



SCHOOL OF ADVANCED COMPUTING & INFORMATION TECHNOLOGY

Department of Computer Science,
Gujarat University



M.SC. SEMESTER - I (AI & ML)

MSCAI111 MATHEMATICAL FOUNDATION

ASSIGNMENT- I

PREPARED BY

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UNIT-1

Introduction to Set theory

Question 1. Which of the following statements are true or false? Justify your answer.

- 1) The set $A = \{a\}$ and $b = \{\{a\}\}$ are equal.
- 2) $\{a\} \subset \{a\}$
- 3) $\{a\} \in \{a\}$
- 4) $\emptyset \subset \{a\}$
- 5) $\emptyset \in \{\emptyset\}$
- 6) $\{3,4\} \subset \{1, 2, 3, \{3,4\}, 5\}$

Question 2. Write down the following sets into roaster form:

- 1) $A = \{x \in \mathbb{R} \mid x \text{ is a real number such that } x^2 = 4\}$
- 2) $B = \{x \in \mathbb{N} \mid x \text{ is a prime number less than } 20\}$
- 3) $C = \{x \in \mathbb{Z} \mid x \text{ is a positive and whose square is less than } 50\}$
- 4) $D = \{x \in \mathbb{Z} \mid x \text{ is a positive divisor of } 20\}$
- 5) $E = \{x \in \mathbb{Z} \mid x \text{ is a multiple of } 4\}$

Question 3. State which of the following sets are finite and which are infinite:

- 1) $A = \{x \in \mathbb{N} \mid x \text{ is a prime number}\}$
- 2) $B = \{x \in \mathbb{N} \mid x \text{ is an even}\}$
- 3) $C = \{x \in \mathbb{N} \mid (x + a)(x - b) = 0\}$, where a and b are arbitrary real constant
- 4) $D = \{x \in \mathbb{Z} \mid x^2 = 9\}$
- 5) $E = \{x \in \mathbb{Q} \mid 3x - 1 = 0\}$

Question 4. Write down any four properties of set operations. Explain each of its through different examples.

Question 5. State and prove Dr' Morgan's laws. Also, sketch the proof with the help of Venn diagram.

Question 6. **(Application of a power sets in bit representation)**

Consider the set $S = \{a_1, a_2, a_3, \dots, a_{10}\}$. Each subset of given set S is denoted by the symbol B_i , where ' i ' represents a sequence of bit in binary digits. Determine the sequence of bit and corresponding set

for the set B_{111} and B_{73} . How will you designate the set $\{a_2, a_6, a_9\}$ and $\{a_1, a_9\}$?

Question 7. Define Cartesian product of two set. Consider $A = \{1, 2, 3\}$, $B = \{3, 5\}$ and $C = \{2, 3, 5\}$. Then compute the following:

- 1) $A \times B, B \times A$
- 2) $A \times A, B \times B$
- 3) $A \times (B \cap C), A \times (B \cup C)$
- 4) $(A \times B) \cap (A \times C), (A \times B) \cup (A \times C)$

Question 8. If A and B are two sets, then prove that $n(A \cup B) = n(A) + n(B) - n(A \cap B)$. Also, sketch the proof using Venn diagram.

Question 9. If A, B and C are sets, then prove that $n(A \cup B \cup C)$ is given by

$$n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

Question 10. **(Application in Counting number of elements)**

In survey of 1000 persons for usage of social media platform, it was found that 280 uses Facebook (F), 300 uses twitter (T) and 420 uses instagram (I), 80 uses both F and T, 100 uses F and I, 50 uses T and I and 30 uses all three platforms. Answer the following:

- 1) How many use at least one of these platforms?
- 2) How many use none of three platforms?
- 3) How many use only Facebook?
- 4) How many use Facebook and Twitter but not Instagram?