1. Color code explained

Definition Block

Theorem Block

Proof Block

Proof that cannot be completed without more info so it is incomplete

2. Set Theory And Categories

2.1. Naive Set Theory

the book does not provide a formal definition of sets which makes sense as it is too advanced for chapter 0 but says how we write sets :

- As their elements : $E = \{1, 2, 3\}$ works for finite sets
- As an easily understood pattern : $E = \{0, 2, 4, ...\}$ works for infinite sets
- Describing how we construct them : $A = \{s \in S \mid s \text{ satisfies } P\}$

also sets don't care about repetion so: $\{1, 2\} \equiv \{1, 2, 1\}$ the ones that care a called multiset

unsuprisingly the author agrees with me in that the most popular sets are the number sets with the empty set: $\emptyset, \mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}, \mathbb{C}$

TODO:define singletons

2.1.1. Set inclusion

$S \subseteq T \Longleftrightarrow (\forall s \in S \Rightarrow s \in T)$
$S \subset T \Longleftrightarrow (\forall s \in S \Rightarrow s \in T \land \exists t \in T, t \notin S)$
also forall sets S $\emptyset \subseteq S$ and $S \subseteq S$

2.1.2. Operations on sets

- union $\cup$
- intersection $\cap$
- difference $\setminus$
- disjoint union $\coprod$ this correponds to tagged unions or in Rust to enums
- carthesian product $\times$
- "quotient by an equivalence relation"

2.1.3. Equivalence relation definition

a relation is an equivalence relation iff:

- reflexivity: $(\forall a \in S) a \sim a$
- symmetry: $(\forall a, b \in S) a \sim b \Rightarrow b \sim a$
- transitivity: $(\forall a, b, c \in S) a \sim b \land b \sim c \Rightarrow a \sim c$

2.1.4. Exercices

1. done
2.
3. $\forall a, b \in S, a \sim b \Rightarrow \exists S_p \in P, a, b \in S_p$
4. as many as the number of partions if they are equivalent so bell number so 5
5. $a \sim b \Rightarrow a$ lives 1km away from b if you build a partition sets you will get non disjoint sets