Contents

1. Category theory basics

1.1. Definition

a Category is a collection of arrows called **morphisms** and dots called **objects** with these conditions:

1. $f : A \to B \land g : B \to C$ then there exist $g \circ f : A \to C$ called the composition of f with g
   - composition is **associative**
2. forall object A in a category there is a morphism $\mathrm{id} : A \longrightarrow A$ such that $\mathrm{id}_B \circ f = f$ and $g \circ \mathrm{id}_A = g$ its the identity morphism

1.2. Examples

1. **the empty category:** no objects and no morphisms
2. a one object category with only identity morphisms
3. multiple objects only identity morphisms
4. **Set:** sets as objects and functions as morphisms
5. **Vect:** vector spaces as objects and linear maps as morphisms
6. **Hask:** haskell types as objects and fuctions as morphisms

1.3. Definition

a morphism $f : A \to B$ is an isomorphism if there exists $g : B \to A$ such that $f \circ g = \mathrm{id}_B \land g \circ f = \mathrm{id}_A$

1.4. Definition

an object O in a category C is terminal iff $\forall A \in C, \exists! f : A \to O$

1.5. Examples

1. the set with 1 element in **Set**
2. the Unit type in **Hask**