Architecture CS, Assignment 2
Boolean Algebras

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November 26, 2024

Throughout this assignment fix some general boolean algebra $\mathbb{B}$. In partucular you **cannot** use truth tables.

1. Prove each of the following equations.

   (a) $x + 1 = 1$.

   (b) $x \cdot 0 = 0$.

   (c) $\bar{\bar{x}} = x$.

   (d) $x + x = x$.

   (e) $x \cdot x = x$.

   (f) $\overline{x + y} = \bar{x} \cdot \bar{y}$. (De-Morgan)

   (g) $\overline{x \cdot y} = \bar{x} + \bar{y}$. (De-Morgan)

   (h) $x + xy = x$.

   (i) $x \cdot (x + y) = x$.

   (j) $x + \bar{x} \cdot y = x + y$.

   (k) $x \cdot (\bar{x} + y) = x \cdot y$.

   (l) $xy + \bar{x}z = (x + z) \cdot (\bar{x} + y)$.

   (m) $xy + \bar{x}z + yz = xy + \bar{x}z$.

2. (a) Prove: $x = xy \iff y = x + y$.

   (b) Define the relation $\leq$ as follows: $x \leq y \iff x = xy$. Prove that $\leq$ is a partial order.