

Instructions: Answer **all** questions and *standard notation is used throughout the paper*.
All the computation must be performed by using MATLAB software.

1.
 - (a) What is a model? List down the two main types of models.
 - (b) What are the main steps of model development?
 - (c) Write down five applications of simulation.
 - (d) What are the components involved in cost of simulation?

2. A ball is thrown upward at 20 m/s from a window 60 m above the ground.
 - (a) How high does it go?
 - (b) When does it reach its highest point?
 - (c) When does it hit the ground?

3.
 - (a) Compute and plot the linear response of a simple pendulum having a mass of 20 g and a length of 10 cm . The initial conditions are $\theta(0) = 90^\circ$ and $\dot{\theta}(0) = 0$.
 - (b) Compute and plot the non-linear response of motion of the simple pendulum in Part (a).
 - (c) Compare the generated plots of two models in Part (a) and Part (b).

4. The *ABC* Manufacturing Company makes two products. The profit estimates are \$ 25 for each unit of product 1 sold and \$ 30 for each unit of product 2 sold. The labor-hour for the products in the three production departments are shown in the following table.

Department	Product 1	Product 2
<i>A</i>	1.50	3.00
<i>B</i>	2.00	1.00
<i>C</i>	0.25	0.25

The departments' production supervisors estimate that the following number of labor-hours will be available during the next month: 450 hours in department *A*, 350 hours in department *B*, and 50 hours in department *C*.

- (a) Develop a linear programming model to maximize profits.
- (b) Find the optimal solution. How much of each product should be produced, and what is the projected profit?

