UCS405 (Discrete Mathematical Structures)

Tutorial Sheet-1 (Set Theory)

1 Let $A = \{n : n \in N \text{ and } n = 3k + 5 \text{ for some } k \in N\}$.Is $23 \in A$?

2 Write the following sets in roaster form:

(i) $A = \{x | \ x \text{ is a positive integer less than } 10 \text{ and } 2^x - 1 \text{ is an odd number}\}$

(ii) $B = \{x \mid x^2 + 7x - 8 = 0, x \in R\}$

3 State which of the following statements are true and which are false:

(i) $37 \in \{x | \ x \text{has exactly two positive factors}\}$

(ii) $7747 \in \{x | \ x \text{ is a multiple of } 37\}$

(iii) $28 \in \{x | \text{the sum of all positive factors of } x \text{ is } 2x\}$

4 Given that *D = {1, 2, 3, ..., 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 student 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,...,9). Find *UNION(B, C), INTER(B, C), COMP(C),* and *DIFF(B, C).*

9 Suppose H = {cat, dog, rabbit, mouse}, F = {dog, cow, duck, pig, rabbit}, and W = {duck, rabbit, deer, frog, mouse}

(i) Find $(H \cap F) \cup W$
(ii) Find $H \cap (F \cup W)$
(iii) 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.

a) If five students are in both classes, how many students are in neither class?
b) How many are in either class?
c) 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
a) The set of all positive even numbers less than or equal to 10
b) The set of all letters in the word "AUSTRALIA".
c) The set of all whole numbers greater than 3 and smaller than 16, and divisible by 3.
d) The set of all whole numbers greater than 5 and smaller than 35, and divisible by 5.
e) The set of all prime numbers divisible by 3.
f) The set of all numbers whose absolute value is equal to 7.