Assignment: MATLAB Tasks on Matrices and Basic Operations

Section A: Basic Matrix Operations

1. Matrix Initialization
   Create the following matrices:
   - A 3x3 identity matrix.
   - A 4x4 matrix of all zeros.
   - A 5x5 matrix of all ones.
   - A 3x3 random matrix with elements between 0 and 10.
2. Matrix Arithmetic
   Given two matrices:

$$A = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix}$$

$$B = \begin{matrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{matrix}$$

   Perform the following operations and display the results:
   - A + B
   - A − B
   - 2 · A
   - Element-wise multiplication A · B.
   - Element-wise division A./ B.
3. Matrix Transposition
   Create a 4x3 matrix and find its transpose. Verify its dimensions.
4. Matrix Inversion
   Generate a 3x3 invertible matrix, calculate its inverse, and verify the result using $A \cdot A^{-1} = I$.

Section B: Intermediate Matrix Manipulations

5. Matrix Indexing
   For the matrix $C = \begin{matrix} 10 & 20 & 30 \\ 40 & 50 & 60 \\ 70 & 80 & 90 \end{matrix}$
   - Extract the second row.
   - Extract the third column.
   - Replace the element in the second row, third column with 100.

- Replace all elements in the first row with zeros.

6. Matrix Determinant and Rank
   Create a 3x3 matrix and calculate its determinant and rank. Display the results.

7. Matrix Multiplication
   Generate two matrices D (2x3) and E (3x4). Perform the matrix multiplication D · E and display the result.

Section C: Applications

9. Solving a System of Linear Equations
   Solve the following system of equations using matrices:

$$2x + 3y + z = 7$$

$$4x + 3y - z = 3$$

$$-x + 2y + 2z = 1$$

Submission Guidelines

- Submit your MATLAB code for each task in a single .m file with clearly labeled sections.
- Include comments in the code to explain your approach.
- Submission is on the Monday, *3rd February, 2025.*