Instructions: Write a Python script to perform the following tasks. Your submission should include the code used to solve the problem and the solution.

Problem 1:

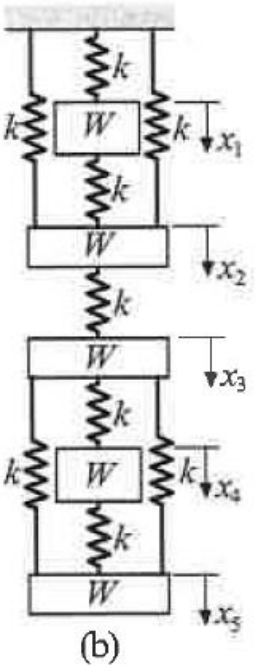
Solve the equations **Ax = b** using Gauss elimination for

$$\boldsymbol{A} = \begin{bmatrix} 2 & -1 & 0 & 0 \\ 0 & 0 & -1 & 1 \\ 0 & -1 & 2 & -1 \\ -1 & 2 & -1 & 0 \end{bmatrix} \quad , \quad \boldsymbol{b} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

You may need to employ pivoting.

Problem 2:

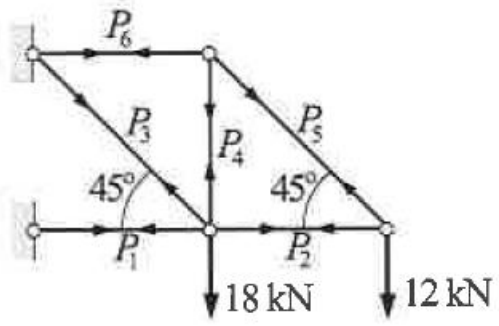
Find the displacement for each of the weights in the following static systems of weights and springs with



(b)

Problem 3:

Consider the static truss below. Find the member force, P_n, in each support. (Hint: The sum of forces on each joint in the x and y direction must be zero in the static case).



Problem 4:

Consider a square, thermally conducting plate with its edges kept at constant temperature as shown below. Assume the heat equation governing the temperature, T, at each point in the plate in the steady state is given by:

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

By dividing the plate into a 3 x 3 grid of squares and rewriting the above as a numerical derivative, find the temperature of each of the squares using (a) a direct method of your choice and (b) an iterative method of your choice.

c) What is the temperature at the center of the square? How does your prediction change as you go from a 3 x 3 to a 5 x 5 to a 7 x 7 grid?