

Practical 5 : - LU Decomposition

Determine the LU Decomposition of the given matrix.

$$Q1 : A = \begin{pmatrix} 1 & 4 & 3 \\ 2 & 7 & 9 \\ 5 & 8 & -2 \end{pmatrix};$$

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In[ ]:= A =  $\begin{pmatrix} 1 & 4 & 3 \\ 2 & 7 & 9 \\ 5 & 8 & -2 \end{pmatrix}$ ;
{lu, p, n} = LUDecomposition[A];
l = LowerTriangularize[lu, -1] + IdentityMatrix[3];
u = UpperTriangularize[lu];
a = l.u;
Print["Lower Triangular matrix is = ", l // MatrixForm]
Print["Upper Triangular matrix is = ", u // MatrixForm]
Print["Verification : ", If[a == A, True, False]]

Lower Triangular matrix is =  $\begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 5 & 12 & 1 \end{pmatrix}$ 

Upper Triangular matrix is =  $\begin{pmatrix} 1 & 4 & 3 \\ 0 & -1 & 3 \\ 0 & 0 & -53 \end{pmatrix}$ 

Verification : True
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$$Q2 : A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

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In[ ]:= A =  $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ ;
{lu, p, n} = LUDecomposition[A];
l = LowerTriangularize[lu, -1] + IdentityMatrix[2];
u = UpperTriangularize[lu];
a = l.u;
Print["Lower Triangular matrix is = ", l // MatrixForm]
Print["Upper Triangular matrix is = ", u // MatrixForm]
Print["Verification : ", If[a == A, True, False]]

Lower Triangular matrix is =  $\begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$ 

Upper Triangular matrix is =  $\begin{pmatrix} 1 & 2 \\ 0 & -2 \end{pmatrix}$ 

Verification : True
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$$Q3 : A = \begin{pmatrix} 2 & 7 & 5 \\ 6 & 20 & 10 \\ 4 & 3 & 0 \end{pmatrix}$$

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In[ ]:= A =  $\begin{pmatrix} 2 & 7 & 5 \\ 6 & 20 & 10 \\ 4 & 3 & 0 \end{pmatrix}$ ;
{lu, p, n} = LUDecomposition[A];
l = LowerTriangularize[lu, -1] + IdentityMatrix[3] ;
u = UpperTriangularize[lu];
a = l.u;
Print["Lower Triangular matrix is  = ", l // MatrixForm]
Print["Upper Triangular matrix is  = ", u // MatrixForm]
Print["Verification : ", If[a == A, True, False]]

Lower Triangular matrix is  =  $\begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & 0 \\ 2 & 11 & 1 \end{pmatrix}$ 

Upper Triangular matrix is  =  $\begin{pmatrix} 2 & 7 & 5 \\ 0 & -1 & -5 \\ 0 & 0 & 45 \end{pmatrix}$ 

Verification : True

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