Instructions: In this lab, we will use Python to solve system of linear equations.

You are required to work on your own. Upload all your .py files and report(pdf format) on Moodle.

Exercise: Sample a set of n column vectors in $\mathbb{R}^m$ taking values in $\{1, 2, \cdots, m\}$ which will form a matrix $A^{m \times n}$. Write a suitable code in python which will solve the following questions.

1. **[R]** Report a randomly sampled matrix A taking the values in $\{1, 2, \cdots, m\}$ of dimension 6×5 and $m = 10$

2. **[R]** Check whether the column vectors are linearly independent or not. Your code should give an output either "Yes" or "No".

3. **[R]** Find the rank of A.

4. **[R]** Given a vector $b \in \mathbb{R}^m$, check whether the system of linear equations $Ax = b$ is solvable or not.

5. If the system is solvable, solve it. Otherwise, report that it has no solution.

6. **[R]** The system $Ax = b$, if solvable, can have either a unique solution or multiple solutions. If the system has a unique solution, then report it. If the system has multiple solutions then report the solution for which

   (a) the $\mathcal{L}^1$ norm is minimized among all the solutions.

   (b) the $\mathcal{L}^2$ norm is minimized among all the solutions.

   (c) the $\mathcal{L}^\infty$ norm is minimized among all the solutions.