline{\text{coHom}}(a, b) \otimes \underline{\text{coHom}}(a', b') \rightarrow \underline{\text{coHom}}(a \otimes a', b \otimes b')$.

1.12.7 CoclosedCoevaluationForCoDual (for IsCapCategoryObject)

▷ `CoclosedCoevaluationForCoDual(a)` (attribute)

Returns: a morphism in $\text{Hom}(a \otimes a_V, 1)$.

The argument is an object a . The output is the coclosed coevaluation morphism $\text{coclcov}_a : a \otimes a_V \rightarrow 1$.

1.12.8 CoclosedCoevaluationForCoDualWithGivenTensorProduct (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `CoclosedCoevaluationForCoDualWithGivenTensorProduct(s, a, r)` (operation)

Returns: a morphism in $\text{Hom}(a \otimes a_V, 1)$.

The arguments are an object $s = a \otimes a_V$, an object a , and an object $r = 1$. The output is the coclosed coevaluation morphism $\text{coclcov}_a : a \otimes a_V \rightarrow 1$.

1.12.9 CoTraceMap (for IsCapCategoryMorphism)

▷ `CoTraceMap(alpha)` (attribute)

Returns: a morphism in $\text{Hom}(1, 1)$.

The argument is an endomorphism $\alpha : a \rightarrow a$. The output is the cotrace morphism $\text{cotrace}_\alpha : 1 \rightarrow 1$.

1.12.10 CoRankMorphism (for IsCapCategoryObject)

▷ `CoRankMorphism(a)` (attribute)

Returns: a morphism in $\text{Hom}(1, 1)$.

The argument is an object a . The output is the corank morphism $\text{corank}_a : 1 \rightarrow 1$.

1.12.11 MorphismToCoBidual (for IsCapCategoryObject)

▷ `MorphismToCoBidual(a)` (attribute)

Returns: a morphism in $\text{Hom}(a, (a_V)_V)$.

The argument is an object a . The output is the inverse of the morphism from the cobidual $a \rightarrow (a_V)_V$.

1.12.12 MorphismToCoBidualWithGivenCoBidual (for IsCapCategoryObject, IsCapCategoryObject)

▷ `MorphismToCoBidualWithGivenCoBidual(a, r)` (operation)

Returns: a morphism in $\text{Hom}(a, (a_V)_V)$.

The argument is an object a , and an object $r = (a_V)_V$. The output is the inverse of the morphism from the cobidual $a \rightarrow (a_V)_V$.

1.13 Convenience Methods

1.13.1 InternalHom (for IsCapCategoryCell, IsCapCategoryCell)

▷ InternalHom(a, b) (operation)
Returns: a cell

This is a convenience method. The arguments are two cells a, b . The output is the internal hom cell. If a, b are two CAP objects the output is the internal Hom object $\underline{\text{Hom}}(a, b)$. If at least one of the arguments is a CAP morphism the output is a CAP morphism, namely the internal hom on morphisms, where any object is replaced by its identity morphism.

1.13.2 InternalCoHom (for IsCapCategoryCell, IsCapCategoryCell)

▷ InternalCoHom(a, b) (operation)
Returns: a cell

This is a convenience method. The arguments are two cells a, b . The output is the internal cohom cell. If a, b are two CAP objects the output is the internal cohom object $\underline{\text{coHom}}(a, b)$. If at least one of the arguments is a CAP morphism the output is a CAP morphism, namely the internal cohom on morphisms, where any object is replaced by its identity morphism.

1.13.3 LeftInternalHom (for IsCapCategoryCell, IsCapCategoryCell)

▷ LeftInternalHom(a, b) (operation)
Returns: a cell

This is a convenience method. The arguments are two cells a, b . The output is the internal hom cell. If a, b are two CAP objects the output is the internal Hom object $\underline{\text{Hom}}_\ell(a, b)$. If at least one of the arguments is a CAP morphism the output is a CAP morphism, namely the internal hom on morphisms, where any object is replaced by its identity morphism.

1.13.4 LeftInternalCoHom (for IsCapCategoryCell, IsCapCategoryCell)

▷ LeftInternalCoHom(a, b) (operation)
Returns: a cell

This is a convenience method. The arguments are two cells a, b . The output is the internal cohom cell. If a, b are two CAP objects the output is the internal cohom object $\underline{\text{coHom}}_\ell(a, b)$. If at least one of the arguments is a CAP morphism the output is a CAP morphism, namely the internal cohom on morphisms, where any object is replaced by its identity morphism.

1.14 Add-methods

1.14.1 AddLeftDistributivityExpanding (for IsCapCategory, IsFunction)

▷ AddLeftDistributivityExpanding(C, F) (operation)
 ▷ AddLeftDistributivityExpanding(C, F, weight) (operation)
Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftDistributivityExpanding. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational

complexity of the function (lower weight = less complex = faster execution). $F : (a, L) \mapsto \text{LeftDistributivityExpanding}(a, L)$.

1.14.2 AddLeftDistributivityExpandingWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ `AddLeftDistributivityExpandingWithGivenObjects(C, F)` (operation)
- ▷ `AddLeftDistributivityExpandingWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftDistributivityExpandingWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, L, r) \mapsto \text{LeftDistributivityExpandingWithGivenObjects}(s, a, L, r)$.

1.14.3 AddLeftDistributivityFactoring (for IsCapCategory, IsFunction)

- ▷ `AddLeftDistributivityFactoring(C, F)` (operation)
- ▷ `AddLeftDistributivityFactoring(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftDistributivityFactoring`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, L) \mapsto \text{LeftDistributivityFactoring}(a, L)$.

1.14.4 AddLeftDistributivityFactoringWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ `AddLeftDistributivityFactoringWithGivenObjects(C, F)` (operation)
- ▷ `AddLeftDistributivityFactoringWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftDistributivityFactoringWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, L, r) \mapsto \text{LeftDistributivityFactoringWithGivenObjects}(s, a, L, r)$.

1.14.5 AddRightDistributivityExpanding (for IsCapCategory, IsFunction)

- ▷ `AddRightDistributivityExpanding(C, F)` (operation)
- ▷ `AddRightDistributivityExpanding(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `RightDistributivityExpanding`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (L, a) \mapsto \text{RightDistributivityExpanding}(L, a)$.

1.14.6 AddRightDistributivityExpandingWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddRightDistributivityExpandingWithGivenObjects(C, F) (operation)
- ▷ AddRightDistributivityExpandingWithGivenObjects(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation RightDistributivityExpandingWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, L, a, r) \mapsto \text{RightDistributivityExpandingWithGivenObjects}(s, L, a, r)$.

1.14.7 AddRightDistributivityFactoring (for IsCapCategory, IsFunction)

- ▷ AddRightDistributivityFactoring(C, F) (operation)
- ▷ AddRightDistributivityFactoring(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation RightDistributivityFactoring. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (L, a) \mapsto \text{RightDistributivityFactoring}(L, a)$.

1.14.8 AddRightDistributivityFactoringWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddRightDistributivityFactoringWithGivenObjects(C, F) (operation)
- ▷ AddRightDistributivityFactoringWithGivenObjects(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation RightDistributivityFactoringWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, L, a, r) \mapsto \text{RightDistributivityFactoringWithGivenObjects}(s, L, a, r)$.

1.14.9 AddBraiding (for IsCapCategory, IsFunction)

- ▷ AddBraiding(C, F) (operation)
- ▷ AddBraiding(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation Braiding. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{Braiding}(a, b)$.

1.14.10 AddBraidingInverse (for IsCapCategory, IsFunction)

- ▷ AddBraidingInverse(C , F) (operation)
- ▷ AddBraidingInverse(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation BraidingInverse. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{BraidingInverse}(a, b)$.

1.14.11 AddBraidingInverseWithGivenTensorProducts (for IsCapCategory, IsFunction)

- ▷ AddBraidingInverseWithGivenTensorProducts(C , F) (operation)
- ▷ AddBraidingInverseWithGivenTensorProducts(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation BraidingInverseWithGivenTensorProducts. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{BraidingInverseWithGivenTensorProducts}(s, a, b, r)$.

1.14.12 AddBraidingWithGivenTensorProducts (for IsCapCategory, IsFunction)

- ▷ AddBraidingWithGivenTensorProducts(C , F) (operation)
- ▷ AddBraidingWithGivenTensorProducts(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation BraidingWithGivenTensorProducts. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{BraidingWithGivenTensorProducts}(s, a, b, r)$.

1.14.13 AddClosedMonoidalLeftCoevaluationMorphism (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalLeftCoevaluationMorphism(C , F) (operation)
- ▷ AddClosedMonoidalLeftCoevaluationMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalLeftCoevaluationMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{ClosedMonoidalLeftCoevaluationMorphism}(a, b)$.

1.14.14 AddClosedMonoidalLeftCoevaluationMorphismWithGivenRange (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalLeftCoevaluationMorphismWithGivenRange(C , F) (operation)
- ▷ AddClosedMonoidalLeftCoevaluationMorphismWithGivenRange(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalLeftCoevaluationMorphismWithGivenRange. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, r) \mapsto \text{ClosedMonoidalLeftCoevaluationMorphismWithGivenRange}(a, b, r)$.

1.14.15 AddClosedMonoidalLeftEvaluationMorphism (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalLeftEvaluationMorphism(C , F) (operation)
- ▷ AddClosedMonoidalLeftEvaluationMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalLeftEvaluationMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{ClosedMonoidalLeftEvaluationMorphism}(a, b)$.

1.14.16 AddClosedMonoidalLeftEvaluationMorphismWithGivenSource (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalLeftEvaluationMorphismWithGivenSource(C , F) (operation)
- ▷ AddClosedMonoidalLeftEvaluationMorphismWithGivenSource(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalLeftEvaluationMorphismWithGivenSource. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, s) \mapsto \text{ClosedMonoidalLeftEvaluationMorphismWithGivenSource}(a, b, s)$.

1.14.17 AddClosedMonoidalRightCoevaluationMorphism (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalRightCoevaluationMorphism(C , F) (operation)
- ▷ AddClosedMonoidalRightCoevaluationMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalRightCoevaluationMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{ClosedMonoidalRightCoevaluationMorphism}(a, b)$.

1.14.18 AddClosedMonoidalRightCoevaluationMorphismWithGivenRange (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalRightCoevaluationMorphismWithGivenRange(C , F) (operation)
- ▷ AddClosedMonoidalRightCoevaluationMorphismWithGivenRange(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalRightCoevaluationMorphismWithGivenRange. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, r) \mapsto \text{ClosedMonoidalRightCoevaluationMorphismWithGivenRange}(a, b, r)$.

1.14.19 AddClosedMonoidalRightEvaluationMorphism (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalRightEvaluationMorphism(C , F) (operation)
- ▷ AddClosedMonoidalRightEvaluationMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalRightEvaluationMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{ClosedMonoidalRightEvaluationMorphism}(a, b)$.

1.14.20 AddClosedMonoidalRightEvaluationMorphismWithGivenSource (for IsCapCategory, IsFunction)

- ▷ AddClosedMonoidalRightEvaluationMorphismWithGivenSource(C , F) (operation)
- ▷ AddClosedMonoidalRightEvaluationMorphismWithGivenSource(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation ClosedMonoidalRightEvaluationMorphismWithGivenSource. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, s) \mapsto \text{ClosedMonoidalRightEvaluationMorphismWithGivenSource}(a, b, s)$.

1.14.21 AddDualOnMorphisms (for IsCapCategory, IsFunction)

- ▷ AddDualOnMorphisms(C , F) (operation)
- ▷ AddDualOnMorphisms(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation DualOnMorphisms. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha) \mapsto \text{DualOnMorphisms}(alpha)$.

1.14.22 AddDualOnMorphismsWithGivenDuals (for IsCapCategory, IsFunction)

- ▷ AddDualOnMorphismsWithGivenDuals(C, F) (operation)
- ▷ AddDualOnMorphismsWithGivenDuals($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation DualOnMorphismsWithGivenDuals. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, alpha, r) \mapsto \text{DualOnMorphismsWithGivenDuals}(s, alpha, r)$.

1.14.23 AddDualOnObjects (for IsCapCategory, IsFunction)

- ▷ AddDualOnObjects(C, F) (operation)
- ▷ AddDualOnObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation DualOnObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{DualOnObjects}(a)$.

1.14.24 AddEvaluationForDual (for IsCapCategory, IsFunction)

- ▷ AddEvaluationForDual(C, F) (operation)
- ▷ AddEvaluationForDual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation EvaluationForDual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{EvaluationForDual}(a)$.

1.14.25 AddEvaluationForDualWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddEvaluationForDualWithGivenTensorProduct(C, F) (operation)
- ▷ AddEvaluationForDualWithGivenTensorProduct($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation EvaluationForDualWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, r) \mapsto \text{EvaluationForDualWithGivenTensorProduct}(s, a, r)$.

1.14.26 AddInternalHomOnMorphisms (for IsCapCategory, IsFunction)

- ▷ AddInternalHomOnMorphisms(C, F) (operation)
- ▷ AddInternalHomOnMorphisms($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomOnMorphisms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha, \beta) \mapsto \text{InternalHomOnMorphisms}(\alpha, \beta)$.

