CSE232: Discrete Mathematics
Assignment 1

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This homework assignment is due on Thursday 09/13, 13:00, at the beginning of the lecture. **Please include your name and student ID.** Each question is worth 10 marks. So the total is 140 marks. You should follow the academic integrity rules for CSE232 that are described at the end of the slides of Lecture 0.

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1. Use set builder notation to give a description of each of these two sets:

(a) $\{0, 1, 4, 9, 16, 25\}$

(b) $\{(0, 0), (0, 1), (0, 2), (1, 0), (1, 1), (2, 0)\}$

2. For each of the statements below, determine whether it is true or false, and justify your answer.

(a) $\{1\} = \{1, 1\}$

(b) $\{1, 2\} = \{2, 1\}$

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

3. Is it true that for all sets A and B, we have $\mathcal{P}(A \cup B) = \mathcal{P}(A) \cup \mathcal{P}(B)$? Justify your answer.

4. Prove that $(A - B) \cup (B - A) = (A \cup B) \cap (\bar{A} \cup \bar{B})$

(a) using Venn diagrams,

(b) and using set identities.

5. What can you say about the sets A and B when $A \times B = B \times A$? Justify your answer.

6. Find a compound proposition with propositional variables p, q and r that is true if and only if exactly two of these variables are true (and the other is false).

7. Prove that $(p \wedge \neg q) \vee (\neg p \wedge q) \equiv (p \vee q) \wedge (\neg p \vee \neg q)$

(a) using a truth table,

(b) and using logical equivalences.

8. Consider the subway network of a city. For any two stations x, y, $P(x, y)$ denotes "x and y are on the same line". In particular, $P(x, x)$ is true for any station x. Express the following proposition using quantifiers, logical connectives, and the predicate P:

- "It is possible go from any station to any other station without changing train more than once".

9. Write a statement that is logically equivalent to the following, and such that the negation $\neg$ appears immediately before P or Q (not any other symbol):

$$\neg\forall x \forall y (P(x, y) \vee Q(x, y)).$$

Justify your answer.