The Four Set Operations

Complement, Intersection, Union and Set Difference

Text – Chapter 2 – Section 3

Set Complement

- The complement of a set, A, (Denoted A′) is the set of all elements of the Universal set that do not belong to set A.

$$A' = \{x \mid x \in U \text{ and } x \notin A\}$$

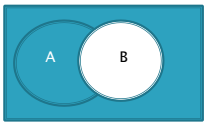
$$U = \{a,b,c,d,e,f,g,h,i\},\ A = \{b,d,c,f\} \text{ then } A' = \{a,e,g,h,i\}$$

- Note: The number of elements in A plus the number of elements in A' equals the number of elements in U. $n(A) + n(A') = n(U)$

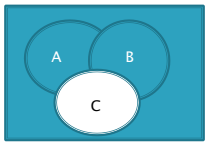
No in-class assignment problem

Set Complement – Venn Diagram

- The shaded area is the Complement of the set B.



- The shaded area is the Complement of the set C.



In-class Assignment: 3. 1 - 3

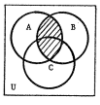
Set Intersection

- The intersection of two sets, A and B, (Denoted as $A \cap B$) is the set of elements that belong to A and B.
  - If $U = \{1,2,3,...,10\}$, $A = \{4,5,6\}$ and $B = \{2,4,6,8,10\}$
  - Then $A \cap B = \{2,4\}$

No in-class assignment problem

Set Intersection in Venn Diagrams

- The diagram below shows the intersection of sets A and B.



- Note: Each of the areas in the diagram can be verbally described.
  - The area with the letter C in it represents all elements that belong to set C but do not belong to sets A and B.

In-class Assignment 3, 4 - 6

Set Union

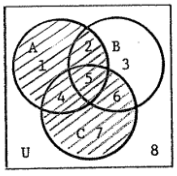
- The union of two sets A and B (Denoted $A \cup B$) is the set of elements that belong to A or B.
  - The word "or" is the inclusive word which includes the elements that belong to both A and B.
- If $U = \{1,2,3,...,10\}$, $A = \{4,5,6\}$ and $B = \{2,4,6,8,10\}$

Then $A \cup B = \{2,4,5,6,8,10\}$

No in-class assignment problem

Set Union in Venn Diagrams

- The diagram at the right shows the union of sets A and C.
  - Note: The intersection of sets A and C is included in the union of the 2 sets.



In-class Assignment 3, 7 - 9

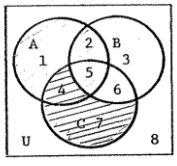
Set Difference

- The set difference of two sets A and B (Denoted A– B) is the set of the elements of set A that do not belong to set B.
  - If $U = \{x \mid x \text{ is a letter of the alphabet}\}$, A= m,i,s,p , B= a,e,i,o,u
  - Then $A - B =$ m,s,p
  - Note: There should be no elements of the second set in the set difference.

In-class assignment 3 - 8

Set Difference in Venn Diagrams

- The diagram below shows the set difference of sets C and B.
  - The order of the sets is important. That is $C - B \neq B - C$.

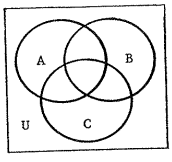


In-class assignment 3, 10 -11

Combination of Set Operations

- Shade the set.

$$\left[A - C' \cup B' \cap A \right]'$$



In-class Assignment 3 - 10