

Total No. of Questions : 20

Total No. of Pages : 04

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M.C.A. I-Sem. ( Main/Back ) Exam. 2024

MCA-101/Mathematical Foundations  
in Computer Science

Time : 3 Hours

Maximum Marks : 70

Min. Passing Marks : 28

**Instructions to Candidates :**

Attempt all ten questions from Part-A. All five questions from Part-B and three questions out of five questions from Part C.

*Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.  
(As mentioned in Form No. 205)*

1. ....

2. ....

**PART -A**

( Word Limit 25 )

[10×2=20]

Q. 1. In how many of the distinct permutations of the Letters in MISSISSIPPI do the four I's not come together?

Q.2/ Find the rank of the following matrix :

$$\begin{bmatrix} 1 & 3 & 5 \\ 2 & -1 & 4 \\ -2 & 8 & 2 \end{bmatrix}$$

Q.3. A family has two children. What is the probability that both the children are boys given that at least one of them is a boy?

Q.4. Find the median of the following data :

16, 1, 16, 6, 14, 4, 13, 8, 9, 23, 47, 9, 7, 8, 17, 28

Q.5. Show that the proposition  $[(P \rightarrow Q) \wedge (Q \rightarrow R)] \rightarrow (P \rightarrow R)$  is a tautology.

Q.6. Define Functionally Complete Set of Connectives.

Q.7/ Evaluate  $0.47362E05 + 0.51321E05 + 0.42121E05$ .

Q.8. Define Eulerian and Hamiltonian graph.

Q.9. Define Spanning tree.

Q.10. How many edges are there in a graph with 7 vertices each of degree 4?

### PART - B

( Word Limit 100 )

[5×4=20]

Q.1. Show that the mapping  $f: \mathbb{R} \rightarrow \mathbb{R}$ , defined by  $f(x) = ax + b$ , where  $a, b \in \mathbb{R}$ ,  $a \neq 0$ . Show that  $f$  is invertible.

Q.2. A doctor is to visit a patient. From the past experience, it is known the probabilities that he will come by train, bus, scooter or by other means of transport are respectively 0.25, 0.35, 0.20, 0.20. If he comes by train, bus, scooter or by other means of transport, the probabilities that he will be late are respectively 0.10, 0.20, 0.40, 0.30. What is the probability that he will be late?

are respectively  $\frac{3}{10}, \frac{1}{5}, \frac{1}{10}$  and  $\frac{2}{5}$ . The probabilities that he will be late are  $\frac{1}{4}, \frac{1}{3}$  and  $\frac{1}{12}$ , if he comes by train, bus and scooter respectively, but if he comes by other means of transport, then he will not be late. When he arrives, he is late. What is the probability that he comes by train?

Q. 3. Translate each of these statements into logical expressions using predicates, quantifiers and logical connectives :

- (a) Something is not in the correct place
- (b) all tools are in the correct place and in excellent conditions
- (c) everything is in the correct place and in excellent condition
- (d) nothing is in the correct place and is in excellent condition

Q. 4. If  $u = \frac{5xy^2}{z^2}$  and errors in  $x, y, z$  be 0.001, compute the relative maximum error in  $u$  when  $x = y = z = 1$ .

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205  
u - s + 2  
- 1 + 2  
1

Q. 5. Let  $G$  be a connected simple planar graph with ' $e$ ' edges and ' $v$ ' vertices and ' $r$ ' regions, then prove that  $v - e + r = 2$ .

**PART - C**

(Any three)

[3×10=30]

1. Define equivalence relation. Let  $A = \{1, 2, 3\}$ . Show that the relation  $R = \{(1,1), (1,2), (2,1), (2,2), (3,3)\}$  is an equivalence relation.

[P.T.O.]

Q.2. Calculate the mean, variance and standard deviation for the following distribution :

Class	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

Q.3. (a) Show that  $\{\vee, \sim\}$  is functionally complete set.

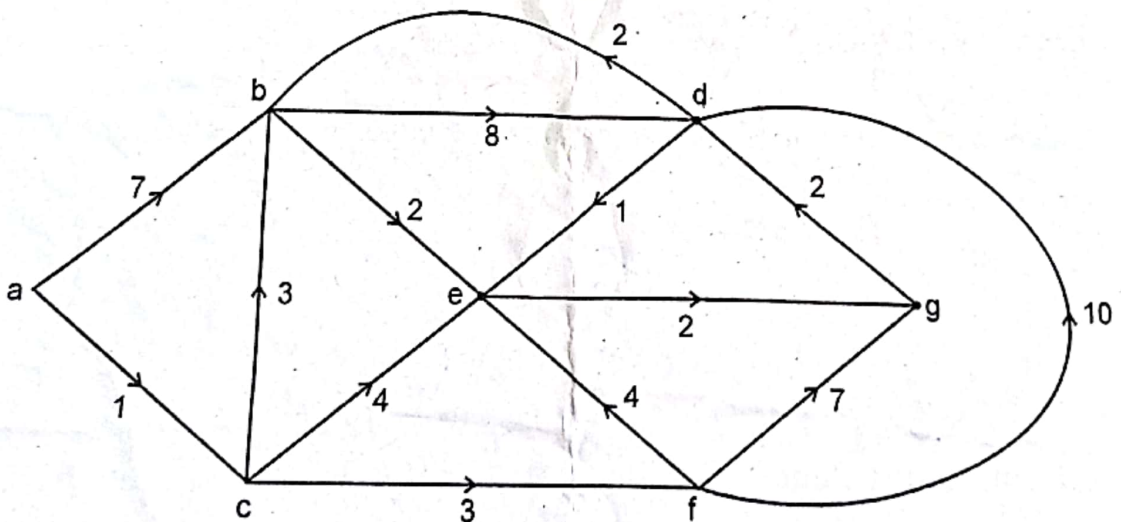
(b) Determine whether following is a Tautology or not :

$$(p \rightarrow q) \vee (q \rightarrow p).$$

Q.4. (a) In successive measurement of period of oscillation of Pendulum, the readings turn out to be 2.63s, 2.56s, 2.42s, 2.71s and 2.80s. Calculate absolute error, mean absolute error and relative error.

(b) Write a short note on errors in numerical computation.

Q.5. Find the shortest path between the vertices a and g in the following directed weight graph :



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