

## Category Theory

### Exercise Sheet 8

Lecture Homepage: <https://www.math.cit.tum.de/algebra/lehre/sommersemester-2022/ss2022-category-theory/>

**Exercise 1.** For some of your favorite categories from some of the other lectures which you are attending, determine which (co)limits exist in these categories.

**Exercise 2.** Explicitly describe small limits and colimits in the category of sets.

**Exercise 3.** Let  $I$  be a category with an initial object  $i_0$ .

- (i) Show that for any functor  $F: I \rightarrow C$ , the limit  $\lim_I F$  exists and describe this limit explicitly.
- (ii) Show that for any  $i \in I$ , the coproduct  $i \coprod i_0$  exists and describe it explicitly.

**Exercise 4.** Find an example of non-isomorphic objects  $c$  and  $d$  of some category  $C$ , such that for all objects  $e \in C$  there exists a bijection  $\text{Hom}(c, e) \cong \text{Hom}(d, e)$  of Hom-sets.