1.14.27 AddInternalHomOnMorphismsWithGivenInternalHoms (for IsCapCategory, IsFunction)

▷ `AddInternalHomOnMorphismsWithGivenInternalHoms(C, F)` (operation)

▷ `AddInternalHomOnMorphismsWithGivenInternalHoms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomOnMorphismsWithGivenInternalHoms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, \alpha, \beta, r) \mapsto \text{InternalHomOnMorphismsWithGivenInternalHoms}(s, \alpha, \beta, r)$.

1.14.28 AddInternalHomOnObjects (for IsCapCategory, IsFunction)

▷ `AddInternalHomOnObjects(C, F)` (operation)

▷ `AddInternalHomOnObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomOnObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{InternalHomOnObjects}(a, b)$.

1.14.29 AddInternalHomToTensorProductLeftAdjunctMorphism (for IsCapCategory, IsFunction)

▷ `AddInternalHomToTensorProductLeftAdjunctMorphism(C, F)` (operation)

▷ `AddInternalHomToTensorProductLeftAdjunctMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomToTensorProductLeftAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g) \mapsto \text{InternalHomToTensorProductLeftAdjunctMorphism}(b, c, g)$.

1.14.30 AddInternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct (for IsCapCategory, IsFunction)

▷ `AddInternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct(C, F)` (operation)

▷ `AddInternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct(C, F,`

`weight)`

`(operation)`

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g, s) \mapsto \text{InternalHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct}(b, c, g, s)$.

1.14.31 `AddInternalHomToTensorProductLeftAdjunctionIsomorphism` (for `IsCapCategory`, `IsFunction`)

▷ `AddInternalHomToTensorProductLeftAdjunctionIsomorphism(C, F)` `(operation)`

▷ `AddInternalHomToTensorProductLeftAdjunctionIsomorphism(C, F, weight)` `(operation)`

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomToTensorProductLeftAdjunctionIsomorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{InternalHomToTensorProductLeftAdjunctionIsomorphism}(a, b, c)$.

1.14.32 `AddInternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects` (for `IsCapCategory`, `IsFunction`)

▷ `AddInternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects(C, F)` `(operation)`

▷ `AddInternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects(C, F, weight)` `(operation)`

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{InternalHomToTensorProductLeftAdjunctionIsomorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.33 `AddInternalHomToTensorProductRightAdjunctMorphism` (for `IsCapCategory`, `IsFunction`)

▷ `AddInternalHomToTensorProductRightAdjunctMorphism(C, F)` `(operation)`

▷ `AddInternalHomToTensorProductRightAdjunctMorphism(C, F, weight)` `(operation)`

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalHomToTensorProductRightAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, c, g) \mapsto \text{InternalHomToTensorProductRightAdjunctMorphism}(a, c, g)$.

1.14.34 AddInternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddInternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct(C , F) (operation)
- ▷ AddInternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, c, g, s) \mapsto \text{InternalHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct}(a, c, g, s)$.

1.14.35 AddInternalHomToTensorProductRightAdjunctionIsomorphism (for IsCapCategory, IsFunction)

- ▷ AddInternalHomToTensorProductRightAdjunctionIsomorphism(C , F) (operation)
- ▷ AddInternalHomToTensorProductRightAdjunctionIsomorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalHomToTensorProductRightAdjunctionIsomorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{InternalHomToTensorProductRightAdjunctionIsomorphism}(a, b, c)$.

1.14.36 AddInternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddInternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects(C , F) (operation)
- ▷ AddInternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{InternalHomToTensorProductRightAdjunctionIsomorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.37 AddIsomorphismFromDualObjectToInternalHomIntoTensorUnit (for IsCapCategory, IsFunction)

- ▷ AddIsomorphismFromDualObjectToInternalHomIntoTensorUnit(C , F) (operation)
- ▷ AddIsomorphismFromDualObjectToInternalHomIntoTensorUnit(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromDualObjectToInternalHomIntoTensorUnit`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromDualObjectToInternalHomIntoTensorUnit}(a)$.

1.14.38 AddIsomorphismFromInternalHomIntoTensorUnitToDualObject (for IsCapCategory, IsFunction)

▷ `AddIsomorphismFromInternalHomIntoTensorUnitToDualObject(C, F)` (operation)

▷ `AddIsomorphismFromInternalHomIntoTensorUnitToDualObject(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalHomIntoTensorUnitToDualObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromInternalHomIntoTensorUnitToDualObject}(a)$.

1.14.39 AddIsomorphismFromInternalHomToObject (for IsCapCategory, IsFunction)

▷ `AddIsomorphismFromInternalHomToObject(C, F)` (operation)

▷ `AddIsomorphismFromInternalHomToObject(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalHomToObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromInternalHomToObject}(a)$.

1.14.40 AddIsomorphismFromInternalHomToObjectWithGivenInternalHom (for IsCapCategory, IsFunction)

▷ `AddIsomorphismFromInternalHomToObjectWithGivenInternalHom(C, F)` (operation)

▷ `AddIsomorphismFromInternalHomToObjectWithGivenInternalHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalHomToObjectWithGivenInternalHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,s) \mapsto \text{IsomorphismFromInternalHomToObjectWithGivenInternalHom}(a,s)$.

1.14.41 AddIsomorphismFromObjectToInternalHom (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromObjectToInternalHom(C , F) (operation)

▷ AddIsomorphismFromObjectToInternalHom(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation IsomorphismFromObjectToInternalHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromObjectToInternalHom}(a)$.

1.14.42 AddIsomorphismFromObjectToInternalHomWithGivenInternalHom (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromObjectToInternalHomWithGivenInternalHom(C , F) (operation)

▷ AddIsomorphismFromObjectToInternalHomWithGivenInternalHom(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation IsomorphismFromObjectToInternalHomWithGivenInternalHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{IsomorphismFromObjectToInternalHomWithGivenInternalHom}(a, r)$.

1.14.43 AddLambdaElimination (for IsCapCategory, IsFunction)

▷ AddLambdaElimination(C , F) (operation)

▷ AddLambdaElimination(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LambdaElimination. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, alpha) \mapsto \text{LambdaElimination}(a, b, alpha)$.

1.14.44 AddLambdaIntroduction (for IsCapCategory, IsFunction)

▷ AddLambdaIntroduction(C , F) (operation)

▷ AddLambdaIntroduction(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LambdaIntroduction. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha) \mapsto \text{LambdaIntroduction}(alpha)$.

1.14.45 AddMonoidalPostComposeMorphism (for IsCapCategory, IsFunction)

- ▷ AddMonoidalPostComposeMorphism(C, F) (operation)
- ▷ AddMonoidalPostComposeMorphism(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPostComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{MonoidalPostComposeMorphism}(a, b, c)$.

1.14.46 AddMonoidalPostComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddMonoidalPostComposeMorphismWithGivenObjects(C, F) (operation)
- ▷ AddMonoidalPostComposeMorphismWithGivenObjects(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPostComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{MonoidalPostComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.47 AddMonoidalPreComposeMorphism (for IsCapCategory, IsFunction)

- ▷ AddMonoidalPreComposeMorphism(C, F) (operation)
- ▷ AddMonoidalPreComposeMorphism(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPreComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{MonoidalPreComposeMorphism}(a, b, c)$.

1.14.48 AddMonoidalPreComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddMonoidalPreComposeMorphismWithGivenObjects(C, F) (operation)
- ▷ AddMonoidalPreComposeMorphismWithGivenObjects(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPreComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{MonoidalPreComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.49 AddMorphismFromTensorProductToInternalHom (for IsCapCategory, IsFunction)

▷ AddMorphismFromTensorProductToInternalHom(C , F) (operation)

▷ AddMorphismFromTensorProductToInternalHom(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismFromTensorProductToInternalHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{MorphismFromTensorProductToInternalHom}(a, b)$.

1.14.50 AddMorphismFromTensorProductToInternalHomWithGivenObjects (for IsCapCategory, IsFunction)

▷ AddMorphismFromTensorProductToInternalHomWithGivenObjects(C , F) (operation)

▷ AddMorphismFromTensorProductToInternalHomWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismFromTensorProductToInternalHomWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{MorphismFromTensorProductToInternalHomWithGivenObjects}(s, a, b, r)$.

1.14.51 AddMorphismToBidual (for IsCapCategory, IsFunction)

▷ AddMorphismToBidual(C , F) (operation)

▷ AddMorphismToBidual(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismToBidual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{MorphismToBidual}(a)$.

1.14.52 AddMorphismToBidualWithGivenBidual (for IsCapCategory, IsFunction)

▷ AddMorphismToBidualWithGivenBidual(C , F) (operation)

▷ AddMorphismToBidualWithGivenBidual(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismToBidualWithGivenBidual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{MorphismToBidualWithGivenBidual}(a, r)$.

1.14.53 AddTensorProductDualityCompatibilityMorphism (for IsCapCategory, IsFunction)

▷ AddTensorProductDualityCompatibilityMorphism(C , F) (operation)

▷ AddTensorProductDualityCompatibilityMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductDualityCompatibilityMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{TensorProductDualityCompatibilityMorphism}(a, b)$.

1.14.54 AddTensorProductDualityCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ AddTensorProductDualityCompatibilityMorphismWithGivenObjects(C , F) (operation)

▷ AddTensorProductDualityCompatibilityMorphismWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductDualityCompatibilityMorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{TensorProductDualityCompatibilityMorphismWithGivenObjects}(s, a, b, r)$.

1.14.55 AddTensorProductInternalHomCompatibilityMorphism (for IsCapCategory, IsFunction)

▷ AddTensorProductInternalHomCompatibilityMorphism(C , F) (operation)

▷ AddTensorProductInternalHomCompatibilityMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductInternalHomCompatibilityMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (list) \mapsto \text{TensorProductInternalHomCompatibilityMorphism}(list)$.

1.14.56 AddTensorProductInternalHomCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ AddTensorProductInternalHomCompatibilityMorphismWithGivenObjects(C , F) (operation)

▷ AddTensorProductInternalHomCompatibilityMorphismWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation

TensorProductInternalHomCompatibilityMorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (source, list, range) \mapsto \text{TensorProductInternalHomCompatibilityMorphismWithGivenObjects}(source, list, range)$.

1.14.57 AddTensorProductToInternalHomLeftAdjunctMorphism (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomLeftAdjunctMorphism(C, F) (operation)
- ▷ AddTensorProductToInternalHomLeftAdjunctMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalHomLeftAdjunctMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f) \mapsto \text{TensorProductToInternalHomLeftAdjunctMorphism}(a, b, f)$.

1.14.58 AddTensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom(C, F) (operation)
- ▷ AddTensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f, i) \mapsto \text{TensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom}(a, b, f, i)$.

1.14.59 AddTensorProductToInternalHomLeftAdjunctionIsomorphism (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomLeftAdjunctionIsomorphism(C, F) (operation)
- ▷ AddTensorProductToInternalHomLeftAdjunctionIsomorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalHomLeftAdjunctionIsomorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{TensorProductToInternalHomLeftAdjunctionIsomorphism}(a, b, c)$.

1.14.60 AddTensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects(C, F) (operation)
- ▷ AddTensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{TensorProductToInternalHomLeftAdjunctionIsomorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.61 AddTensorProductToInternalHomRightAdjunctMorphism (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomRightAdjunctMorphism(C, F) (operation)
- ▷ AddTensorProductToInternalHomRightAdjunctMorphism(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalHomRightAdjunctMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f) \mapsto \text{TensorProductToInternalHomRightAdjunctMorphism}(a, b, f)$.

1.14.62 AddTensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom(C, F) (operation)
- ▷ AddTensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f, i) \mapsto \text{TensorProductToInternalHomRightAdjunctMorphismWithGivenInternalHom}(a, b, f, i)$.

1.14.63 AddTensorProductToInternalHomRightAdjunctionIsomorphism (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalHomRightAdjunctionIsomorphism(C, F) (operation)
- ▷ AddTensorProductToInternalHomRightAdjunctionIsomorphism(C, F, weight) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToInternalHomRightAdjunctionIsomorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{TensorProductToInternalHomRightAdjunctionIsomorphism}(a, b, c)$.

1.14.64 AddTensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddTensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects(C, F)` (operation)
 ▷ `AddTensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{TensorProductToInternalHomRightAdjunctionIsomorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.65 AddUniversalPropertyOfDual (for IsCapCategory, IsFunction)

▷ `AddUniversalPropertyOfDual(C, F)` (operation)
 ▷ `AddUniversalPropertyOfDual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `UniversalPropertyOfDual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (t, a, \alpha) \mapsto \text{UniversalPropertyOfDual}(t, a, \alpha)$.

1.14.66 AddCoDualOnMorphisms (for IsCapCategory, IsFunction)

▷ `AddCoDualOnMorphisms(C, F)` (operation)
 ▷ `AddCoDualOnMorphisms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoDualOnMorphisms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha) \mapsto \text{CoDualOnMorphisms}(\alpha)$.

