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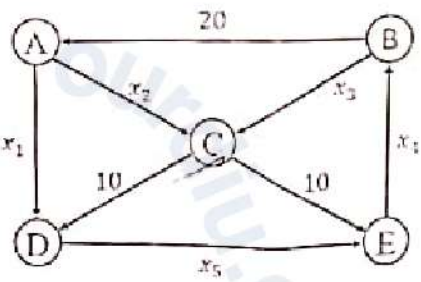
Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science and Engineering
Final Examination, Fall-2024
Course Code: MAT 102, Course Title: Mathematics II
Level: 01 Term: 02 Batch: 66

Time: 2 Hours **Marks: 40**

Answer All Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	Given $A = \begin{bmatrix} 3 & -2 & 1 \\ 0 & 5 & -3 \\ 2 & -7 & 4 \end{bmatrix}$. (i) Construct the inverse matrix A^{-1}. (ii) Organize A^{-1} as a sum of a symmetric matrix and a skew-symmetric matrix. (iii) Identify whether the matrix A is orthogonal or not.	[5+3+1]	CO2
	b)	Given the matrix $M = \begin{bmatrix} 3 & -2 & 4 & 7 \\ 2 & 1 & 0 & -3 \\ 2 & 8 & -8 & 2 \end{bmatrix}$, identify the Rank, construct the Reduced Row Echelon Form (RREF) and the Normal Form (NF) of M.	[5]	
2.		The figure below shows the traffic flow (vehicles per hour) through a network of streets.  (i) Analyze the traffic flow in the network and construct a system of linear equations that represents this network. (ii) Examine the relationships among the variables x_1, x_2, x_3, x_4 and x_5 by solving the system of equations. (iii) Discover the traffic flow when $x_5 = 25$.	[2+3+1]	CO3
3.		Given $M = \begin{bmatrix} -5 & 0 & 0 \\ 9 & 2 & 0 \\ -1 & 4 & -3 \end{bmatrix}$. (i) List out the eigenvalues of M^{-2} and $(MM^{-1})^4$. (ii) Inspect the trace of M^5 and the spectrum of $(M^{-3})^T$.	[4+4]	CO3
4.	a)	Assess the linear independence of the vectors $(1, 0, 2, 3)$, $(0, 1, 4, 5)$ and $(1, 1, 6, 8)$. If they are dependent, find a linear dependence relation and verify it.	[3+2]	CO4
	b)	$P(x, y, z, t) = (4x + y - 2z - 3t, 2x + y + z - 4t, 6x - 9z + 9t)$, $Q(x, y) = (2xy, 5y, x)$, $R(x, y, z) = (2x - y + 3z, x + 4y - 2z, -x + 2y + z)$, $S(x, y, z) = (4x + y, x - z, z + y)$. (i) Examine which are LT. (ii) Evaluate $RoSoP$ and PoS.	[4+3]	