

**SEF015: Discrete Mathematics (2022-23)*****Material for the Q&A session or...Tutorial 8 (Week 9)***

This material is for your tutorial in Week 9 and is designed to help your understanding. Please try to answer all the questions before you join your tutorial group.

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Question 1. Verify the Inclusion–Exclusion formula  $|S \cup T| = |S| + |T| - |S \cap T|$  for the sets  $S = \{a, b, c\}$  and  $T = \{b, d, e, x, z\}$ .

Question 2. For finite sets  $A$  and  $B$ , if  $|A| = 4$  and  $|B| = 10$  what range of values can  $|A \cap B|$  take? What about  $|A \cup B|$ ?

Question 3. In a group of students, 65 play foot ball, 45 play hockey, 42 play cricket, 20 play foot ball and hockey, 25 play foot ball and cricket, 15 play hockey and cricket and 8 play all the three games. Using Venn diagram, find the total number of students in the group (Assume that each student in the group plays at least one game). Verify your answer using Inclusion–Exclusion formula for three sets.

Question 4. Let  $A = \{1, 2, 3\}$  and  $B = \{a, b\}$ . Compute the sets  $A \times B$ ,  $B \times A$ ,  $A \times A$  and  $B \times B$ .

Question 5. Consider the following binary relations on the set  $A = \{1, 2, 3\}$ :

(i)  $R = \{(1, 1), (1, 2), (1, 3), (3, 3)\}$ ,

(ii)  $S = \{(1, 1), (1, 2), (2, 2), (2, 3)\}$ .

Determine whether or not any of the above relations on  $A$  is reflexive, symmetric, transitive, or antisymmetric.

Question 6. Let  $S = \{1, 2, 3, 4, 5\}$ . Is the following relation on  $S$  an equivalence relation?

$R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (3, 4), (3, 5), (4, 3), (4, 4), (4, 5), (5, 3), (5, 4), (5, 5)\}$

Question 7. Let  $S = \{1, 2, 3, 4\}$ . for each of the relations  $R_1$ ,  $R_2$  and  $R_3$  on  $S$  below, decide whether it is a partial order, a total order, or nothing:

(a)  $R_1 = \{(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (1, 3), (3, 4), (1, 4)\}$ ,

(b)  $R_2 = R_1 \cup \{(2, 3), (2, 4)\}$ ,

(c)  $R_3 = \{(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (2, 1), (3, 4), (4, 3)\}$ .