CBCS SCHEME

USN

20MCA14

First Semester MCA Degree Examination, July/August 2022
Mathematical Foundation for Computer Applications

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Statistical tables are permitted.

Module-1

1 a. Define a set, power set and a single ton set with an example for each. (06 Marks)
b. State and prove Associative Laws of set theory. (07 Marks)
c. Find the eigen values and eigen vectors of $A = \begin{pmatrix} -1 & 3 \\ -2 & 4 \end{pmatrix}$. (07 Marks)

OR

2 a. Let $A = \{1, 2, 3, 4\}$ $B = \{2, 4, 5, 6\}$. Find : i) $A \cup B$ ii) $A - B$ iii) $B - A$. (07 Marks)
b. 30 cars were assembled in a factory. The options available were a ratio AC and white wall tyres. It is known that 15 of the cars have radios, 8 of them have AC and 6 of them have white wall tyres. Three of them have all 3 options. Determine at least how many cars do not have any option at all. (07 Marks)
c. State and prove pigeonhole principle. Prove that if 30 dictionaries in a library contain a total of 61, 237 pages then at least one of the dictionaries must have atleast 2045 pages. (06 Marks)

Module-2

3 a. Define the following with an example :
i) Conjunction
ii) Disjunction. (06 Marks)
b. Prove that for any 3 propositions p, q, r
$[p \to (q \wedge r)] \Leftrightarrow [(p \to q) \wedge (p \to r)]$. (07 Marks)
c. Write the converse, inverse and contrapositive of the statement "If 2 is an integer, then 9 is a multiple of 3". (07 Marks)

OR

4 a. Let p, q, r be propositions having the truth values 0, 0 and 1 respectively. Find the truth values of i) $(p \vee q) \vee r$ ii) $(p \wedge q) \wedge r$. (06 Marks)
b. Give the direct proof and indirect proof of "If n is an odd integer, then n^2 is an odd integer". (05 Marks)
c. Let the unwerse be the set of all integers. Consider the following open statements
$p(x) : x > 3$ $q(x) : x + 1$ is even $r(x) : x \leq 0$.
Write down the truth values of i) $p(2)$ ii) $p(3) \vee \sim r(3)$. (04 Marks)
d. Test whether the argument is valid. If Sachin hits a century, then he gets a free car.
Sachin hits a century
$\therefore$ Sachin gets a free car (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 :

$A = \{1, 2, 3, 4\}$

$R = \{(1, 1), (1, 2)(2, 1)(2, 2)(3, 4)(4, 3)(3, 3)(4, 4)\}$

a relation on A. Verify that R is an equivalence relation on A. **(06 Marks)**

b. Let A = {1, 2, 3, 4} R be the relation on A defined by xRy iff x divides y. Write down R as the set of ordered pairs and draw the digraph of R. **(07 Marks)**

c. Let $M_R = \begin{pmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$ $M_S = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix}$ be the matrix relations of the relations R and S on A.

Find :

i) $R \cup S$

ii) $R \cap S$

iii) $\overline{R}$. Given A = {a, b, c}. **(07 Marks)**

OR

6 a. Define partition of a set and equivalent class with an example. **(10 Marks)**

b. Draw the Hasse diagram representing the positive divisors of 36. **(10 Marks)**

Module-4

7 a. The probability distribution of a finite random variable X is given by the following table :

x	−2	−1	0	1	2	3
P(x)	0.1	K	0.2	2K	0.3	K

Find the value of K, mean and variance. **(10 Marks)**

b. When a coin is tossed 4 times, find the probability of getting.

i) Exactly one head

ii) At most 3 heads

iii) At least 2 heads. **(10 Marks)**

OR

8 a. Find the value of c such that

$$f(x) = \begin{cases} \frac{x}{6} + c & 0 \le x \le 3 \\ 0 & \text{elsewhere} \end{cases}$$ is a p.d.f. Also find P(1 x 2) **(06 Marks)**

b. In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that the shower will last for :

i) 10 min or more

ii) Less than 10 minutes

iii) Between 10 and 12 minutes. **(07 Marks)**

c. If x is a normal variable with mean 30 and standard deviation 5 find the probability that

i) $26 \le x \le 40$

ii) $x \ge 45$. **(07 Marks)**

Module-5

9 a. Define the following with suitable examples :
   i) Simple graph
   ii) Null graph
   iii) Complete bipartite graph. (06 Marks)

b. Explain Konigsberg bridge problem. (07 Marks)

c. Check whether the following graphs are isomorphic.

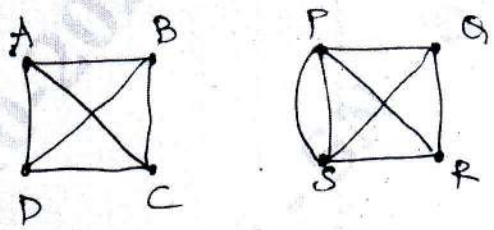

Fig.Q9(c) (07 Marks)

OR

10 a. Define the following with an example :
   i) Spanning subgraph
   ii) Induced subgraph
   iii) Planar graphs. (06 Marks)

b. Give the graph coloring of the graph shown in Fig.Q10(b) below.

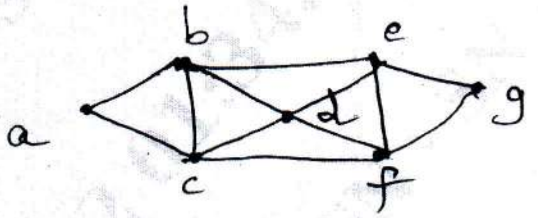

Fig.Q10(b) (07 Marks)

c. Use Dijkstra's algorithm to find the shortest path from vertex 1 to each of the other vertices in the weighted directed network shown in the Fig.Q10(c).

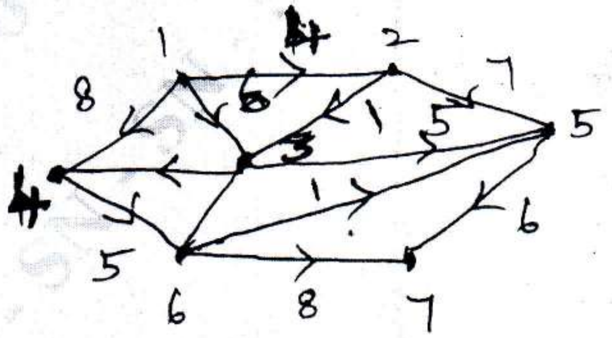

Fig.Q10(c)

Indicate the weight of the shortest paths. (07 Marks)

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