1.14.67 AddCoDualOnMorphismsWithGivenCoDuals (for IsCapCategory, IsFunction)

▷ `AddCoDualOnMorphismsWithGivenCoDuals(C, F)` (operation)
 ▷ `AddCoDualOnMorphismsWithGivenCoDuals(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoDualOnMorphismsWithGivenCoDuals`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, \alpha, r) \mapsto \text{CoDualOnMorphismsWithGivenCoDuals}(s, \alpha, r)$.

1.14.68 AddCoDualOnObjects (for IsCapCategory, IsFunction)

- ▷ `AddCoDualOnObjects(C , F)` (operation)
- ▷ `AddCoDualOnObjects(C , F , $weight$)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoDualOnObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{CoDualOnObjects}(a)$.

1.14.69 AddCoDualityTensorProductCompatibilityMorphism (for IsCapCategory, IsFunction)

- ▷ `AddCoDualityTensorProductCompatibilityMorphism(C , F)` (operation)
- ▷ `AddCoDualityTensorProductCompatibilityMorphism(C , F , $weight$)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoDualityTensorProductCompatibilityMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{CoDualityTensorProductCompatibilityMorphism}(a, b)$.

1.14.70 AddCoDualityTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ `AddCoDualityTensorProductCompatibilityMorphismWithGivenObjects(C , F)` (operation)
- ▷ `AddCoDualityTensorProductCompatibilityMorphismWithGivenObjects(C , F , $weight$)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoDualityTensorProductCompatibilityMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{CoDualityTensorProductCompatibilityMorphismWithGivenObjects}(s, a, b, r)$.

1.14.71 AddCoLambdaElimination (for IsCapCategory, IsFunction)

- ▷ `AddCoLambdaElimination(C , F)` (operation)
- ▷ `AddCoLambdaElimination(C , F , $weight$)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoLambdaElimination`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, \alpha) \mapsto \text{CoLambdaElimination}(a, b, \alpha)$.

1.14.72 AddCoLambdaIntroduction (for IsCapCategory, IsFunction)

- ▷ `AddCoLambdaIntroduction(C, F)` (operation)
- ▷ `AddCoLambdaIntroduction(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoLambdaIntroduction`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha) \mapsto \text{CoLambdaIntroduction}(\alpha)$.

1.14.73 AddCoclosedEvaluationForCoDual (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedEvaluationForCoDual(C, F)` (operation)
- ▷ `AddCoclosedEvaluationForCoDual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedEvaluationForCoDual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{CoclosedEvaluationForCoDual}(a)$.

1.14.74 AddCoclosedEvaluationForCoDualWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedEvaluationForCoDualWithGivenTensorProduct(C, F)` (operation)
- ▷ `AddCoclosedEvaluationForCoDualWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedEvaluationForCoDualWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, r) \mapsto \text{CoclosedEvaluationForCoDualWithGivenTensorProduct}(s, a, r)$.

1.14.75 AddCoclosedMonoidalLeftCoevaluationMorphism (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalLeftCoevaluationMorphism(C, F)` (operation)
- ▷ `AddCoclosedMonoidalLeftCoevaluationMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalLeftCoevaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computa-

tional complexity of the function (lower weight = less complex = faster execution). $F : (a,b) \mapsto \text{CoclosedMonoidalLeftCoevaluationMorphism}(a,b)$.

1.14.76 AddCoclosedMonoidalLeftCoevaluationMorphismWithGivenSource (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalLeftCoevaluationMorphismWithGivenSource(C, F)` (operation)
- ▷ `AddCoclosedMonoidalLeftCoevaluationMorphismWithGivenSource(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalLeftCoevaluationMorphismWithGivenSource`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,b,s) \mapsto \text{CoclosedMonoidalLeftCoevaluationMorphismWithGivenSource}(a,b,s)$.

1.14.77 AddCoclosedMonoidalLeftEvaluationMorphism (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalLeftEvaluationMorphism(C, F)` (operation)
- ▷ `AddCoclosedMonoidalLeftEvaluationMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalLeftEvaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,b) \mapsto \text{CoclosedMonoidalLeftEvaluationMorphism}(a,b)$.

1.14.78 AddCoclosedMonoidalLeftEvaluationMorphismWithGivenRange (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalLeftEvaluationMorphismWithGivenRange(C, F)` (operation)
- ▷ `AddCoclosedMonoidalLeftEvaluationMorphismWithGivenRange(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalLeftEvaluationMorphismWithGivenRange`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,b,r) \mapsto \text{CoclosedMonoidalLeftEvaluationMorphismWithGivenRange}(a,b,r)$.

1.14.79 AddCoclosedMonoidalRightCoevaluationMorphism (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalRightCoevaluationMorphism(C, F)` (operation)
- ▷ `AddCoclosedMonoidalRightCoevaluationMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalRightCoevaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{CoclosedMonoidalRightCoevaluationMorphism}(a, b)$.

1.14.80 AddCoclosedMonoidalRightCoevaluationMorphismWithGivenSource (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalRightCoevaluationMorphismWithGivenSource(C, F)` (operation)
- ▷ `AddCoclosedMonoidalRightCoevaluationMorphismWithGivenSource(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalRightCoevaluationMorphismWithGivenSource`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, s) \mapsto \text{CoclosedMonoidalRightCoevaluationMorphismWithGivenSource}(a, b, s)$.

1.14.81 AddCoclosedMonoidalRightEvaluationMorphism (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalRightEvaluationMorphism(C, F)` (operation)
- ▷ `AddCoclosedMonoidalRightEvaluationMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalRightEvaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{CoclosedMonoidalRightEvaluationMorphism}(a, b)$.

1.14.82 AddCoclosedMonoidalRightEvaluationMorphismWithGivenRange (for IsCapCategory, IsFunction)

- ▷ `AddCoclosedMonoidalRightEvaluationMorphismWithGivenRange(C, F)` (operation)
- ▷ `AddCoclosedMonoidalRightEvaluationMorphismWithGivenRange(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `CoclosedMonoidalRightEvaluationMorphismWithGivenRange`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, r) \mapsto \text{CoclosedMonoidalRightEvaluationMorphismWithGivenRange}(a, b, r)$.

1.14.83 AddInternalCoHomOnMorphisms (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomOnMorphisms(C, F) (operation)
- ▷ AddInternalCoHomOnMorphisms($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomOnMorphisms. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha, beta) \mapsto \text{InternalCoHomOnMorphisms}(alpha, beta)$.

1.14.84 AddInternalCoHomOnMorphismsWithGivenInternalCoHoms (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomOnMorphismsWithGivenInternalCoHoms(C, F) (operation)
- ▷ AddInternalCoHomOnMorphismsWithGivenInternalCoHoms($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomOnMorphismsWithGivenInternalCoHoms. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, alpha, beta, r) \mapsto \text{InternalCoHomOnMorphismsWithGivenInternalCoHoms}(s, alpha, beta, r)$.

1.14.85 AddInternalCoHomOnObjects (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomOnObjects(C, F) (operation)
- ▷ AddInternalCoHomOnObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomOnObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{InternalCoHomOnObjects}(a, b)$.

1.14.86 AddInternalCoHomTensorProductCompatibilityMorphism (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomTensorProductCompatibilityMorphism(C, F) (operation)
- ▷ AddInternalCoHomTensorProductCompatibilityMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomTensorProductCompatibilityMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (list) \mapsto \text{InternalCoHomTensorProductCompatibilityMorphism}(list)$.

1.14.87 AddInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects(C , F) (operation)
- ▷ AddInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomTensorProductCompatibilityMorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (source, list, range) \mapsto \text{InternalCoHomTensorProductCompatibilityMorphismWithGivenObjects}(source, list, range)$.

1.14.88 AddInternalCoHomToTensorProductLeftAdjunctMorphism (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomToTensorProductLeftAdjunctMorphism(C , F) (operation)
- ▷ AddInternalCoHomToTensorProductLeftAdjunctMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomToTensorProductLeftAdjunctMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, c, f) \mapsto \text{InternalCoHomToTensorProductLeftAdjunctMorphism}(a, c, f)$.

1.14.89 AddInternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct(C , F) (operation)
- ▷ AddInternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, c, f, t) \mapsto \text{InternalCoHomToTensorProductLeftAdjunctMorphismWithGivenTensorProduct}(a, c, f, t)$.

1.14.90 AddInternalCoHomToTensorProductRightAdjunctMorphism (for IsCapCategory, IsFunction)

- ▷ AddInternalCoHomToTensorProductRightAdjunctMorphism(C , F) (operation)
- ▷ AddInternalCoHomToTensorProductRightAdjunctMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalCoHomToTensorProductRightAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f) \mapsto \text{InternalCoHomToTensorProductRightAdjunctMorphism}(a, b, f)$.

1.14.91 AddInternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ `AddInternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct(C, F)` (operation)
- ▷ `AddInternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `InternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f, t) \mapsto \text{InternalCoHomToTensorProductRightAdjunctMorphismWithGivenTensorProduct}(a, b, f, t)$.

1.14.92 AddIsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit(C, F)` (operation)
- ▷ `AddIsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromCoDualObjectToInternalCoHomFromTensorUnit}(a)$.

1.14.93 AddIsomorphismFromInternalCoHomFromTensorUnitToCoDualObject (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromInternalCoHomFromTensorUnitToCoDualObject(C, F)` (operation)
- ▷ `AddIsomorphismFromInternalCoHomFromTensorUnitToCoDualObject(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalCoHomFromTensorUnitToCoDualObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the compu-

tational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromInternalCoHomFromTensorUnitToCoDualObject}(a)$.

1.14.94 AddIsomorphismFromInternalCoHomToObject (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromInternalCoHomToObject(C, F)` (operation)
- ▷ `AddIsomorphismFromInternalCoHomToObject(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalCoHomToObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromInternalCoHomToObject}(a)$.

1.14.95 AddIsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom(C, F)` (operation)
- ▷ `AddIsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{IsomorphismFromInternalCoHomToObjectWithGivenInternalCoHom}(a, s)$.

1.14.96 AddIsomorphismFromObjectToInternalCoHom (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromObjectToInternalCoHom(C, F)` (operation)
- ▷ `AddIsomorphismFromObjectToInternalCoHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromObjectToInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromObjectToInternalCoHom}(a)$.

1.14.97 AddIsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom(C, F)` (operation)
- ▷ `AddIsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom(C, F, weight)` (operation)

(operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{IsomorphismFromObjectToInternalCoHomWithGivenInternalCoHom}(a, r)$.

1.14.98 AddMonoidalPostCoComposeMorphism (for IsCapCategory, IsFunction)

▷ `AddMonoidalPostCoComposeMorphism(C, F)` (operation)

▷ `AddMonoidalPostCoComposeMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPostCoComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{MonoidalPostCoComposeMorphism}(a, b, c)$.

1.14.99 AddMonoidalPostCoComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddMonoidalPostCoComposeMorphismWithGivenObjects(C, F)` (operation)

▷ `AddMonoidalPostCoComposeMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPostCoComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{MonoidalPostCoComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.100 AddMonoidalPreCoComposeMorphism (for IsCapCategory, IsFunction)

▷ `AddMonoidalPreCoComposeMorphism(C, F)` (operation)

▷ `AddMonoidalPreCoComposeMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPreCoComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{MonoidalPreCoComposeMorphism}(a, b, c)$.

1.14.101 AddMonoidalPreCoComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddMonoidalPreCoComposeMorphismWithGivenObjects(C, F)` (operation)

▷ `AddMonoidalPreCoComposeMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MonoidalPreCoComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{MonoidalPreCoComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.102 AddMorphismFromCoBidual (for IsCapCategory, IsFunction)

▷ `AddMorphismFromCoBidual(C, F)` (operation)

▷ `AddMorphismFromCoBidual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromCoBidual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{MorphismFromCoBidual}(a)$.

1.14.103 AddMorphismFromCoBidualWithGivenCoBidual (for IsCapCategory, IsFunction)

▷ `AddMorphismFromCoBidualWithGivenCoBidual(C, F)` (operation)

▷ `AddMorphismFromCoBidualWithGivenCoBidual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromCoBidualWithGivenCoBidual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{MorphismFromCoBidualWithGivenCoBidual}(a, s)$.

1.14.104 AddMorphismFromInternalCoHomToTensorProduct (for IsCapCategory, IsFunction)

▷ `AddMorphismFromInternalCoHomToTensorProduct(C, F)` (operation)

▷ `AddMorphismFromInternalCoHomToTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromInternalCoHomToTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{MorphismFromInternalCoHomToTensorProduct}(a, b)$.

1.14.105 AddMorphismFromInternalCoHomToTensorProductWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddMorphismFromInternalCoHomToTensorProductWithGivenObjects(C, F)` (operation)

▷ `AddMorphismFromInternalCoHomToTensorProductWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromInternalCoHomToTensorProductWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{MorphismFromInternalCoHomToTensorProductWithGivenObjects}(s, a, b, r)$.

1.14.106 **AddTensorProductToInternalCoHomLeftAdjunctMorphism (for IsCapCategory, IsFunction)**

- ▷ `AddTensorProductToInternalCoHomLeftAdjunctMorphism(C, F)` (operation)
- ▷ `AddTensorProductToInternalCoHomLeftAdjunctMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToInternalCoHomLeftAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g) \mapsto \text{TensorProductToInternalCoHomLeftAdjunctMorphism}(b, c, g)$.

