UNIVERSITI MALAYSIA PAHANG

NUMERICAL METHODS & OPTIMIZATION (BTP 2412)

Assignment 1(a)

Instructions:

Solve the following questions by using Naïve Gauss Elimination Method and/or Gauss-Jordan Elimination Method. If one of the solvers could not be used to solve the problems, justify the reason(s).

Question 1

The following system of equations is designed to determine concentrations of chlorine ('C_i' in g/m3) in a series of reactors as a function of the amount of mass input to each reactor (the right-hand sides in g/day). Calculate the chlorine concentration for each of reactors in a day.

$$3C_1 + C_3 - C_4 = 2$$

$$-C_2 + 3C_3 = -1$$

$$C_1 + 3C_2 + 4C_4 = 4$$

$$3C_1 - 9C_2 + 4C_3 + 5C_4 = 0$$

Question 2

Idealized spring-mass systems have numerous application throughout engineering. The following figure shows an arrangement of four spring in series being depressed with a force of 3000 kg. At equilibrium, force balance equations can be developed defining the interrelationships between the springs:

$$k_2(x_2 - x_1) = k_1 x_1$$

$$k_3(x_3 - x_2) = k_2(x_2 - x_1)$$

$$k_4(x_4 - x_3) = k_3(x_3 - x_2)$$

$$F = k_4(x_4 - x_3)$$

where k's are spring constants. If k_1 through k_4 are 100, 50, 80 and 200 N/m, respectively, compute the x's.

Question 3

An electrical engineer supervises the production of the three types of the electrical components. Three kinds of material – material, plastic and rubber – are required for the production. The amounts needed to produce each component are:

Component	Metal, (g/ component)	Plastic, (g/ component)	Rubber, (g/ component)
1	15	0.30	1.0
2	17	0.40	1.2
3	19	0.55	1.5

If totals of 3.89, 0.095, and 0.282 kg of metal, plastic and rubber, respectively, are available each day, how many components can be produced per day?