This document will contain definitions and other trivial notes.

1 'Trivial' definitons

Definiton 1.1 (Inclusion Map)**.** For $A \subseteq B$, a map $f : A \to B$ that takes $x \in A$ to $x \in B$

Definiton 1.2 (Monomorphism)**.** Injective homomorphism

Definiton 1.3 (Epimorphism)**.** Surjective homomorphism

Definiton 1.4 (Endomorphism)**.** A homomorphism with same domain and co-domain

Definiton 1.5 (Automorphism)**.** An isomorphism with same domain and co-domain

Definiton 1.6 (Pre-order)**.** A reflexive, transitive binary relation.

Definiton 1.7 (Partial Order)**.** Pre-order that's antisymmetric.

Definiton 1.8 (Total Order)**.** Partial order with trichotomy.

Definiton 1.9 (Presheaf)**.** A functor $\mathcal{A}^{op} \mapsto Set$

2 Group Theory

Definiton 2.1 (Monoid)**.** A semi-group with identity.

Definiton 2.2 (Direct Product)**.** Direct product of groups G and H is the group on the set $G \times H$ with the binary operation:

$$(a, b)(a', b') = (aa', bb') \text{ where } a, a' \in G;\ b, b' \in H$$

Definiton 2.3 (Congruence Relation)**.** On a monoid M , an equivalence relation, $\sim$, such that $\forall a, a', b, b' \in M$,

$$a \sim a',\, b \sim b' \implies ab \sim a'b'$$

Definiton 2.4 ((left) G-Set)**.** Let G be a group, and X a set. Then, f is a left group action on of G on X, or X is a left G-Set iff

$$f : G \times X \mapsto X : \forall x \in X\ ,\ f(e_G, x) = x \text{ and } \forall a, b \in G\ ,\ f(ab, x) = f(a, f(b, x))$$

Definiton 2.5 (Natural Projection)**.** Let G be a group and $N \trianglelefteq G$. Natural projection, $\pi : G \to G/N$ defined as $g \mapsto gN$