1.14.107 **AddTensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom (for IsCapCategory, IsFunction)**

- ▷ `AddTensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom(C, F)` (operation)
- ▷ `AddTensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g, i) \mapsto \text{TensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom}(b, c, g, i)$.

1.14.108 **AddTensorProductToInternalCoHomRightAdjunctMorphism (for IsCapCategory, IsFunction)**

- ▷ `AddTensorProductToInternalCoHomRightAdjunctMorphism(C, F)` (operation)
- ▷ `AddTensorProductToInternalCoHomRightAdjunctMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToInternalCoHomRightAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g) \mapsto \text{TensorProductToInternalCoHomRightAdjunctMorphism}(b, c, g)$.

1.14.109 AddTensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom(C , F) (operation)
- ▷ AddTensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g, i) \mapsto \text{TensorProductToInternalCoHomRightAdjunctMorphismWithGivenInternalCoHom}(b, c, g, i)$.

1.14.110 AddUniversalPropertyOfCoDual (for IsCapCategory, IsFunction)

- ▷ AddUniversalPropertyOfCoDual(C , F) (operation)
- ▷ AddUniversalPropertyOfCoDual(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation UniversalPropertyOfCoDual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (t, a, alpha) \mapsto \text{UniversalPropertyOfCoDual}(t, a, alpha)$.

1.14.111 AddIsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit (for IsCapCategory, IsFunction)

- ▷ AddIsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit(C , F) (operation)
- ▷ AddIsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation IsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromLeftDualObjectToLeftInternalHomIntoTensorUnit}(a)$.

1.14.112 AddIsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject (for IsCapCategory, IsFunction)

- ▷ AddIsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject(C , F) (operation)
- ▷ AddIsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromLeftInternalHomIntoTensorUnitToLeftDualObject}(a)$.

1.14.113 AddIsomorphismFromLeftInternalHomToObject (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromLeftInternalHomToObject(C, F)` (operation)
- ▷ `AddIsomorphismFromLeftInternalHomToObject(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftInternalHomToObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromLeftInternalHomToObject}(a)$.

1.14.114 AddIsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom(C, F)` (operation)
- ▷ `AddIsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{IsomorphismFromLeftInternalHomToObjectWithGivenLeftInternalHom}(a, s)$.

1.14.115 AddIsomorphismFromObjectToLeftInternalHom (for IsCapCategory, IsFunction)

- ▷ `AddIsomorphismFromObjectToLeftInternalHom(C, F)` (operation)
- ▷ `AddIsomorphismFromObjectToLeftInternalHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromObjectToLeftInternalHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromObjectToLeftInternalHom}(a)$.

1.14.116 AddIsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom (for IsCapCategory, IsFunction)

- ▷ AddIsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom(C, F) (operation)
- ▷ AddIsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{IsomorphismFromObjectToLeftInternalHomWithGivenLeftInternalHom}(a, r)$.

1.14.117 AddLeftClosedMonoidalCoevaluationMorphism (for IsCapCategory, IsFunction)

- ▷ AddLeftClosedMonoidalCoevaluationMorphism(C, F) (operation)
- ▷ AddLeftClosedMonoidalCoevaluationMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalCoevaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftClosedMonoidalCoevaluationMorphism}(a, b)$.

1.14.118 AddLeftClosedMonoidalCoevaluationMorphismWithGivenRange (for IsCapCategory, IsFunction)

- ▷ AddLeftClosedMonoidalCoevaluationMorphismWithGivenRange(C, F) (operation)
- ▷ AddLeftClosedMonoidalCoevaluationMorphismWithGivenRange($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalCoevaluationMorphismWithGivenRange`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, r) \mapsto \text{LeftClosedMonoidalCoevaluationMorphismWithGivenRange}(a, b, r)$.

1.14.119 AddLeftClosedMonoidalEvaluationForLeftDual (for IsCapCategory, IsFunction)

- ▷ AddLeftClosedMonoidalEvaluationForLeftDual(C, F) (operation)
- ▷ AddLeftClosedMonoidalEvaluationForLeftDual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalEvaluationForLeftDual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computa-

tional complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{LeftClosedMonoidalEvaluationForLeftDual}(a)$.

1.14.120 AddLeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct(C, F)` (operation)

▷ `AddLeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, r) \mapsto \text{LeftClosedMonoidalEvaluationForLeftDualWithGivenTensorProduct}(s, a, r)$.

1.14.121 AddLeftClosedMonoidalEvaluationMorphism (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalEvaluationMorphism(C, F)` (operation)

▷ `AddLeftClosedMonoidalEvaluationMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalEvaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftClosedMonoidalEvaluationMorphism}(a, b)$.

1.14.122 AddLeftClosedMonoidalEvaluationMorphismWithGivenSource (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalEvaluationMorphismWithGivenSource(C, F)` (operation)

▷ `AddLeftClosedMonoidalEvaluationMorphismWithGivenSource(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalEvaluationMorphismWithGivenSource`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, s) \mapsto \text{LeftClosedMonoidalEvaluationMorphismWithGivenSource}(a, b, s)$.

1.14.123 AddLeftClosedMonoidalLambdaElimination (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalLambdaElimination(C, F)` (operation)

▷ `AddLeftClosedMonoidalLambdaElimination(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalLambdaElimination`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, \alpha) \mapsto \text{LeftClosedMonoidalLambdaElimination}(a, b, \alpha)$.

1.14.124 AddLeftClosedMonoidalLambdaIntroduction (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalLambdaIntroduction(C, F)` (operation)

▷ `AddLeftClosedMonoidalLambdaIntroduction(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalLambdaIntroduction`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha) \mapsto \text{LeftClosedMonoidalLambdaIntroduction}(\alpha)$.

1.14.125 AddLeftClosedMonoidalPostComposeMorphism (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalPostComposeMorphism(C, F)` (operation)

▷ `AddLeftClosedMonoidalPostComposeMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalPostComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{LeftClosedMonoidalPostComposeMorphism}(a, b, c)$.

1.14.126 AddLeftClosedMonoidalPostComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalPostComposeMorphismWithGivenObjects(C, F)` (operation)

▷ `AddLeftClosedMonoidalPostComposeMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalPostComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{LeftClosedMonoidalPostComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.127 AddLeftClosedMonoidalPreComposeMorphism (for IsCapCategory, IsFunction)

▷ `AddLeftClosedMonoidalPreComposeMorphism(C, F)` (operation)

▷ `AddLeftClosedMonoidalPreComposeMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalPreComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{LeftClosedMonoidalPreComposeMorphism}(a, b, c)$.

1.14.128 AddLeftClosedMonoidalPreComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ `AddLeftClosedMonoidalPreComposeMorphismWithGivenObjects(C, F)` (operation)
- ▷ `AddLeftClosedMonoidalPreComposeMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftClosedMonoidalPreComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{LeftClosedMonoidalPreComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.129 AddLeftDualOnMorphisms (for IsCapCategory, IsFunction)

- ▷ `AddLeftDualOnMorphisms(C, F)` (operation)
- ▷ `AddLeftDualOnMorphisms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftDualOnMorphisms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha) \mapsto \text{LeftDualOnMorphisms}(alpha)$.

1.14.130 AddLeftDualOnMorphismsWithGivenLeftDuals (for IsCapCategory, IsFunction)

- ▷ `AddLeftDualOnMorphismsWithGivenLeftDuals(C, F)` (operation)
- ▷ `AddLeftDualOnMorphismsWithGivenLeftDuals(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftDualOnMorphismsWithGivenLeftDuals`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, alpha, r) \mapsto \text{LeftDualOnMorphismsWithGivenLeftDuals}(s, alpha, r)$.

1.14.131 AddLeftDualOnObjects (for IsCapCategory, IsFunction)

- ▷ `AddLeftDualOnObjects(C, F)` (operation)
- ▷ `AddLeftDualOnObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftDualOnObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{LeftDualOnObjects}(a)$.

1.14.132 AddLeftInternalHomOnMorphisms (for IsCapCategory, IsFunction)

- ▷ `AddLeftInternalHomOnMorphisms(C, F)` (operation)
- ▷ `AddLeftInternalHomOnMorphisms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalHomOnMorphisms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha, \beta) \mapsto \text{LeftInternalHomOnMorphisms}(\alpha, \beta)$.

1.14.133 AddLeftInternalHomOnMorphismsWithGivenLeftInternalHoms (for IsCapCategory, IsFunction)

- ▷ `AddLeftInternalHomOnMorphismsWithGivenLeftInternalHoms(C, F)` (operation)
- ▷ `AddLeftInternalHomOnMorphismsWithGivenLeftInternalHoms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalHomOnMorphismsWithGivenLeftInternalHoms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, \alpha, \beta, r) \mapsto \text{LeftInternalHomOnMorphismsWithGivenLeftInternalHoms}(s, \alpha, \beta, r)$.

1.14.134 AddLeftInternalHomOnObjects (for IsCapCategory, IsFunction)

- ▷ `AddLeftInternalHomOnObjects(C, F)` (operation)
- ▷ `AddLeftInternalHomOnObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalHomOnObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftInternalHomOnObjects}(a, b)$.

1.14.135 AddLeftInternalHomToTensorProductAdjunctMorphism (for IsCapCategory, IsFunction)

- ▷ `AddLeftInternalHomToTensorProductAdjunctMorphism(C, F)` (operation)
- ▷ `AddLeftInternalHomToTensorProductAdjunctMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalHomToTensorProductAdjunctMorphism`. Op-

tionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g) \mapsto \text{LeftInternalHomToTensorProductAdjunctMorphism}(b, c, g)$.

1.14.136 AddLeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct (for IsCapCategory, IsFunction)

▷ `AddLeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct(C, F)` (operation)

▷ `AddLeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g, t) \mapsto \text{LeftInternalHomToTensorProductAdjunctMorphismWithGivenTensorProduct}(b, c, g, t)$.

1.14.137 AddMorphismFromTensorProductToLeftInternalHom (for IsCapCategory, IsFunction)

▷ `AddMorphismFromTensorProductToLeftInternalHom(C, F)` (operation)

▷ `AddMorphismFromTensorProductToLeftInternalHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromTensorProductToLeftInternalHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{MorphismFromTensorProductToLeftInternalHom}(a, b)$.

1.14.138 AddMorphismFromTensorProductToLeftInternalHomWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddMorphismFromTensorProductToLeftInternalHomWithGivenObjects(C, F)` (operation)

▷ `AddMorphismFromTensorProductToLeftInternalHomWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromTensorProductToLeftInternalHomWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{MorphismFromTensorProductToLeftInternalHomWithGivenObjects}(s, a, b, r)$.

1.14.139 AddMorphismToLeftBidual (for IsCapCategory, IsFunction)

▷ AddMorphismToLeftBidual(C, F) (operation)

▷ AddMorphismToLeftBidual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismToLeftBidual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{MorphismToLeftBidual}(a)$.

1.14.140 AddMorphismToLeftBidualWithGivenLeftBidual (for IsCapCategory, IsFunction)

▷ AddMorphismToLeftBidualWithGivenLeftBidual(C, F) (operation)

▷ AddMorphismToLeftBidualWithGivenLeftBidual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismToLeftBidualWithGivenLeftBidual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{MorphismToLeftBidualWithGivenLeftBidual}(a, r)$.

1.14.141 AddTensorProductLeftDualityCompatibilityMorphism (for IsCapCategory, IsFunction)

▷ AddTensorProductLeftDualityCompatibilityMorphism(C, F) (operation)

▷ AddTensorProductLeftDualityCompatibilityMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductLeftDualityCompatibilityMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{TensorProductLeftDualityCompatibilityMorphism}(a, b)$.

1.14.142 AddTensorProductLeftDualityCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ AddTensorProductLeftDualityCompatibilityMorphismWithGivenObjects(C, F) (operation)

▷ AddTensorProductLeftDualityCompatibilityMorphismWithGivenObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductLeftDualityCompatibilityMorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{TensorProductLeftDualityCompatibilityMorphismWithGivenObjects}(s, a, b, r)$.

1.14.143 AddTensorProductLeftInternalHomCompatibilityMorphism (for IsCapCategory, IsFunction)

▷ AddTensorProductLeftInternalHomCompatibilityMorphism(C , F) (operation)

▷ AddTensorProductLeftInternalHomCompatibilityMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductLeftInternalHomCompatibilityMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (list) \mapsto \text{TensorProductLeftInternalHomCompatibilityMorphism}(list)$.

1.14.144 AddTensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ AddTensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects(C , F) (operation)

▷ AddTensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (source, list, range) \mapsto \text{TensorProductLeftInternalHomCompatibilityMorphismWithGivenObjects}(source, list, range)$.

1.14.145 AddTensorProductToLeftInternalHomAdjunctMorphism (for IsCapCategory, IsFunction)

▷ AddTensorProductToLeftInternalHomAdjunctMorphism(C , F) (operation)

▷ AddTensorProductToLeftInternalHomAdjunctMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToLeftInternalHomAdjunctMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f) \mapsto \text{TensorProductToLeftInternalHomAdjunctMorphism}(a, b, f)$.

