WARM-UP-PROJECT
(SPACES OF MATRICES)

Goals: To introduce matrix input functions, finding the basis and dimensions of spaces, reducing the matrix into RREF, solving the system of equations (using Direct methods).

- **To get Started:** Open a new Matlab script and save it as lab01.m.
- **Matlab commands used:** `if-elseif-end`, `while ...end`, `for ...end`, `size`, `function`, `fprintf`, `zeros`

1. Introduction

In this project, we will find the basis of column as well as row space of matrices. Also we will ~~are~~ solve the system of linear equations using matrices by transforming them to RREF. Consider the following system of equation(s):

$$\begin{aligned} x_1 &= \frac{x_5}{2} \\ x_2 &= \frac{x_1}{4} \\ x_3 &= \frac{x_2}{2} \\ x_4 &= \frac{x_1}{4} + \frac{x_2}{2} + \frac{x_5}{2} \\ x_5 &= \frac{x_1}{4} + x_3 + x_4 + x_6 \\ x_6 &= \frac{x_1}{4} \end{aligned} \tag{1.1}$$

Problem 1. Write the above system of equations (1.1) in~~to~~ the form $x = xP$ and $y = Ay$, where $x = (x_1, x_2, x_3, x_4, x_5, x_6)$ and $y = x^T$.

Problem 2. Using pen and paper, find the basis of column space and row space of matrices P and A. Do you find any relation between the basis of column space of P and row space of A. Also write a `MATLAB` code to find the basis of column space and row space of both matrices and verify your answer.

Problem 3. Re-write the given system of equations (1.1) in the form of $By = 0$ and find the basis of null space of matrices $(A - I)$ and B using pen and paper, where I represents here the 6×6 Identity matrix. Do you find any relation between the null space of these matrices? Write a MATLAB code to find the basis of null space of these matrices and verify your answer.

Problem 4. Write a program in `MATLAB` using `loops` and `conditional statements` to find the RREF form of the matrices P, A and B. **Do not use direct command to find the RREF form in MATLAB**

Problem 5. Solve the given system of equations (1.1) using Gauss Elimination and Gauss Jordan method and inspect its consistency ~~also~~. Write a program in `MATLAB` for the same and print its consistency along with the solution (if it exists).