

UCS-405 (Discrete Mathematical Structures)

Tutorial Sheet-1 (Set Theory)

- 1 Let $A = \{n : n \in \mathbb{N} \text{ and } n = 3k + 5 \text{ for some } k \in \mathbb{N}\}$. Is $23 \in A$?
- 2 Write the following sets in roaster form:
 - (i) $A = \{x \mid x \text{ is a positive integer less than 10 and } 2^x - 1 \text{ is an odd number}\}$
 - (ii) $B = \{x \mid x^2 + 7x - 8 = 0, x \in \mathbb{R}\}$
- 3 State which of the following statements are true and which are false:
 - (i) $37 \in \{x \mid x \text{ has exactly two positive factors}\}$
 - (ii) $7747 \in \{x \mid x \text{ is a multiple of 37}\}$
 - (iii) $28 \in \{x \mid \text{the sum of all positive factors of } x \text{ is } 2x\}$
- 4 Given that $D = \{1, 2, 3, \dots, 100\}$, then
 - (i) Write the subset A of D , whose elements are odd numbers.
 - (ii) Write the subset B of D , whose elements are represented by $x + 2$, where $x \in D$.
- 5 Given that $E = \{2, 4, 6, 8, 10\}$. If n represents any member of E , then, write the following sets containing all numbers represented by
 - (i) $n + 1$
 - (ii) n^2
- 6 Let $X = \{1, 2, 3, 4, 5, 6\}$. If n represent any member of X , express the following in form of sets:
 - (i) $n \in x \text{ but } 2n \notin X$
 - (ii) $n + 5 = 8$
 - (iii) n is greater than 4.
- 7 Draw the Venn diagrams to illustrate the following relationship among sets E , M and U , where E is the set of students studying English in a school, M is the set of students studying Mathematics in the same school, U is the set of all students in that school.
 - (i) All the students who study Mathematics study English, but some students who study English do not study Mathematics.
 - (ii) There is no student who studies both Mathematics and English.
 - (iii) Some of the students study Mathematics but do not study English, some study English but do not study Mathematics, and some study both.
 - (iv) Not all students study Mathematics, but every students studying English studies Mathematics.
- 8 Let $B = \{1, 2, 3, 4, 5\}$ and $C = \{3, 4, 5, 6, 7, 8\}$ be subsets of the universal set $U = [1, 2, \dots, 9)$. Find $UNION(B, C)$, $INTER(B, C)$, $COMP(C)$, and $DIFF(B, C)$.

- 9 Suppose $H = \{\text{cat, dog, rabbit, mouse}\}$, $F = \{\text{dog, cow, duck, pig, rabbit}\}$, and $W = \{\text{duck, rabbit, deer, frog, mouse}\}$
- Find $(H \cap F) \cup W$
 - Find $H \cap (F \cup W)$
 - Find $(H \cap F)^c \cap W$
- 10 Verify DeMorgan's Laws for the sets $A = \{1, 2, 3, 4\}$ and $B = \{3, 5, 6, 8\}$ when the universal set is $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$.
- 11 At sunnydale high school there are 55 students in either algebra, biology or chemistry class 28 students in algebra class, 30 students in biology class, 24 students in chemistry class, 8 students in both algebra and biology, 16 students in both biology and chemistry, 5 students in both algebra and chemistry. How many students are in all three classes?
- 12 In a class of 120 students numbered 1 to 120, all even numbered students opt for Physics, whose numbers are divisible by 5 opt for Chemistry and those whose numbers are divisible by 7 opt for Math. How many opt for none of the three subjects?
- 13 Out of forty students, 14 are taking English Composition and 29 are taking Chemistry.
- If five students are in both classes, how many students are in neither class?
 - How many are in either class?
 - What is the probability that a randomly-chosen student from this group is taking only the Chemistry class?
- 14 List all terms in each set
- The set of all positive even numbers less than or equal to 10
 - The set of all letters in the word "AUSTRALIA".
 - The set of all whole numbers greater than 3 and smaller than 16, and divisible by 3.
 - The set of all whole numbers greater than 5 and smaller than 35, and divisible by 5.
 - The set of all prime numbers divisible by 3.
 - The set of all numbers whose absolute value is equal to 7.