

CS 311H: Discrete Math (Fall 2026)

Problem Set #5

Due: Sep 25, 2026

Problem 1:

Determine which of the following equalities hold for all sets A , B , and C . If the equality fails, determine whether the statement becomes true if the symbol $=$ is replaced by $\subseteq$ or $\supseteq$. Prove all claims.

(a) $A \cup (A \cap B) = A$.

(b) $A - (A - B) = B$.

(c) $A - (B \cup C) = (A - B) \cup (A - C)$.

Problem 2: Prove

Prove that $\mathcal{P}(A) \subseteq \mathcal{P}(B)$ if and only if $A \subseteq B$.

Problem 3: Prove or Disprove

Prove or disprove that if A and B are sets, then $\mathcal{P}(A \times B) = \mathcal{P}(A) \times \mathcal{P}(B)$.

Problem 4: Prove using Set Identities

Let A , B , and C be sets. Using the set identities (and only the set identities) show that

$$\left(\overline{(A \cup B)} \cap \overline{(B \cup C)}\right) \cap \overline{(C \cup A)} = (\overline{A} \cap \overline{B}) \cap \overline{C}.$$

Problem 5: Symmetric difference—Prove using Set-Builder Notation

The symmetric difference of A and B , denoted by $A \oplus B$ is the set containing those elements in A or B , but not in both A and B .

Show using set-builder notation method (and only the set-builder notation method) that

(a) $A \oplus B = (A \cup B) - (A \cap B)$

(b) $A \oplus B = (A - B) \cup (B - A)$