1.14.146 AddTensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom (for IsCapCategory, IsFunction)

▷ AddTensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom(C , F) (operation)

▷ AddTensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, f, i) \mapsto \text{TensorProductToLeftInternalHomAdjunctMorphismWithGivenLeftInternalHom}(a, b, f, i)$.

1.14.147 AddUniversalPropertyOfLeftDual (for IsCapCategory, IsFunction)

▷ `AddUniversalPropertyOfLeftDual(C, F)` (operation)

▷ `AddUniversalPropertyOfLeftDual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `UniversalPropertyOfLeftDual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (t, a, \alpha) \mapsto \text{UniversalPropertyOfLeftDual}(t, a, \alpha)$.

1.14.148 AddIsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit (for IsCapCategory, IsFunction)

▷ `AddIsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit(C, F)` (operation)

▷ `AddIsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromLeftCoDualObjectToLeftInternalCoHomFromTensorUnit}(a)$.

1.14.149 AddIsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject (for IsCapCategory, IsFunction)

▷ `AddIsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject(C, F)` (operation)

▷ `AddIsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromLeftInternalCoHomFromTensorUnitToLeftCoDualObject}(a)$.

1.14.150 AddIsomorphismFromLeftInternalCoHomToObject (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromLeftInternalCoHomToObject(C, F) (operation)

▷ AddIsomorphismFromLeftInternalCoHomToObject($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftInternalCoHomToObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromLeftInternalCoHomToObject}(a)$.

1.14.151 AddIsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom(C, F) (operation)

▷ AddIsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{IsomorphismFromLeftInternalCoHomToObjectWithGivenLeftInternalCoHom}(a, s)$.

1.14.152 AddIsomorphismFromObjectToLeftInternalCoHom (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromObjectToLeftInternalCoHom(C, F) (operation)

▷ AddIsomorphismFromObjectToLeftInternalCoHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromObjectToLeftInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{IsomorphismFromObjectToLeftInternalCoHom}(a)$.

1.14.153 AddIsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom(C, F) (operation)

▷ AddIsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{IsomorphismFromObjectToLeftInternalCoHomWithGivenLeftInternalCoHom}(a, r)$.

1.14.154 AddLeftCoDualOnMorphisms (for IsCapCategory, IsFunction)

▷ `AddLeftCoDualOnMorphisms(C, F)` (operation)

▷ `AddLeftCoDualOnMorphisms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoDualOnMorphisms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha) \mapsto \text{LeftCoDualOnMorphisms}(alpha)$.

1.14.155 AddLeftCoDualOnMorphismsWithGivenLeftCoDuals (for IsCapCategory, IsFunction)

▷ `AddLeftCoDualOnMorphismsWithGivenLeftCoDuals(C, F)` (operation)

▷ `AddLeftCoDualOnMorphismsWithGivenLeftCoDuals(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoDualOnMorphismsWithGivenLeftCoDuals`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, alpha, r) \mapsto \text{LeftCoDualOnMorphismsWithGivenLeftCoDuals}(s, alpha, r)$.

1.14.156 AddLeftCoDualOnObjects (for IsCapCategory, IsFunction)

▷ `AddLeftCoDualOnObjects(C, F)` (operation)

▷ `AddLeftCoDualOnObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoDualOnObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{LeftCoDualOnObjects}(a)$.

1.14.157 AddLeftCoDualityTensorProductCompatibilityMorphism (for IsCapCategory, IsFunction)

▷ `AddLeftCoDualityTensorProductCompatibilityMorphism(C, F)` (operation)

▷ `AddLeftCoDualityTensorProductCompatibilityMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoDualityTensorProductCompatibilityMorphism`.

Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftCoDualityTensorProductCompatibilityMorphism}(a, b)$.

1.14.158 AddLeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

▷ `AddLeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects(C, F)` (operation)

▷ `AddLeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{LeftCoDualityTensorProductCompatibilityMorphismWithGivenObjects}(s, a, b, r)$.

1.14.159 AddLeftCoclosedMonoidalCoevaluationMorphism (for IsCapCategory, IsFunction)

▷ `AddLeftCoclosedMonoidalCoevaluationMorphism(C, F)` (operation)

▷ `AddLeftCoclosedMonoidalCoevaluationMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalCoevaluationMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftCoclosedMonoidalCoevaluationMorphism}(a, b)$.

1.14.160 AddLeftCoclosedMonoidalCoevaluationMorphismWithGivenSource (for IsCapCategory, IsFunction)

▷ `AddLeftCoclosedMonoidalCoevaluationMorphismWithGivenSource(C, F)` (operation)

▷ `AddLeftCoclosedMonoidalCoevaluationMorphismWithGivenSource(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalCoevaluationMorphismWithGivenSource`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, s) \mapsto \text{LeftCoclosedMonoidalCoevaluationMorphismWithGivenSource}(a, b, s)$.

1.14.161 AddLeftCoclosedMonoidalEvaluationForLeftCoDual (for IsCapCategory, IsFunction)

▷ AddLeftCoclosedMonoidalEvaluationForLeftCoDual(C , F) (operation)

▷ AddLeftCoclosedMonoidalEvaluationForLeftCoDual(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftCoclosedMonoidalEvaluationForLeftCoDual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{LeftCoclosedMonoidalEvaluationForLeftCoDual}(a)$.

1.14.162 AddLeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct (for IsCapCategory, IsFunction)

▷ AddLeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct(C , F) (operation)

▷ AddLeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, r) \mapsto \text{LeftCoclosedMonoidalEvaluationForLeftCoDualWithGivenTensorProduct}(s, a, r)$.

1.14.163 AddLeftCoclosedMonoidalEvaluationMorphism (for IsCapCategory, IsFunction)

▷ AddLeftCoclosedMonoidalEvaluationMorphism(C , F) (operation)

▷ AddLeftCoclosedMonoidalEvaluationMorphism(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftCoclosedMonoidalEvaluationMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftCoclosedMonoidalEvaluationMorphism}(a, b)$.

1.14.164 AddLeftCoclosedMonoidalEvaluationMorphismWithGivenRange (for IsCapCategory, IsFunction)

▷ AddLeftCoclosedMonoidalEvaluationMorphismWithGivenRange(C , F) (operation)

▷ AddLeftCoclosedMonoidalEvaluationMorphismWithGivenRange(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftCoclosedMonoidalEvaluationMorphismWithGivenRange.

Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, r) \mapsto \text{LeftCoclosedMonoidalEvaluationMorphismWithGivenRange}(a, b, r)$.

1.14.165 AddLeftCoclosedMonoidalLambdaElimination (for IsCapCategory, IsFunction)

- ▷ `AddLeftCoclosedMonoidalLambdaElimination(C, F)` (operation)
- ▷ `AddLeftCoclosedMonoidalLambdaElimination(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalLambdaElimination`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, \alpha) \mapsto \text{LeftCoclosedMonoidalLambdaElimination}(a, b, \alpha)$.

1.14.166 AddLeftCoclosedMonoidalLambdaIntroduction (for IsCapCategory, IsFunction)

- ▷ `AddLeftCoclosedMonoidalLambdaIntroduction(C, F)` (operation)
- ▷ `AddLeftCoclosedMonoidalLambdaIntroduction(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalLambdaIntroduction`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha) \mapsto \text{LeftCoclosedMonoidalLambdaIntroduction}(\alpha)$.

1.14.167 AddLeftCoclosedMonoidalPostCoComposeMorphism (for IsCapCategory, IsFunction)

- ▷ `AddLeftCoclosedMonoidalPostCoComposeMorphism(C, F)` (operation)
- ▷ `AddLeftCoclosedMonoidalPostCoComposeMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalPostCoComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{LeftCoclosedMonoidalPostCoComposeMorphism}(a, b, c)$.

1.14.168 AddLeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ `AddLeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects(C, F)` (operation)
- ▷ `AddLeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{LeftCoclosedMonoidalPostCoComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.169 **AddLeftCoclosedMonoidalPreCoComposeMorphism (for IsCapCategory, IsFunction)**

- ▷ `AddLeftCoclosedMonoidalPreCoComposeMorphism(C, F)` (operation)
- ▷ `AddLeftCoclosedMonoidalPreCoComposeMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalPreCoComposeMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{LeftCoclosedMonoidalPreCoComposeMorphism}(a, b, c)$.

1.14.170 **AddLeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects (for IsCapCategory, IsFunction)**

- ▷ `AddLeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects(C, F)` (operation)
- ▷ `AddLeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{LeftCoclosedMonoidalPreCoComposeMorphismWithGivenObjects}(s, a, b, c, r)$.

1.14.171 **AddLeftInternalCoHomOnMorphisms (for IsCapCategory, IsFunction)**

- ▷ `AddLeftInternalCoHomOnMorphisms(C, F)` (operation)
- ▷ `AddLeftInternalCoHomOnMorphisms(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalCoHomOnMorphisms`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (\alpha, \beta) \mapsto \text{LeftInternalCoHomOnMorphisms}(\alpha, \beta)$.

1.14.172 AddLeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms (for IsCapCategory, IsFunction)

- ▷ AddLeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms(C, F) (operation)
- ▷ AddLeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, alpha, beta, r) \mapsto \text{LeftInternalCoHomOnMorphismsWithGivenLeftInternalCoHoms}(s, alpha, beta, r)$.

1.14.173 AddLeftInternalCoHomOnObjects (for IsCapCategory, IsFunction)

- ▷ AddLeftInternalCoHomOnObjects(C, F) (operation)
- ▷ AddLeftInternalCoHomOnObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftInternalCoHomOnObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{LeftInternalCoHomOnObjects}(a, b)$.

1.14.174 AddLeftInternalCoHomTensorProductCompatibilityMorphism (for IsCapCategory, IsFunction)

- ▷ AddLeftInternalCoHomTensorProductCompatibilityMorphism(C, F) (operation)
- ▷ AddLeftInternalCoHomTensorProductCompatibilityMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftInternalCoHomTensorProductCompatibilityMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (list) \mapsto \text{LeftInternalCoHomTensorProductCompatibilityMorphism}(list)$.

1.14.175 AddLeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddLeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects(C, F) (operation)
- ▷ AddLeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation LeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects. Optionally, a

weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (source, list, range) \mapsto \text{LeftInternalCoHomTensorProductCompatibilityMorphismWithGivenObjects}(source, list, range)$.

1.14.176 AddLeftInternalCoHomToTensorProductAdjunctMorphism (for IsCapCategory, IsFunction)

- ▷ `AddLeftInternalCoHomToTensorProductAdjunctMorphism(C, F)` (operation)
- ▷ `AddLeftInternalCoHomToTensorProductAdjunctMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalCoHomToTensorProductAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, c, f) \mapsto \text{LeftInternalCoHomToTensorProductAdjunctMorphism}(a, c, f)$.

1.14.177 AddLeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ `AddLeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct(C, F)` (operation)
- ▷ `AddLeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, c, f, t) \mapsto \text{LeftInternalCoHomToTensorProductAdjunctMorphismWithGivenTensorProduct}(a, c, f, t)$.

1.14.178 AddMorphismFromLeftCoBidual (for IsCapCategory, IsFunction)

- ▷ `AddMorphismFromLeftCoBidual(C, F)` (operation)
- ▷ `AddMorphismFromLeftCoBidual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromLeftCoBidual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{MorphismFromLeftCoBidual}(a)$.

1.14.179 AddMorphismFromLeftCoBidualWithGivenLeftCoBidual (for IsCapCategory, IsFunction)

- ▷ `AddMorphismFromLeftCoBidualWithGivenLeftCoBidual(C, F)` (operation)
- ▷ `AddMorphismFromLeftCoBidualWithGivenLeftCoBidual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromLeftCoBidualWithGivenLeftCoBidual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{MorphismFromLeftCoBidualWithGivenLeftCoBidual}(a, s)$.

1.14.180 **AddMorphismFromLeftInternalCoHomToTensorProduct (for IsCapCategory, IsFunction)**

▷ `AddMorphismFromLeftInternalCoHomToTensorProduct(C, F)` (operation)

▷ `AddMorphismFromLeftInternalCoHomToTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromLeftInternalCoHomToTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{MorphismFromLeftInternalCoHomToTensorProduct}(a, b)$.

1.14.181 **AddMorphismFromLeftInternalCoHomToTensorProductWithGivenObjects (for IsCapCategory, IsFunction)**

▷ `AddMorphismFromLeftInternalCoHomToTensorProductWithGivenObjects(C, F)` (operation)

▷ `AddMorphismFromLeftInternalCoHomToTensorProductWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromLeftInternalCoHomToTensorProductWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{MorphismFromLeftInternalCoHomToTensorProductWithGivenObjects}(s, a, b, r)$.

1.14.182 **AddTensorProductToLeftInternalCoHomAdjunctMorphism (for IsCapCategory, IsFunction)**

▷ `AddTensorProductToLeftInternalCoHomAdjunctMorphism(C, F)` (operation)

▷ `AddTensorProductToLeftInternalCoHomAdjunctMorphism(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `TensorProductToLeftInternalCoHomAdjunctMorphism`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g) \mapsto \text{TensorProductToLeftInternalCoHomAdjunctMorphism}(b, c, g)$.

