SQC & OR Unit Indian Statistical Institute Bangalore
MS-QMS (Semester II) Operations Research - II
Mid-Term - 2021-22

Time: 2 Hours **Date: March 14, 2022**

Answer as many as you can. Maximum you can score 50 marks.

1. Discuss the Branch & Bound method. Using the Branch & Bound, solve the following integer programming problem (IPP). **(15)**

Maximize $Z = 3x_1 + 5x_2$
Subject to

$$2x_1 + 4x_2 \le 25$$
$$x_1 \le 8$$
$$x_2 \le 5$$
$$x_1, x_2 \ge 0 \& \text{int}\, eger$$

2. Discuss the Travelling Salesman Problem (TSP). Write the mathematical programming model for TSP. How to deal with the sub-tour? What are the differences between TSP and Shortest Path Problem? Solve the following TSP using Dynamic programming. **(20)**

	Cities			
Cities	**C1**	**C2**	**C3**	**C4**
C1	∞	20	30	10
C2	15	∞	16	4
C3	3	5	∞	2
C4	19	6	18	∞

3. Define & elaborate the followings: **(05)**
(a). Dynamic programming.
(b). Bellman's Principle of Optimality.
(c). Stage, state and return function.

4. A production manager is faced with the problem of job allocation of his two production teams. The production rate of team-1 is 8 units per hour while of team-2 are 5 units per hour. The normal working hours for each of teams is 40 hours/week. **(15)**

The production manager has prioritized the following goals for the coming week*:*

Priority-1 (P1): Avoid the under-achievement of production level of 650 units.
Priority-2 (P2): Overtime operation of team-1 is limited to 5 hours.
Priority-1 (P3): The total overtime for both teams should be minimized.
Priority-2 (P4): Any under-utilization of regular working hours of the teams should be avoided assigning different weights according to the relative productivity of the two teams.

Formulate a goal programming problem (GPP). Write the AMPL code for the model and run file with the appropriate syntax.