

COT 3100 Recitation Problems: Sets

1) Let $A = \{2, 3, 5, 7\}$ and $B = \{1, 2, 4\}$. List the following sets: $A \cup B$, $A \cap B$, $A - B$, $B - A$, $A \times B$, $\wp(A)$, and $\wp(B)$.

2) Let A , B , and C be three sets. Using the Set Laws (and definition of Set Difference, show that

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

3) Use the Set Laws to show that the two following sets are equal:

$$A \cup (B \cap \bar{C}) \qquad \overline{\bar{A} \cap \bar{B}} \cap (A \cup (A \cap C) \cup \bar{C})$$

4) Using proof by contradiction, prove the following assertion about finite sets A and B :

$$\text{If } A \cup B = A \cap B, \text{ then } A = B.$$

Once you set up the contradiction, you should have to investigate two cases.

5) Determine, with proof, whether or not the statement for #4 is true in both directions, namely, can we say that "If **and only if** $A \cup B = A \cap B$, then $A = B$?

6) Prove or disprove the following assertion: Let A , B and C be non-empty finite sets taken from the universe of integers. If $A \subseteq B \cap C$, then $\bar{B} \subseteq \bar{A}$.

7) Let A , B and C be three sets. Prove or disprove: $A - C = (A - B) \cup (B - C)$.

8) Prove or disprove the following assertion about sets A , B and C :

$$\text{if } B \subseteq A \cap C, \text{ then } A - C \subseteq A - B.$$

9) Prove or disprove the following assertion about sets A , B , C and D :

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

10) Consider finite sets A , B and C where we know the cardinalities of the following sets:

$$\begin{aligned} |A \cap C| &= 7 \\ |A \cap B \cap C| &= 3 \\ |A \cup B| &= 20 \\ |A \cap B| &= 8 \\ |B \cup C| &= 22 \\ |A \cup B \cup C| &= 23 \end{aligned}$$

Determine $|B|$.