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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester MCA (Two Years) Degree (R, S) Examination December/January 2023-24

Course Code: 20MCA101

Course Name: MATHEMATICAL FOUNDATIONS FOR COMPUTING

Max. Marks: 60 Duration: 3 Hours

PART A

Answer all questions, each carries3 marks. Marks

1 If $A = \{1,2,3,4\}$ give an example of a relation $\Re$ on A that is (3)

a. Reflexive and symmetric, but not transitive.

b. Reflexive and transitive, but not symmetric.

c. Symmetric and transitive, but not reflexive.

2 Consider a relation $\Re$ on $A = \{1,2,3\}$ whose matrix representation is given. (3)

Determine its inverse. $M_{\mathcal{R}} = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

39, -29

3 Use the Euclidean algorithm to obtain integers x, y satisfying (3)

$$\gcd(1769, 2378) = 1769x + 2378y$$

4 Solve the recurrence relation $a_n = 5a_{n-1} + 6a_{n-2}$ (3)

5 Prove that the sum of the degrees of all vertices of a graph G is twice the number of edges in it. (3)

6 Define a planar graph with examples. (3)

7 State the fundamental theorem for linear systems. (3)

8 How to convert a matrix into row echelon form? What are the information obtained from this form? (3)

9 In a partially destroyed laboratory record, only lines of regression y on x and x on y are available as $4x - 5y + 33 = 0$, $20x - 9y = 107$ respectively. Calculate the coefficient of correlation between x and y. (3)

10 Form the normal equations for fitting a straight line in least squares method with n-data. (3)

(2,3), (3,2)

(1,1)=(1,1)
(1,1) (1,1)

PART B

Answer any one question from each module. Each question carries 6 marks.

Module I

11 Let $A = (1,2,3,4,5) \times (1,2,3,4,5)$ and define $\mathcal{R}$ on A by $(x_1, y_1)\mathcal{R}(x_2, y_2)$ if $x_1 + y_1 = x_2 + y_2$. Verify that $\mathcal{R}$ is an equivalence relation on A. (6)

OR

12 Using Warshall's algorithm, find the transitive closure of the relation $R = [(1,2), (2,3), (3,3)]$ on the set $A = \{1,2,3\}$. (6)

Module II

13
a. Show that the square of any integer is of the form $3k$ or $3k + 1$. (2)

b. Find the remainders when 2^{50} and 41^{65} are divided by 7. (4)

OR

14 Find the solution for the following set of congruent equations using Chinese Remainder theorem, (6)

$x \equiv 2 \mathrm{mod}(3)$

$x \equiv 3 \mathrm{mod}(5)$

$x \equiv 2 \mathrm{mod}(7)$

$n = n_1 \times n_2 \times n_3$ $\quad N_i x \equiv 1 (\mathrm{mod}\ n_i)$

$N_1 = \frac{n}{n_1}$, $N_2 = \frac{n}{n_2}$

$\bar{x} = a_1 N_1 x_1 (\mathrm{mod}\ n)$

Module III

15
a. Prove that a non-empty connected graph G is Eulerian if and only if its vertices are all of even degree. (4)

b. Represent the Konigsberg bridge problem by means of a graph. Does it have a solution? Justify. (2)

OR

16 Give an example of a connected graph that has

a. Neither an Euler circuit nor a Hamiltonian cycle. (3)

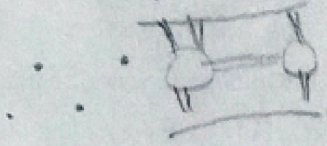
b. Both a Hamiltonian cycle and Euler circuit. (3)

Module IV

17 Let $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 5 & -2 \\ 1 & 1 & 2 \end{bmatrix}$

$\lambda^3 - (\text{sum of diag})\lambda^2 + [\ ] - |A| = 0$

Find eigenvalues and eigen vectors of A. (6)



OR

(1,3) (2,3)
(1,3)

18 Solve the following system of linear equations by Gauss Elimination method,

$x_1 - x_2 + x_3 = 0$ (3)

$-x_1 + x_2 - x_3 = 0$ (3)

$10x_2 + 25x_3 = 90$

$20x_1 + 10x_2 = 80$

Module V

19 Employ the method of least squares to fit a parabola $y = a + bx + cx^2$ to the following data (x, y): $(-1,2), (0,0), (0,1), (1,2)$ (6)

OR

20 Compute Spearman's rank correlation coefficient r for the following data (6)

Person	A	B	C	D	E	F	G	H	I	J
Rank in Statistics	9	10	6	5	7	2	4	8	1	3
Rank in Income	1	2	3	4	5	6	7	8	9	10

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