

# Discrete Mathematics and Algorithms (CSE 611)

## Assignment Set 1

Total Marks: 130

Deadline: August 20, 2013 (Tuesday), 4:00 pm after class

Each question carries 10 marks.

1. Let  $A, B, X$  and  $Y$  be sets such that  $A \cup B = X \cup Y$ ,  $A \cap B = X \cap Y = \emptyset$ . Show that  $X = \emptyset$  if and only if  $B = (X \cap A) \cup (Y \cap B)$ .
2. Prove or disprove the following statement:  
If  $A, B, C$  be any three sets, then  $(A \cap B) \times C = (A \cap C) \times (A \cap C)$ .
3. Prove or disprove the following statement:  
If  $A, B, C, D$  be any four sets, then  $(A \times B) \cup (C \times D) = (A \cup C) \times (B \cap D)$ .
4. If  $A$  and  $B$  are two sets having  $m$  and  $n$  elements respectively, prove that  $|A \times B| = mn$ .
5. If  $L$  is a straight line and  $E$  an ellipse in a plane, what are all possible values of  $|L \cap E|$ ?
6. In a survey of 100 delegates attending an international conference, the number of delegates who knew one or more of the 3 languages Tamil, Punjabi, and Bengali was as follows. Tamil 28, Punjabi 30, Bengali 42; Tamil and Bengali 10; Tamil and Punjabi 8; Punjabi and Bengali 5. Only 3 delegates knew all the three languages.  
(i) How many did not know any languages at all ?  
(ii) How many knew only Bengali?
7. In a class 70% of the students like mango, 80% like bananas, 75% like apples, 85% like grapes and  $x\%$  like all the four fruits. Find the minimum value that is possible for  $x$ .
8. Let  $R = \{(a, a), (b, c), (a, b)\}$  be a relation on the set  $S = \{a, b, c\}$ . Add the minimum number of elements to  $R$  so that  $R$  becomes

- (i) reflexive
- (ii) symmetric
- (iii) transitive
- (iv) anti-symmetric
- (v) equivalence relation.

9. If  $R_1$  and  $R_2$  be two equivalence relations on a set  $A$ , then are the following are equivalence relations on  $A$ :
- (i)  $R_1 \cap R_2$
  - (ii)  $R_1 \cup R_2$ .
10. Construct an example of relations on the set  $S = \{a, b, c, d, e\}$  which satisfy the following property:  
Reflexive and symmetric, but not transitive.
11. Construct an example of relations on the set  $S = \{a, b, c, d, e\}$  which satisfy the following property:  
Symmetric and transitive, but not reflexive.
12. Construct an example of relations on the set  $S = \{a, b, c, d, e\}$  which satisfy the following property:  
Neither symmetric, nor reflexive, nor transitive.
13. For a given set  $A$ , consider the relation

$$R = \{(x, y) \mid x \in \mathcal{P}(A), y \in \mathcal{P}(A), \text{ and } x \subseteq y\}.$$

Prove or disprove that  $R$  is a partial order relation. Note that  $\mathcal{P}(S)$  denotes the power set of a set  $S$ .

### ***Submission Instructions***

Copying in assignments leads to award ZERO marks in assignment marks. Also, the source from which you have copied, that source student will be treated under the same rule.

Please submit the assignment in hard copy stating the following at the top:

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submitted by

Name: XYZ, Roll No: abc