1.14.183 AddTensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom (for IsCapCategory, IsFunction)

- ▷ AddTensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom(C, F) (operation)
- ▷ AddTensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom.

Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (b, c, g, i) \mapsto \text{TensorProductToLeftInternalCoHomAdjunctMorphismWithGivenLeftInternalCoHom}(b, c, g, i)$.

1.14.184 AddUniversalPropertyOfLeftCoDual (for IsCapCategory, IsFunction)

- ▷ AddUniversalPropertyOfLeftCoDual(C, F) (operation)
- ▷ AddUniversalPropertyOfLeftCoDual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation UniversalPropertyOfLeftCoDual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (t, a, alpha) \mapsto \text{UniversalPropertyOfLeftCoDual}(t, a, alpha)$.

1.14.185 AddAssociatorLeftToRight (for IsCapCategory, IsFunction)

- ▷ AddAssociatorLeftToRight(C, F) (operation)
- ▷ AddAssociatorLeftToRight($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation AssociatorLeftToRight. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{AssociatorLeftToRight}(a, b, c)$.

1.14.186 AddAssociatorLeftToRightWithGivenTensorProducts (for IsCapCategory, IsFunction)

- ▷ AddAssociatorLeftToRightWithGivenTensorProducts(C, F) (operation)
- ▷ AddAssociatorLeftToRightWithGivenTensorProducts($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation AssociatorLeftToRightWithGivenTensorProducts. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{AssociatorLeftToRightWithGivenTensorProducts}(s, a, b, c, r)$.

1.14.187 AddAssociatorRightToLeft (for IsCapCategory, IsFunction)

- ▷ AddAssociatorRightToLeft(C, F) (operation)
- ▷ AddAssociatorRightToLeft($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `AssociatorRightToLeft`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b, c) \mapsto \text{AssociatorRightToLeft}(a, b, c)$.

1.14.188 AddAssociatorRightToLeftWithGivenTensorProducts (for IsCapCategory, IsFunction)

- ▷ AddAssociatorRightToLeftWithGivenTensorProducts(C, F) (operation)
- ▷ AddAssociatorRightToLeftWithGivenTensorProducts($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `AssociatorRightToLeftWithGivenTensorProducts`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, c, r) \mapsto \text{AssociatorRightToLeftWithGivenTensorProducts}(s, a, b, c, r)$.

1.14.189 AddLeftUnitor (for IsCapCategory, IsFunction)

- ▷ AddLeftUnitor(C, F) (operation)
- ▷ AddLeftUnitor($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftUnitor`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{LeftUnitor}(a)$.

1.14.190 AddLeftUnitorInverse (for IsCapCategory, IsFunction)

- ▷ AddLeftUnitorInverse(C, F) (operation)
- ▷ AddLeftUnitorInverse($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftUnitorInverse`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{LeftUnitorInverse}(a)$.

1.14.191 AddLeftUnitorInverseWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddLeftUnitorInverseWithGivenTensorProduct(C, F) (operation)
- ▷ AddLeftUnitorInverseWithGivenTensorProduct($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftUnitorInverseWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{LeftUnitorInverseWithGivenTensorProduct}(a, r)$.

1.14.192 AddLeftUnitorWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ `AddLeftUnitorWithGivenTensorProduct(C, F)` (operation)
- ▷ `AddLeftUnitorWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `LeftUnitorWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{LeftUnitorWithGivenTensorProduct}(a, s)$.

1.14.193 AddRightUnitor (for IsCapCategory, IsFunction)

- ▷ `AddRightUnitor(C, F)` (operation)
- ▷ `AddRightUnitor(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `RightUnitor`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{RightUnitor}(a)$.

1.14.194 AddRightUnitorInverse (for IsCapCategory, IsFunction)

- ▷ `AddRightUnitorInverse(C, F)` (operation)
- ▷ `AddRightUnitorInverse(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `RightUnitorInverse`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{RightUnitorInverse}(a)$.

1.14.195 AddRightUnitorInverseWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ `AddRightUnitorInverseWithGivenTensorProduct(C, F)` (operation)
- ▷ `AddRightUnitorInverseWithGivenTensorProduct(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `RightUnitorInverseWithGivenTensorProduct`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{RightUnitorInverseWithGivenTensorProduct}(a, r)$.

1.14.196 AddRightUnitorWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddRightUnitorWithGivenTensorProduct(C, F) (operation)
- ▷ AddRightUnitorWithGivenTensorProduct($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation RightUnitorWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{RightUnitorWithGivenTensorProduct}(a, s)$.

1.14.197 AddTensorProductOnMorphisms (for IsCapCategory, IsFunction)

- ▷ AddTensorProductOnMorphisms(C, F) (operation)
- ▷ AddTensorProductOnMorphisms($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductOnMorphisms. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha, beta) \mapsto \text{TensorProductOnMorphisms}(alpha, beta)$.

1.14.198 AddTensorProductOnMorphismsWithGivenTensorProducts (for IsCapCategory, IsFunction)

- ▷ AddTensorProductOnMorphismsWithGivenTensorProducts(C, F) (operation)
- ▷ AddTensorProductOnMorphismsWithGivenTensorProducts($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductOnMorphismsWithGivenTensorProducts. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, alpha, beta, r) \mapsto \text{TensorProductOnMorphismsWithGivenTensorProducts}(s, alpha, beta, r)$.

1.14.199 AddTensorProductOnObjects (for IsCapCategory, IsFunction)

- ▷ AddTensorProductOnObjects(C, F) (operation)
- ▷ AddTensorProductOnObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductOnObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (arg2, arg3) \mapsto \text{TensorProductOnObjects}(arg2, arg3)$.

1.14.200 AddTensorUnit (for IsCapCategory, IsFunction)

- ▷ AddTensorUnit(C, F) (operation)
- ▷ AddTensorUnit($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorUnit. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : () \mapsto \text{TensorUnit}()$.

1.14.201 AddCoevaluationForDual (for IsCapCategory, IsFunction)

- ▷ AddCoevaluationForDual(C, F) (operation)
- ▷ AddCoevaluationForDual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation CoevaluationForDual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{CoevaluationForDual}(a)$.

1.14.202 AddCoevaluationForDualWithGivenTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddCoevaluationForDualWithGivenTensorProduct(C, F) (operation)
- ▷ AddCoevaluationForDualWithGivenTensorProduct($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation CoevaluationForDualWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, r) \mapsto \text{CoevaluationForDualWithGivenTensorProduct}(s, a, r)$.

1.14.203 AddIsomorphismFromInternalHomToTensorProductWithDualObject (for IsCapCategory, IsFunction)

- ▷ AddIsomorphismFromInternalHomToTensorProductWithDualObject(C, F) (operation)
- ▷ AddIsomorphismFromInternalHomToTensorProductWithDualObject($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation IsomorphismFromInternalHomToTensorProductWithDualObject. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{IsomorphismFromInternalHomToTensorProductWithDualObject}(a, b)$.

1.14.204 AddIsomorphismFromTensorProductWithDualObjectToInternalHom (for IsCapCategory, IsFunction)

- ▷ AddIsomorphismFromTensorProductWithDualObjectToInternalHom(C, F) (operation)
- ▷ AddIsomorphismFromTensorProductWithDualObjectToInternalHom($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation IsomorphismFromTensorProductWithDualObjectToInternalHom. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{IsomorphismFromTensorProductWithDualObjectToInternalHom}(a, b)$.

1.14.205 AddMorphismFromBidual (for IsCapCategory, IsFunction)

- ▷ AddMorphismFromBidual(C, F) (operation)
- ▷ AddMorphismFromBidual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismFromBidual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{MorphismFromBidual}(a)$.

1.14.206 AddMorphismFromBidualWithGivenBidual (for IsCapCategory, IsFunction)

- ▷ AddMorphismFromBidualWithGivenBidual(C, F) (operation)
- ▷ AddMorphismFromBidualWithGivenBidual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismFromBidualWithGivenBidual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, s) \mapsto \text{MorphismFromBidualWithGivenBidual}(a, s)$.

1.14.207 AddMorphismFromInternalHomToTensorProduct (for IsCapCategory, IsFunction)

- ▷ AddMorphismFromInternalHomToTensorProduct(C, F) (operation)
- ▷ AddMorphismFromInternalHomToTensorProduct($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismFromInternalHomToTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, b) \mapsto \text{MorphismFromInternalHomToTensorProduct}(a, b)$.

1.14.208 AddMorphismFromInternalHomToTensorProductWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddMorphismFromInternalHomToTensorProductWithGivenObjects(C, F) (operation)
- ▷ AddMorphismFromInternalHomToTensorProductWithGivenObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation MorphismFromInternalHomToTensorProductWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{MorphismFromInternalHomToTensorProductWithGivenObjects}(s, a, b, r)$.

1.14.209 AddRankMorphism (for IsCapCategory, IsFunction)

- ▷ AddRankMorphism(C, F) (operation)
- ▷ AddRankMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation RankMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{RankMorphism}(a)$.

1.14.210 AddTensorProductInternalHomCompatibilityMorphismInverse (for IsCapCategory, IsFunction)

- ▷ AddTensorProductInternalHomCompatibilityMorphismInverse(C, F) (operation)
- ▷ AddTensorProductInternalHomCompatibilityMorphismInverse($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductInternalHomCompatibilityMorphismInverse. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (list) \mapsto \text{TensorProductInternalHomCompatibilityMorphismInverse}(list)$.

1.14.211 AddTensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects (for IsCapCategory, IsFunction)

- ▷ AddTensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects(C, F) (operation)
- ▷ AddTensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects. Optionally,

a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (source, list, range) \mapsto \text{TensorProductInternalHomCompatibilityMorphismInverseWithGivenObjects}(source, list, range)$.

1.14.212 AddTraceMap (for IsCapCategory, IsFunction)

- ▷ AddTraceMap(C, F) (operation)
- ▷ AddTraceMap($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation TraceMap. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha) \mapsto \text{TraceMap}(alpha)$.

1.14.213 AddCoRankMorphism (for IsCapCategory, IsFunction)

- ▷ AddCoRankMorphism(C, F) (operation)
- ▷ AddCoRankMorphism($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation CoRankMorphism. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{CoRankMorphism}(a)$.

1.14.214 AddCoTraceMap (for IsCapCategory, IsFunction)

- ▷ AddCoTraceMap(C, F) (operation)
- ▷ AddCoTraceMap($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation CoTraceMap. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (alpha) \mapsto \text{CoTraceMap}(alpha)$.

1.14.215 AddCoclosedCoevaluationForCoDual (for IsCapCategory, IsFunction)

- ▷ AddCoclosedCoevaluationForCoDual(C, F) (operation)
- ▷ AddCoclosedCoevaluationForCoDual($C, F, weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation CoclosedCoevaluationForCoDual. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{CoclosedCoevaluationForCoDual}(a)$.

1.14.216 AddCoclosedCoevaluationForCoDualWithGivenTensorProduct (for IsCapCategory, IsFunction)

▷ AddCoclosedCoevaluationForCoDualWithGivenTensorProduct(C , F) (operation)

▷ AddCoclosedCoevaluationForCoDualWithGivenTensorProduct(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation CoclosedCoevaluationForCoDualWithGivenTensorProduct. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (s, a, r) \mapsto \text{CoclosedCoevaluationForCoDualWithGivenTensorProduct}(s, a, r)$.

1.14.217 AddInternalCoHomTensorProductCompatibilityMorphismInverse (for IsCapCategory, IsFunction)

▷ AddInternalCoHomTensorProductCompatibilityMorphismInverse(C , F) (operation)

▷ AddInternalCoHomTensorProductCompatibilityMorphismInverse(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomTensorProductCompatibilityMorphismInverse. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (list) \mapsto \text{InternalCoHomTensorProductCompatibilityMorphismInverse}(list)$.

1.14.218 AddInternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects (for IsCapCategory, IsFunction)

▷ AddInternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects(C , F) (operation)

▷ AddInternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects(C , F , $weight$) (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation InternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (source, list, range) \mapsto \text{InternalCoHomTensorProductCompatibilityMorphismInverseWithGivenObjects}(source, list, range)$.

1.14.219 AddIsomorphismFromInternalCoHomToTensorProductWithCoDualObject (for IsCapCategory, IsFunction)

▷ AddIsomorphismFromInternalCoHomToTensorProductWithCoDualObject(C , F) (operation)

▷ AddIsomorphismFromInternalCoHomToTensorProductWithCoDualObject(C , F , $weight$) (operation)

(operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromInternalCoHomToTensorProductWithCoDualObject`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,b) \mapsto \text{IsomorphismFromInternalCoHomToTensorProductWithCoDualObject}(a,b)$.

1.14.220 `AddIsomorphismFromTensorProductWithCoDualObjectToInternalCoHom` (for `IsCapCategory`, `IsFunction`)

- ▷ `AddIsomorphismFromTensorProductWithCoDualObjectToInternalCoHom(C, F)` (operation)
- ▷ `AddIsomorphismFromTensorProductWithCoDualObjectToInternalCoHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `IsomorphismFromTensorProductWithCoDualObjectToInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,b) \mapsto \text{IsomorphismFromTensorProductWithCoDualObjectToInternalCoHom}(a,b)$.

