

(1) Empty set, the universe

$$A \cup \emptyset = A$$

$$A \cap \overline{\emptyset} = A$$

(3) Commutativity

$$A \cup B = B \cup A$$

$$A \cap B = B \cap A$$

(5) Complement

$$A \cap \overline{A} = \emptyset$$

$$A \cup \overline{A} = \overline{\emptyset}$$

(2) Associativity

$$(A \cup B) \cup C = A \cup (B \cup C)$$

$$(A \cap B) \cap C = A \cap (B \cap C)$$

(4) Distributivity

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

(6) de Morgan

$$\overline{(A \cup B)} = \overline{A} \cap \overline{B}$$

$$\overline{(A \cap B)} = \overline{A} \cup \overline{B}$$

(7) a) $A \subseteq B$ iff $A \cup B = B$ iff $A \cap B = A$ b) $A \setminus B = A \cap \overline{B}$

$$= \left(\underbrace{(Z \cap (Z \cup Y))}_{AL} \cup \underbrace{(X \cap Y \cap Z \cap Y)}_{(5)} \right)$$

$$\simeq \left(Z \cup (X \cap Z) \right)$$

$$\stackrel{AL}{=} Z$$