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20MCA14

First Semester MCA Degree Examination, Jan./Feb. 2021
Mathematical Foundation for Computer Applications

Time: 3 hrs. Max. Marks: 100

Note: ***1. Answer FIVE full questions, choosing ONE full question from each module.***
2. Use of Statistical table is permitted.

Module-1

1 a. Define a set, empty set and a singleton set with example for each. **(04 Marks)**

b. Define union and intersection of two sets with example. **(04 Marks)**

c. Find the eigen values and eigen vectors of the matrix.

$$\begin{pmatrix} 2 & 1 & -2 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$ **(12 Marks)**

OR

2 a. What is the cardinality of a set? Find the cardinality of the sets A and B where $A = \{2, 3, 4, 5, 6, 7, 8, 9, 9\}$ and $B = \{a, e, i, o, u\}$. **(04 Marks)**

b. A total of 1232 students have taken a course in Java, 879 in C and 114 have taken a course in C++. Further 103 have taken courses in both Java and C, 23 have taken courses in both. Java and C++ and 14 have taken courses in both C and C++. If 2092 students have taken atleast one of Java, C and C++, how many students have taken a course in all the three subjects. **(08 Marks)**

c. For any three sets A, B, C prove that i) $\overline{A \cup B} = \overline{A} \cap \overline{B}$ ii) $\overline{A \cap B} = \overline{A} \cup \overline{B}$ **(06 Marks)**

d. State and explain Pigeon hole principle. **(02 Marks)**

Module-2

3 a. What is a Proposition? Let p and q be the propositions "swimming in the new jersy seashore is allowed and sharks have been near the sea shore". Express each of the following compound propositions as an English sentence.

i) $p \rightarrow \sim g$ ii) $\sim p \rightarrow \sim q$ iii) $p \leftrightarrow q$ **(06 Marks)**

b. Write the contra positive, the converse and the inverse of the conditional statement "If the home team wins, then it is raining". **(06 Marks)**

c. Show that the compound proposition $[(p \leftrightarrow q) \wedge (q \leftrightarrow r) \wedge (r \leftrightarrow p)]$ is logically equivalent to $[(p \rightarrow q) \wedge (q \rightarrow r) \wedge (r \rightarrow p)]$. **(08 Marks)**

OR

4 a. Show that the following argument is valid. If Today is Tuesday, I have a test in Mathematics (or) Economics. If my Economics professor is sick, I will not have a test in Economics. Today is Tuesday and my Economics professor is sick. Therefore I have a test in Mathematics. **(08 Marks)**

b. Give the proof of the following statement, "If n is an odd integer, then n^2 is odd using direct and indirect proof method". **(07 Marks)**

c. What is the truth value of $\forall x(x^2 >= x)$,

i) If the domain consists of all real numbers.

ii) If the domain consists of all integers. **(05 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

5 a. Let A = {1, 2, 3, 4}, let R = {(1, 3), (1, 1), (3, 1), (1, 2), (3, 3), (4, 4)} be a relation on A. Determine whether R is reflexive, symmetric, anti-symmetric (or) transitive. **(08 Marks)**

b. Give the directed graph of the relation R = {(1, 1), (1, 3), (2, 1), (2, 3), (2, 4), (3, 1), (3, 2), (4, 1)} on the set {1, 2, 3, 4} **(04 Marks)**

c. Let R_1 and R_2 be the relations represented by the matrices

$$M_{R_1} = \begin{pmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix} \text{ and } M_{R_2} = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix}$$

Determine:

i) $R_1 \cup R_2$ ii) $R_1 \cap R_2$ iii) R_1 iv) R_2 **(08 Marks)**

OR

6 a. Discuss briefly on partitions and equivalence classes. **(08 Marks)**

b. Draw the Hasse diagram representing the partial ordering {(a, b)/a divides b} on {1, 2, 3, 4, 6, 8, 12}. **(12 Marks)**

Module-4

7 a. A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6
P(x)	k	3k	5k	7k	9k	11k	13k

i) Find k

ii) Evaluate $P(X < 4)$, $P(X \geq 5)$, $P(3 < X \leq 6)$.

iii) Find the minimum value of K so that $P(X \leq 2) > 0.3$. **(11 Marks)**

b. The probability that a pen manufactured by a company will be defective is 1/10. If 12 such pens are manufactured find the probability that i) exactly two will be defective ii) atleast two will be defective iii) None will be defective. **(09 Marks)**

OR

8 a. For the probability density function f(x), where

$$f(x) = \begin{cases} x^2/3, & -1 < x < 2 \\ 0, & \text{else where} \end{cases}$$

find F(x) and use it to evaluate $P(0 < X \leq 1)$. **(06 Marks)**

b. The probability that a patient recovers from a rare blood disease is 0.4. If 15 people are known to have contracted the diseases. What is the probability that

i) Atleast 10 survive

ii) From 3 to 8 survive

iii) Exactly 5 survive. **(09 Marks)**

c. Given a standard normal distribution find the value of K such that

i) $P(z > K) = 0.3015$

ii) $P(K < z < -0.18) = 0.4197$ **(05 Marks)**

Module-5

9 a. Define the following with suitable examples:

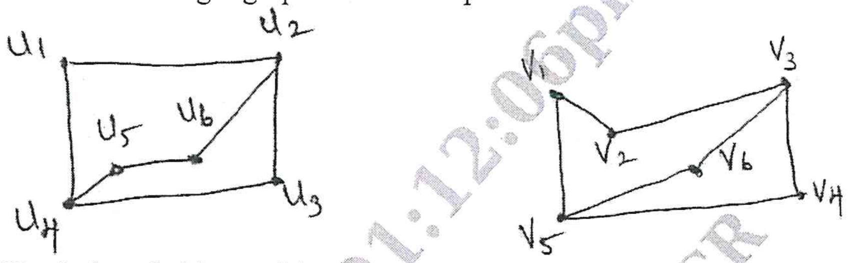
i) Simple graph

ii) Complete graph

iii) Bipartite graph

iv) Complete bipartite graph. **(06 Marks)**

b. Check whether the following 2 graphs are Isomorphic with each other. **(06 Marks)**



c. Explain the Konigsberg bridge problem. **(08 Marks)**

OR

10 a. Define the terms:
i) Hamilton path
ii) Eulers path
iii) Planar graphs
iv) Subgraph of a graph with suitable example for each. **(06 Marks)**

b. Give the graph colouring of the graph shown in Fig.Q.10(b).

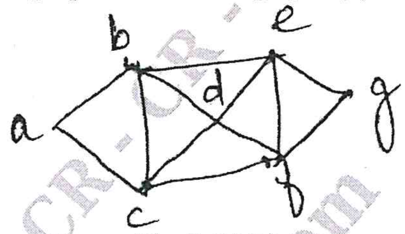


Fig.Q.10(b)

(04 Marks)

c. Use Dijkstra's algorithm to find the length of a shortest path between the vertices a and z in the graph given below, shown in Fig.Q.10(c).

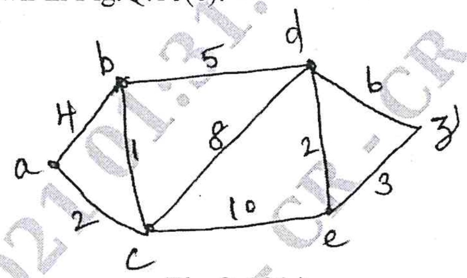


Fig.Q.10(c)

(10 Marks)

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