FYIT/SEM I/CLDS

Time: 2½ Hrs. Marks:75

Note: (1) All questions are compulsory with internal choice.
(2) Figures to the right indicate full marks.
(3) Symbols have their usual meanings.
(4) Use of scientific calculator fx 82 series and below is only allowed.

Q.1 **Attempt Any Three of the following.** (15)

(i) Define partition of a set. Is $\{\{3,7,8\},\{2,9\},\{1,4,5\}\}$ a partition of $\{1,2,3,4,5,6,7,8,9\}$? Justify your answer.

(ii) For all sets A, B and C, Prove by using set identities: $(A \cup B) - C = (A - C) \cup (B - C)$

(iii) Indicate whether each of the following arguments is valid or invalid. Justify your answers by drawing diagrams.

(a) If man is bachelor, he is unhappy.
If man is unhappy, he dies young.
∴ All bachelors, die young.

(b) All scholars are absent minded.
John is a scholar.
∴ John is absent minded.

(iv) Prove by contrapositive method of proof, if $A \cup C \subseteq A \cap C$ then $A = C$.

(v) A survey of 126 students found that:
92 students are taking atleast an English class.
90 students are taking atleast a Mathematics class.
68 students are taking atleast a Science class.
36 students are taking atleast English, Math and Science classes.
68 students are taking atleast English and Math classes.
47 students are taking atleast Math and Science classes.
51 students are taking atleast English and Science classes.
How many students are taking only English class?
How many students are taking only Math and Science class?
How many students are not taking any class?

(vi) Let $\mathbb{R}$ be a set of real numbers and a relation $\leq$ defined on $\mathbb{R}$. Check whether $(\mathbb{R}, \leq)$ is a POSET.

Q.2 **Attempt Any Three of the following.** (15)

(i) If $f: \mathbb{R} - \{2/5\} \longrightarrow \mathbb{R} - \{4/5\}$ is defined as $f(x) = \frac{(4x+3)}{(5x-2)}$, Determine whether the function is bijective and if so, find its inverse.

(ii) Consider permutation $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 5 & 6 & 1 & 3 & 4 \end{pmatrix}$ and $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 4 & 3 & 1 & 2 & 5 \end{pmatrix}$ in S_6.

Find

a) $\tau \circ \sigma$ b) σ^{-1} c) $\sigma \circ \tau$ d) σ^2

(iii) A box contains five white balls and three black balls. If five balls are selected from the box. What is the probability that three of them are white?

(iv) The probability that a man aged sixty will live up to seventy years is 0.60. What is the probability that out of 10 such men now at sixty years, atleast seven will live up to seventy years?

(v) Find the mean, variance and standard deviation for the probability distribution.

X	2	3	8
P(X)	1/4	1/2	1/4

(vi) Suppose X is a random variable with mean 75 and standard deviation 5. Estimate the probability that X lies between 55 and 95.

Q.3 **Attempt Any Three of the following.** (15)

(i) Find the number of distinct permutations that can be formed from all the letters of the word "SOCIOLOGICAL".

(ii) Suppose five people check in their hats at a restaurant and they are given back their hats at random. Find the probability that no person receives his/her own hat.

(iii) Find the number of non-negative solutions $x + y + z = 20$ with the condition that $x \geq 5,\ y \geq 3,\ z \geq 1$.

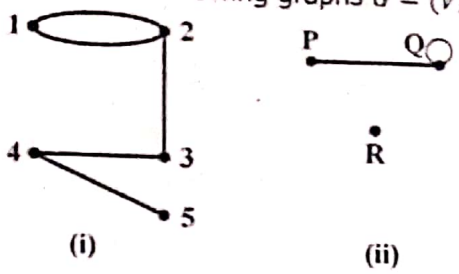
(iv) Suppose five points are chosen from the interior of a square S, where side has length two inches. Show that the distance between two of the points must be less than $\sqrt{2}$ inches.

(v) How many positive integers not exceeding 1000 is not divisible by 3 or 5 or 7?

(vi) Find the product of set $A \times B \times C$ where $A = \{1,2\},\ B = \{a,b,c\},\ C = \{x,y\}$.

Q.4 **Attempt Any Three of the following.**

(i) Consider the following graphs $G = (V, E, \gamma)$ and answer the questions. (15)



(i) (ii)

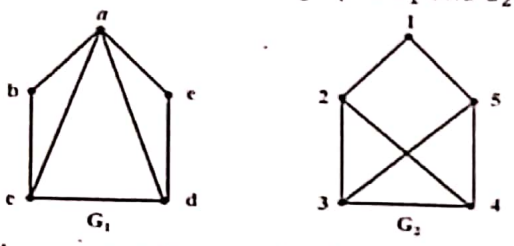
(a) Describe G formally.
(b) Find the degree of each vertex.
(c) Verify the sum of degrees and number of edges in G.

(ii) Is it possible to draw a simple graph with four vertices and seven edges? Justify.

(iii) Explain Konigsberg seven bridges problem.

(iv) Is there a Hamiltonian path in any of the complete graphs $K\_4,4$ and $K\_4,5$.

(v) Determine whether the graphs G_1 and G_2 are isomorphic.



(vi) How many edges must a planar graph have, if it has seven regions and five nodes? Draw one such graph.

Q.5 **Attempt Any Three of the following.** (15)

(i) Draw Hasse diagram for the following relations on set $A = \{1, 2, 3, 12\}$ with relation $R = \{(1,1), (2,2), (3,3), (4,4), (12,12), (1,2), (4,12), (1,3), (1,4), (1,12), (2,4), (2,12), (3,12)\}$

(ii) Explain the following with an example:
a) Upper bound b) Lower bound

(iii) Determine whether the following Hasse diagram represent a lattice.

(iv) Explain DFS algorithm.

(v) Explain in-order traversal.

(vi) Represent the expression in a binary tree and determine its value.
$(3 + 9 \times (15 \div 5)) \div (15 - (70 - (12 \times 5)))$

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