1.14.221 `AddMorphismFromTensorProductToInternalCoHom` (for `IsCapCategory`, `IsFunction`)

- ▷ `AddMorphismFromTensorProductToInternalCoHom(C, F)` (operation)
- ▷ `AddMorphismFromTensorProductToInternalCoHom(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromTensorProductToInternalCoHom`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a,b) \mapsto \text{MorphismFromTensorProductToInternalCoHom}(a,b)$.

1.14.222 `AddMorphismFromTensorProductToInternalCoHomWithGivenObjects` (for `IsCapCategory`, `IsFunction`)

- ▷ `AddMorphismFromTensorProductToInternalCoHomWithGivenObjects(C, F)` (operation)
- ▷ `AddMorphismFromTensorProductToInternalCoHomWithGivenObjects(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismFromTensorProductToInternalCoHomWithGivenObjects`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational com-

plexity of the function (lower weight = less complex = faster execution). $F : (s, a, b, r) \mapsto \text{MorphismFromTensorProductToInternalCoHomWithGivenObjects}(s, a, b, r)$.

1.14.223 AddMorphismToCoBidual (for IsCapCategory, IsFunction)

- ▷ `AddMorphismToCoBidual(C, F)` (operation)
- ▷ `AddMorphismToCoBidual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismToCoBidual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a) \mapsto \text{MorphismToCoBidual}(a)$.

1.14.224 AddMorphismToCoBidualWithGivenCoBidual (for IsCapCategory, IsFunction)

- ▷ `AddMorphismToCoBidualWithGivenCoBidual(C, F)` (operation)
- ▷ `AddMorphismToCoBidualWithGivenCoBidual(C, F, weight)` (operation)

Returns: nothing

The arguments are a category C and a function F . This operation adds the given function F to the category for the basic operation `MorphismToCoBidualWithGivenCoBidual`. Optionally, a weight (default: 100) can be specified which should roughly correspond to the computational complexity of the function (lower weight = less complex = faster execution). $F : (a, r) \mapsto \text{MorphismToCoBidualWithGivenCoBidual}(a, r)$.

Chapter 2

Examples and Tests

2.1 Test functions

2.1.1 AdditiveMonoidalCategoriesTest

▷ `AdditiveMonoidalCategoriesTest(cat, a, L)` (function)

The arguments are

- a CAP category *cat*
- an object *a*
- a list *L* of objects

This function checks for every operation declared in `AdditiveMonoidalCategories.gd` if it is computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.2 TestBraidingForInvertibility (for IsCapCategory, IsCapCategoryObject, IsCapCategoryObject)

▷ `TestBraidingForInvertibility(cat, obj_1, obj_2)` (operation)

Returns: a boolean

This is a debug operation. The arguments are three objects *obj₁*, *obj₂* in a braided monoidal category *cat*. The output is true if the braiding is invertible, false otherwise.

2.1.3 TestBraidingCompatibility (for IsCapCategory, IsCapCategoryObject, IsCapCategoryObject)

▷ TestBraidingCompatibility(*cat*, *obj_1*, *obj_2*, *obj_3*) (operation)

Returns: a boolean

This is a debug operation. The arguments are three objects *obj₁*, *obj₂*, *obj₃* in a braided monoidal category *cat*. The output is true if the braiding compatibilities with the associator hold, false otherwise.

2.1.4 TestBraidingCompatibilityForAllTriplesInList (for IsCapCategory, IsList)

▷ TestBraidingCompatibilityForAllTriplesInList(*cat*, *L*) (operation)

Returns: a boolean

This is a debug operation. The argument is a list *L* of objects in a braided monoidal category *cat*. The output is true if the braiding compatibilities with the associator hold for all triples of objects in *L*, otherwise false.

2.1.5 BraidedMonoidalCategoriesTest

▷ BraidedMonoidalCategoriesTest(*cat*, *a*, *b*) (function)

The arguments are

- a CAP category *cat*
- objects *a*, *b*

This function checks for every operation declared in BraidedMonoidalCategories.gd if it is computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to Opposite(), to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer dual_pre/postprocessor_funcs.

2.1.6 ClosedMonoidalCategoriesTest

▷ ClosedMonoidalCategoriesTest(*cat*, *a*, *b*, *c*, *d*, *alpha*, *beta*, *gamma*, *delta*, *epsilon*, *zeta*) (function)

The arguments are

- a CAP category *cat*
- objects *a*, *b*, *c*, *d*
- a morphism $\alpha : a \rightarrow b$

- a morphism $\beta : c \rightarrow d$
- a morphism $\gamma : a \otimes b \rightarrow 1$
- a morphism $\delta : c \otimes d \rightarrow 1$
- a morphism $\varepsilon : 1 \rightarrow \text{Hom}(a, b)$
- a morphism $\zeta : 1 \rightarrow \text{Hom}(c, d)$

This function checks for every operation declared in `ClosedMonoidalCategories.gd` if it is computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.7 ClosedMonoidalCategoriesTestWithGiven

▷ `ClosedMonoidalCategoriesTestWithGiven(cat, a, b, c, d, alpha, beta)` (function)

The arguments are

- a CAP category *cat*
- objects *a, b, c, d*
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$

This function checks for some `*WithGiven` operations declared in `ClosedMonoidalCategories.gd` if they are computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.8 CoclosedMonoidalCategoriesTest

▷ `CoclosedMonoidalCategoriesTest(cat, a, b, c, d, alpha, beta, gamma, delta, epsilon, zeta)` (function)

The arguments are

- a CAP category *cat*
- objects a, b, c, d
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$
- a morphism $\gamma : 1 \rightarrow a \otimes b$
- a morphism $\delta : 1 \rightarrow c \otimes d$
- a morphism $\varepsilon : \text{coHom}(a, b) \rightarrow 1$
- a morphism $\zeta : \text{coHom}(c, d) \rightarrow 1$

This function checks for every operation declared in `CoclosedMonoidalCategories.gd` if it is computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.9 CoclosedMonoidalCategoriesTestWithGiven

▷ `CoclosedMonoidalCategoriesTestWithGiven(cat, a, b, c, d, alpha, beta, gamma, delta, epsilon, zeta)` (function)

The arguments are

- a CAP category *cat*
- objects a, b, c, d
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$

This function checks for some `*WithGiven` operations declared in `CoclosedMonoidalCategories.gd` if they are computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in `cat`. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.10 LeftClosedMonoidalCategoriesTest

▷ `LeftClosedMonoidalCategoriesTest(cat, a, b, c, d, alpha, beta, gamma, delta, epsilon, zeta)` (function)

The arguments are

- a CAP category `cat`
- objects a, b, c, d
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$
- a morphism $\gamma : a \otimes b \rightarrow 1$
- a morphism $\delta : c \otimes d \rightarrow 1$
- a morphism $\varepsilon : 1 \rightarrow \text{Hom}(a, b)$
- a morphism $\zeta : 1 \rightarrow \text{Hom}(c, d)$

This function checks for every operation declared in `LeftClosedMonoidalCategories.gd` if it is computable in the CAP category `cat`. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of `cat`. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in `cat`. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.11 LeftClosedMonoidalCategoriesTestWithGiven

▷ `LeftClosedMonoidalCategoriesTestWithGiven(cat, a, b, c, d, alpha, beta, gamma, delta, epsilon, zeta)` (function)

The arguments are

- a CAP category `cat`
- objects a, b, c, d
- a morphism $\alpha : a \rightarrow b$

- a morphism $\beta : c \rightarrow d$

This function checks for some `*WithGiven operationS` declared in `LeftClosedMonoidalCategories.gd` if they are computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.12 LeftCoclosedMonoidalCategoriesTest

▷ `LeftCoclosedMonoidalCategoriesTest(cat, a, b, c, d, alpha, beta, gamma, delta, epsilon, zeta)` (function)

The arguments are

- a CAP category *cat*
- objects a, b, c, d
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$
- a morphism $\gamma : 1 \rightarrow a \otimes b$
- a morphism $\delta : 1 \rightarrow c \otimes d$
- a morphism $\varepsilon : \text{coHom}(a, b) \rightarrow 1$
- a morphism $\zeta : \text{coHom}(c, d) \rightarrow 1$

This function checks for every operation declared in `LeftCoclosedMonoidalCategories.gd` if it is computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.13 LeftCoclosedMonoidalCategoriesTestWithGiven

▷ LeftCoclosedMonoidalCategoriesTestWithGiven(*cat*, *a*, *b*, *c*, *d*, *alpha*, *beta*, *gamma*, *delta*, *epsilon*, *zeta*) (function)

The arguments are

- a CAP category *cat*
- objects *a, b, c, d*
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$

This function checks for some *WithGiven operations declared in LeftCoclosedMonoidalCategories.gd if they are computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to Opposite(), to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer dual_pre/postprocessor_funcs.

2.1.14 MonoidalCategoriesTensorProductOnObjectsAndTensorUnitTest

▷ MonoidalCategoriesTensorProductOnObjectsAndTensorUnitTest(*cat*, *a*, *b*) (function)

The arguments are

- a CAP category *cat*
- objects *a, b*

This function checks for every operation declared in MonoidalCategoriesTensorProductOnObjectsAndTensorUnit.gd if it is computable in the CAP category *cat*. If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of *cat*. Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to Opposite(), to only primitively install dual operations for primitively installed operations in *cat*. The advantage is, that more derivations might be tested. On the downside, this might test fewer dual_pre/postprocessor_funcs.

2.1.15 TestMonoidalUnitorsForInvertibility (for IsCapCategory, IsCapCategoryObject)

▷ TestMonoidalUnitorsForInvertibility(*cat*, *obj*) (operation)

Returns: a boolean

This is a debug operation. The arguments are two objects *obj* in a monoidal category *cat*. The output is true if the left and right unitors are invertible for *obj*.

2.1.16 TestAssociatorForInvertibility (for IsCapCategory, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ TestAssociatorForInvertibility(*cat*, *obj_1*, *obj_2*, *obj_3*) (operation)

Returns: a boolean

This is a debug operation. The arguments are two objects *obj₁*, *obj₂*, *obj₃* in a monoidal category *cat*. The output is true if the associator are invertible for these 3 objects, false otherwise.

2.1.17 TestMonoidalTriangleIdentity (for IsCapCategory, IsCapCategoryObject, IsCapCategoryObject)

▷ TestMonoidalTriangleIdentity(*cat*, *obj_1*, *obj_2*) (operation)

Returns: a boolean

This is a debug operation. The arguments are two objects *obj₁*, *obj₂* in a monoidal category *cat*. The output is true if the triangle identity holds for these 2 objects, false otherwise.

2.1.18 TestMonoidalTriangleIdentityForAllPairsInList (for IsCapCategory, IsList)

▷ TestMonoidalTriangleIdentityForAllPairsInList(*cat*, *L*) (operation)

Returns: a boolean

This is a debug operation. The argument is a list *L* of objects in a monoidal category *cat*. The output is true if the triangle identity holds for all pairs of objects in *L*, otherwise false.

2.1.19 TestMonoidalPentagonIdentity (for IsCapCategory, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ TestMonoidalPentagonIdentity(*cat*, *obj_1*, *obj_2*, *obj_3*, *obj_4*) (operation)

Returns: a boolean

This is a debug operation. The arguments are 4 objects *obj₁*, *obj₂*, *obj₃*, *obj₄* in a monoidal category *cat*. The output is true if the pentagon identity holds for these 4 objects, false otherwise.

2.1.20 TestMonoidalPentagonIdentityUsingWithGivenOperations (for IsCapCategory, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ TestMonoidalPentagonIdentityUsingWithGivenOperations(*cat*, *obj_1*, *obj_2*, *obj_3*, *obj_4*) (operation)

Returns: a boolean

This is a debug operation. The arguments are 4 objects $obj_1, obj_2, obj_3, obj_4$ in a monoidal category cat . The output is true if the pentagon identity holds for these 4 objects, false otherwise. This test uses the WithGiven-operations.

2.1.21 TestMonoidalPentagonIdentityForAllQuadruplesInList (for IsCapCategory, IsList)

▷ TestMonoidalPentagonIdentityForAllQuadruplesInList(cat, L) (operation)

Returns: a boolean

This is a debug operation. The argument is a list L of objects in a monoidal category cat . The output is true if the pentagon identity holds for all quadruples of objects in L , otherwise false.

2.1.22 MonoidalCategoriesTest

▷ MonoidalCategoriesTest($cat, a, b, c, alpha, beta$) (function)

The arguments are

- a CAP category cat
- objects a, b, c
- a morphism $\alpha : a \rightarrow b$
- a morphism $\beta : c \rightarrow d$

This function checks for every operation declared in MonoidalCategories.gd if it is computable in the CAP category cat . If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of cat . Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to Opposite(), to only primitively install dual operations for primitively installed operations in cat . The advantage is, that more derivations might be tested. On the downside, this might test fewer dual_pre/postprocessor_funcs.

