RAMA UNIVERSITY

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Faculty of Engineering and Technology

Discrete Mathematics (CSPS-111)

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Outlines

- **Set Operations**
- **The Union Operator**
- **The Intersection Operator**
- **Set Difference**
- **Set Complements**

Set Operations

- *The complement of a set A contains exactly those elements under consideration that are not in A: denoted A^c (or $\overline{A}$ as in the text)*
- $A^c = U - A$
- *Example: U = N, B = {250, 251, 252, …}*
- $B^c = \{0, 1, 2, \ldots, 248, 249\}$

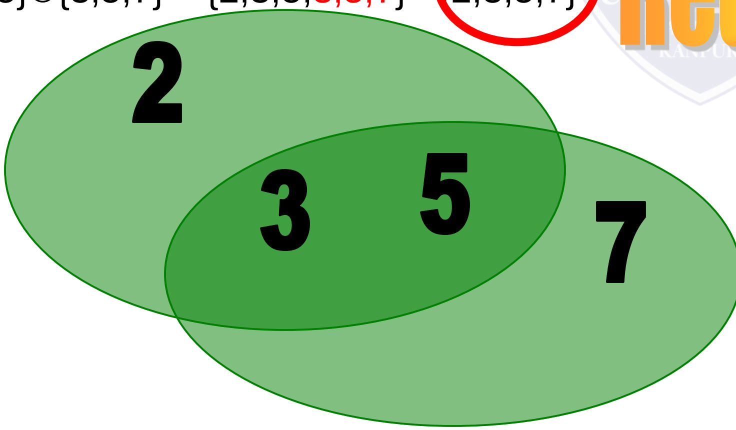
The Union Operator

- For sets A, B, their *union* $A \cup B$ is the set containing all elements that are either in A, **or** (“$\vee$”) in B (or, of course, in both).
- Formally, $\forall A,B$: $A \cup B = \{x \mid x \in A \vee x \in B\}$.
- Note that $A \cup B$ contains all the elements of A **and** it contains all the elements of B:
  $\forall A, B$: $(A \cup B \supseteq A) \wedge (A \cup B \supseteq B)$

Union Examples:

- {a, b,c}∪{2,3} = {a,b,c,2,3}
- {2,3,5}∪{3,5,7} = {2,3,5,3,5,7} = {2,3,5,7}

Required Form

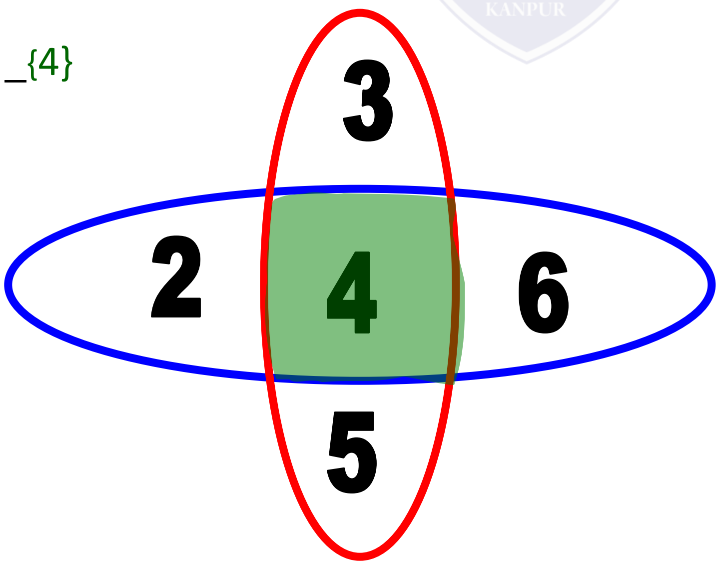


The Intersection Operator

- For sets *A*, *B*, their *intersection* $A \cap B$ is the set containing all elements that are simultaneously in *A* **and** ("$\wedge$") in *B*.
- Formally, $\forall A,B$: $A \cap B \equiv \{x \mid x \in A \wedge x \in B\}$.
- Note that $A \cap B$ is a subset of *A* **and** it is a subset of *B*:
  $\forall A, B$: $(A \cap B \subseteq A) \wedge (A \cap B \subseteq B)$

Intersection Examples:

- $\{a,b,c\} \cap \{2,3\}$ = __$\varnothing$
- $\{2,4,6\} \cap \{3,4,5\}$ = _$\{4\}$



Set Difference

- For sets *A*, *B*, the *difference of A and B*, written *A*–*B*, is the set of all elements that are in *A* but not *B*.
- $A - B :\equiv \{x \mid x \in A \wedge x \notin B\}$

  $= \{x \mid \neg(x \in A \rightarrow x \in B)\}$
- Also called:

  The *complement of B with respect to A*.

Set Difference Examples

- {1,2,3,4,5,6} – {2,3,5,7,9,11} =

  _______{ 1,4,6 }______
- **Z** – **N** = {… , -1, 0, 1, 2, … } – {0, 1, … }

  = {*x* | *x* is an integer but not a nat. #}

  = {*x* | *x* is a negative integer}

  = {… , -3, -2, -1}

Set Complements

The Power Set

- The *universe of discourse* can itself be considered a set, call it *U*.
- The *complement* of *A*, written , is the complement of *A* w.r.t. *U*, *i.e.*, it is *U*–*A.*
- *E.g.,* If *U*=**N**,

$$\overline{\{3,5\}} = \{0,1,2,4,6,7,\ldots$$