

Math 1313
Chapter 6 – Section 6.1
Part II – Set Operations

Set Complementation

Let U be a universal set and A be a subset of U , then

1. $U^c = \emptyset$
2. $\emptyset^c = U$
3. $(A^c)^c = A$
4. $A \cup A^c = U$
5. $A \cap A^c = \emptyset$

Set Operations

Let U be a universal set. If A , B , and C are arbitrary subsets of U , then

1. $A \cup B = B \cup A$
2. $A \cap B = B \cap A$
3. $(A \cup (B \cup C)) = ((A \cup B) \cup C)$
4. $(A \cap (B \cap C)) = ((A \cap B) \cap C)$
5. $(A \cup (B \cap C)) = (A \cup B) \cap (A \cup C)$
6. $(A \cap (B \cup C)) = (A \cap B) \cup (A \cap C)$

De Morgan's Laws

Let A and B be sets. Then

1. $(A \cup B)^c = A^c \cap B^c$

2. $(A \cap B)^c = A^c \cup B^c$

These laws can be extended out to a finite number of sets.

Example 1: Let $U = \{1, 2, 3, 4, a, b, c, d\}$, $A = \{2, 4, a, c, d\}$, $B = \{1, 2, b, c\}$, and $C = \{2, 4, a, c, d\}$.

Find the given sets.

a. $(A \cap C)$

b. $(B^c \cap A)$

Example 2: Let $U = \{1, 2, 3, 4, a, b, c, d\}$, $A = \{1, 4, a, b, d\}$, $B = \{2, 3, b, c\}$, and $C = \{3, 4, c, d\}$.

Find the given sets.

a. $(C \cup A)$

b. $(C^c \cap B^c)$

Example 3: Let $U=\{1, 2, 3, 4, a, b, c, d\}$, $A=\{2, 3, 4, a\}$, $B=\{1, 3, a, b, c\}$, and $C=\{1, 2, 4, a, d\}$.

Find the given set.

$$((A \cap B)^c \cup C)$$

Example 4: Let $U=\{1, 2, 3, 4, a, b, c, d\}$, $A=\{3, 4, b, c\}$, $B=\{1, 4, a, c\}$, and $C=\{2, 3, 4, a, c, d\}$.

Find the given set.

$$((A^c \cup C) \cap B^c)$$

Example 5: Let U denote the set of all children in a given 1st grade class. Let $L = \{x \in U \mid x \text{ likes lemon pie}\}$, $A = \{x \in U \mid x \text{ likes apple pie}\}$ and $B = \{x \in U \mid x \text{ likes blueberry pie}\}$.

Describe the given set in words.

a. $A \cap L$

The set of children in a given 1st grade class that

b. $((A \cup B) \cap L^c)$

The set of children in a given 1st grade class that

Example 6: Using the same sets above:

Describe the given statement in set notation.

a. The set of children in a given 1st grade class that like apple pie or blueberry pie.

b. The set of children in a given 1st grade class that do not like lemon pie or blueberry pie and do like apple pie.