Every topology provides a complete Heyting algebra in the form of its open set lattice.

0.1 Constructions on Categories

$C \times D$ has elements (A, B), we define $f : A \to C$ $g : B \to D$, $h : A \times B \to C \times D$ or $h : (f, g)$

Projections

$$\begin{tikzcd} & C \times D \arrow[dl, "\pi_1"'] \arrow[dr, "\pi_2"] & \\ C & & D \end{tikzcd}$$

$\pi_1(1_A, 1_B) = 1_A = 1_{\pi_1(A,B)}$

Opposite Category For any category C, the opposite category is notated C^{op}. It is the same but with the arrows reversed.

Op is its own inverse

$$(C^{op})^{op} = C$$

Op preservers products, functors, and slices

$$(C \times D)^{op} = C^{op} \times D^{op}$$

$$(F(C, D))^{op} = F(C^{op}, C^{op}$$

Arrow Category

Definition 1. Monoids One object category, group without inverses Natural Numbers with addition