2.1.23 TestZigZagIdentitiesForDual (for IsCapCategory, IsCapCategoryObject)

▷ TestZigZagIdentitiesForDual(cat, obj) (operation)

Returns: a boolean

This is a debug operation. The argument is an object obj in a rigid symmetric monoidal category cat . The output is true if the zig zag identity for duals hold, false otherwise.

2.1.24 RigidSymmetricClosedMonoidalCategoriesTest

▷ RigidSymmetricClosedMonoidalCategoriesTest($cat, a, b, c, d, alpha$) (function)

The arguments are

- a CAP category cat

- objects a, b, c, d
- an endomorphism $\alpha : a \rightarrow a$

This function checks for every object and morphism declared in `RigidSymmetricClosedMonoidalCategories.gd` if it is computable in the CAP category cat . If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of cat . Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in cat . The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

2.1.25 RigidSymmetricCoclosedMonoidalCategoriesTest

▷ `RigidSymmetricCoclosedMonoidalCategoriesTest(cat, a, b, c, d, alpha)` (function)

The arguments are

- a CAP category cat
- objects a, b, c, d
- an endomorphism $\alpha : a \rightarrow a$

This function checks for every object and morphism declared in `RigidSymmetricCoclosedMonoidalCategories.gd` if it is computable in the CAP category cat . If yes, then the operation is executed with the parameters given above and compared to the equivalent computation in the opposite category of cat . Pass the options

- `verbose := true` to output more information.
- `only_primitive_operations := true`, which is passed on to `Opposite()`, to only primitively install dual operations for primitively installed operations in cat . The advantage is, that more derivations might be tested. On the downside, this might test fewer `dual_pre/postprocessor_funcs`.

Chapter 3

Code Generation for Monoidal Categories

3.1 Monoidal Categories

3.1.1 WriteFileForMonoidalStructure

▷ WriteFileForMonoidalStructure(*key_val_rec*, *package_name*, *files_rec*) (function)

Returns: nothing

This functions uses the dictionary *key_val_rec* to create a new monoidal structure. It generates the necessary files in the package *package_name* using the file-correspondence table *files_rec*. See the implementation for details.

3.2 Closed Monoidal Categories

3.2.1 WriteFileForClosedMonoidalStructure

▷ WriteFileForClosedMonoidalStructure(*key_val_rec*, *package_name*, *files_rec*) (function)

Returns: nothing

This functions uses the dictionary *key_val_rec* to create a new closed monoidal structure. It generates the necessary files in the package *package_name* using the file-correspondence table *files_rec*. See the implementation for details.

3.2.2 WriteFileForLeftClosedMonoidalStructure

▷ WriteFileForLeftClosedMonoidalStructure(*key_val_rec*, *package_name*, *files_rec*) (function)

Returns: nothing

This functions uses the dictionary *key_val_rec* to create a new left closed monoidal structure. It generates the necessary files in the package *package_name* using the file-correspondence table *files_rec*. See the implementation for details.

3.3 Coclosed Monoidal Categories

3.3.1 WriteFileForCoclosedMonoidalStructure

▷ `WriteFileForCoclosedMonoidalStructure(key_val_rec, package_name, files_rec)`
(function)

Returns: nothing

This functions uses the dictionary `key_val_rec` to create a new coclosed monoidal structure. It generates the necessary files in the package `package_name` using the file-correspondence table `files_rec`. See the implementation for details.

3.3.2 WriteFileForLeftCoclosedMonoidalStructure

▷ `WriteFileForLeftCoclosedMonoidalStructure(key_val_rec, package_name, files_rec)`
(function)

Returns: nothing

This functions uses the dictionary `key_val_rec` to create a new left coclosed monoidal structure. It generates the necessary files in the package `package_name` using the file-correspondence table `files_rec`. See the implementation for details.

Chapter 4

The terminal category with multiple objects

This is an example of a category which is created using `CategoryConstructor` out of no input.

This category “lies” in all doctrines and can hence be used (in conjunction with `LazyCategory`) in order to check the type-correctness of the various derived methods provided by `CAP` or any `CAP`-based package.

4.1 Constructors

4.2 GAP Categories

Chapter 5

Legacy Operations and Synonyms

5.1 Legacy operations

5.1.1 `CoclosedCoevaluationMorphism` (for `IsCapCategoryObject`, `IsCapCategoryObject`)

▷ `CoclosedCoevaluationMorphism(a, b)` (operation)

This is a legacy operation for `CoclosedMonoidalLeftCoevaluationMorphism(b, a)`, i.e., with the first and second argument interchanged.

5.1.2 `CoclosedCoevaluationMorphismWithGivenSource` (for `IsCapCategoryObject`, `IsCapCategoryObject`, `IsCapCategoryObject`)

▷ `CoclosedCoevaluationMorphismWithGivenSource(a, b, s)` (operation)

This is a legacy operation for `CoclosedMonoidalLeftCoevaluationMorphismWithGivenSource(b, a, s)`, i.e., with the first and second argument interchanged.

5.1.3 `CoclosedEvaluationMorphism` (for `IsCapCategoryObject`, `IsCapCategoryObject`)

▷ `CoclosedEvaluationMorphism(a, b)` (operation)

This is a legacy operation for `CoclosedMonoidalLeftEvaluationMorphism(b, a)`, i.e., with the first and second argument interchanged.

5.1.4 `CoclosedEvaluationMorphismWithGivenRange` (for `IsCapCategoryObject`, `IsCapCategoryObject`, `IsCapCategoryObject`)

▷ `CoclosedEvaluationMorphismWithGivenRange(a, b, r)` (operation)

This is a legacy operation for `CoclosedMonoidalLeftEvaluationMorphismWithGivenRange(b, a, r)`, i.e., with the first and second argument interchanged.

5.1.5 CoevaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ `CoevaluationMorphism(a, b)` (operation)

This is a legacy operation for `ClosedMonoidalLeftCoevaluationMorphism(b, a)`, i.e., with the first and second argument interchanged.

5.1.6 CoevaluationMorphismWithGivenRange (for IsCapCategoryObject, IsCapCategoryObject)

▷ `CoevaluationMorphismWithGivenRange(a, b, r)` (operation)

This is a legacy operation for `ClosedMonoidalLeftCoevaluationMorphismWithGivenRange(b, a, r)`, i.e., with the first and second argument interchanged.

5.2 Synonyms for legacy operations

5.2.1 EvaluationMorphism (for IsCapCategoryObject, IsCapCategoryObject)

▷ `EvaluationMorphism(arg1, arg2)` (operation)

This is a synonym for `ClosedMonoidalLeftEvaluationMorphism`.

5.2.2 EvaluationMorphismWithGivenSource (for IsCapCategoryObject, IsCapCategoryObject, IsCapCategoryObject)

▷ `EvaluationMorphismWithGivenSource(arg1, arg2, arg3)` (operation)

This is a synonym for `ClosedMonoidalLeftEvaluationMorphismWithGivenSource`.

5.2.3 InternalCoHomToTensorProductAdjunctionMap (for IsObject)

▷ `InternalCoHomToTensorProductAdjunctionMap(arg)` (operation)

This is a synonym for `InternalCoHomToTensorProductLeftAdjunctMorphism`.

5.2.4 InternalCoHomToTensorProductAdjunctionMapWithGivenTensorProduct (for IsObject)

▷ `InternalCoHomToTensorProductAdjunctionMapWithGivenTensorProduct(arg)` (operation)

This is a synonym for `InternalCoHomToTensorProductLeftAdjunctionMapWithGivenTensorProduct`.

5.2.5 InternalHomToTensorProductAdjunctionMap (for IsObject)

▷ InternalHomToTensorProductAdjunctionMap(*arg*) (operation)

This is a synonym for InternalHomToTensorProductLeftAdjunctMorphism.

5.2.6 InternalHomToTensorProductAdjunctionMapWithGivenTensorProduct (for IsObject)

▷ InternalHomToTensorProductAdjunctionMapWithGivenTensorProduct(*arg*) (operation)

This is a synonym for InternalHomToTensorProductLeftAdjunctionMapWithGivenTensorProduct.

5.2.7 TensorProductToInternalCoHomAdjunctionMap (for IsObject)

▷ TensorProductToInternalCoHomAdjunctionMap(*arg*) (operation)

This is a synonym for TensorProductToInternalCoHomLeftAdjunctMorphism.

5.2.8 TensorProductToInternalCoHomAdjunctionMapWithGivenInternalCoHom (for IsObject)

▷ TensorProductToInternalCoHomAdjunctionMapWithGivenInternalCoHom(*arg*) (operation)

This is a synonym for TensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom.

5.2.9 TensorProductToInternalHomAdjunctionMap (for IsObject)

▷ TensorProductToInternalHomAdjunctionMap(*arg*) (operation)

This is a synonym for TensorProductToInternalHomLeftAdjunctMorphism.

5.2.10 TensorProductToInternalHomAdjunctionMapWithGivenInternalHom (for IsObject)

▷ TensorProductToInternalHomAdjunctionMapWithGivenInternalHom(*arg*) (operation)

This is a synonym for TensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom.

5.2.11 InternalCoHomToTensorProductLeftAdjunctionMap (for IsObject)

▷ InternalCoHomToTensorProductLeftAdjunctionMap(*arg*) (operation)

This is a synonym for InternalCoHomToTensorProductLeftAdjunctMorphism.

5.2.12 InternalHomToTensorProductLeftAdjunctionMap (for IsObject)

▷ `InternalHomToTensorProductLeftAdjunctionMap(arg)` (operation)

This is a synonym for `InternalHomToTensorProductLeftAdjunctMorphism`.

5.2.13 TensorProductToInternalCoHomLeftAdjunctionMap (for IsObject)

▷ `TensorProductToInternalCoHomLeftAdjunctionMap(arg)` (operation)

This is a synonym for `TensorProductToInternalCoHomLeftAdjunctMorphism`.

5.2.14 TensorProductToInternalCoHomLeftAdjunctionMapWithGivenInternalCoHom (for IsObject)

▷ `TensorProductToInternalCoHomLeftAdjunctionMapWithGivenInternalCoHom(arg)` (operation)

This is a synonym for `TensorProductToInternalCoHomLeftAdjunctMorphismWithGivenInternalCoHom`.

5.2.15 TensorProductToInternalHomLeftAdjunctionMap (for IsObject)

▷ `TensorProductToInternalHomLeftAdjunctionMap(arg)` (operation)

This is a synonym for `TensorProductToInternalHomLeftAdjunctMorphism`.

5.2.16 TensorProductToInternalHomLeftAdjunctionMapWithGivenInternalHom (for IsObject)

▷ `TensorProductToInternalHomLeftAdjunctionMapWithGivenInternalHom(arg)` (operation)

This is a synonym for `TensorProductToInternalHomLeftAdjunctMorphismWithGivenInternalHom`.

Chapter 6

MonoidalCategories automatic generated documentation

6.1 MonoidalCategories automatic generated documentation of properties

6.1.1 IsAdditiveMonoidalCategory (for IsCapCategory)

▷ `IsAdditiveMonoidalCategory(C)` (property)

Returns: true or false

The property of the category C being additive monoidal, i.e., where the tensor product preserves finite direct sums.

6.1.2 IsBraidedMonoidalCategory (for IsCapCategory)

▷ `IsBraidedMonoidalCategory(C)` (property)

Returns: true or false

The property of the category C being braided monoidal.

6.1.3 IsClosedMonoidalCategory (for IsCapCategory)

▷ `IsClosedMonoidalCategory(C)` (property)

Returns: true or false

The property of the category C being (bi)closed monoidal.

6.1.4 IsCoclosedMonoidalCategory (for IsCapCategory)

▷ `IsCoclosedMonoidalCategory(C)` (property)

Returns: true or false

The property of the category C being (bi)coclosed monoidal.

6.1.5 IsLeftClosedMonoidalCategory (for IsCapCategory)

▷ `IsLeftClosedMonoidalCategory(C)` (property)

Returns: true or false

The property of the category \mathcal{C} being left closed monoidal.

6.1.6 IsLeftCoclosedMonoidalCategory (for IsCapCategory)

- ▷ IsLeftCoclosedMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being coclosed monoidal.

6.1.7 IsMonoidalCategory (for IsCapCategory)

- ▷ IsMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being monoidal.

6.1.8 IsStrictMonoidalCategory (for IsCapCategory)

- ▷ IsStrictMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being strict monoidal.

6.1.9 IsRigidSymmetricClosedMonoidalCategory (for IsCapCategory)

- ▷ IsRigidSymmetricClosedMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being rigid symmetric closed monoidal.

6.1.10 IsRigidSymmetricCoclosedMonoidalCategory (for IsCapCategory)

- ▷ IsRigidSymmetricCoclosedMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being rigid symmetric coclosed monoidal.

6.1.11 IsSymmetricClosedMonoidalCategory (for IsCapCategory)

- ▷ IsSymmetricClosedMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being symmetric closed monoidal.

6.1.12 IsSymmetricCoclosedMonoidalCategory (for IsCapCategory)

- ▷ IsSymmetricCoclosedMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being symmetric coclosed monoidal.

6.1.13 IsSymmetricMonoidalCategory (for IsCapCategory)

- ▷ IsSymmetricMonoidalCategory(\mathcal{C}) (property)
Returns: true or false
 The property of the category \mathcal{C} being symmetric monoidal.

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