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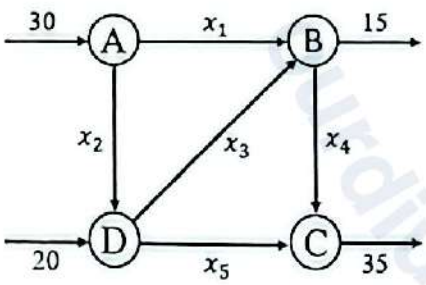
Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science and Engineering
Final Examination, Spring-2025
Course Code: MAT 102, Course Title: Mathematics II
Level: 01 Term: 02 Batch: 67

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 $A = \begin{bmatrix} 4 & 1 & 3 \\ -2 & 1 & 2 \\ 1 & 0 & 5 \end{bmatrix}$. (i) Organize A as a sum of a symmetric matrix and a skew-symmetric matrix. (ii) Construct A^{-1} if it exists. (iii) Identify whether the matrix A^{-1} is orthogonal or not.	[3+5+1]	CO2
	b)	Given the matrix $M = \begin{bmatrix} 1 & -3 & 4 & -3 & 2 & 5 \\ 3 & -7 & 8 & -5 & 8 & 9 \\ 0 & 3 & -6 & 6 & 4 & -5 \end{bmatrix}$, identify the Rank, construct the Row Echelon Form (REF) and the Reduced Row Echelon Form (RREF) 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 $x_3 = 5$ and $x_5 = 20$.	[2+3+1]	CO3
3.		Given $M = \begin{bmatrix} 3 & 0 & 2 \\ 6 & 4 & 3 \\ -4 & 0 & -6 \end{bmatrix}$. (i) List out the eigenvalues of M^{-3} and $(MM^{-1})^6$. (ii) Inspect the trace of M^4 and the spectrum of $(M^T)^{-5}$.	[4+4]	CO3
4.	a)	Assess the linear independence of the vectors $(1,-2,1,3), (-2,4,2,2)$ and $(3,-6,1,5)$. If they are dependent, find a linear dependence relation and verify it.	[3+2]	CO4
	b)	$P(x,y,z) = (-3y, 2x+y, 3y-z)$, $Q(x,y,z) = (2x-y, xy+z, z-x)$, $R(x,y,z) = (4x, x-y, 2x-y+z)$, $S(x,y,z) = (x+y-z, 2y+z)$. (i) Examine which are Linear Transformations. (ii) Evaluate RoP and PoS.	[4+3]	

A^{-1} $|A| = \frac{1}{2}$