Indian Statistical Institute, Bangalore
M.S (QMS) First Year
First Semester - Operations Research I

Semester End Exam   Duration: 3hrs   Date: Nov 14, 2014
   This question paper carries 65 marks. Answer as many questions. Maximum you can
                              score is 60 marks

1. A product mix problem was max $z = 12x_1 + 20x_2 + 18x_3 + 40x_4$ subject to

    Carpentry shop capacity per month $4x_1 + 9x_2 + 7x_3 + 10x_4 + s_1 = 6000$
    Finishing shop capacity per month $x_1 + x_2 + 3x_3 + 40x_4 + s_2 = 4000$
                                           $x_1 x_2 x_3 x_4 s_1 s_2 \geq 0$

    The optimum simplex table is given here

C_B	BV	X_1	X_2	X_3	X_4	S_1	S_2	X_B
	C_j	12	20	18	40	0	0	
12	X_1	1	7/3	5/3	0	4/15	-1/15	4000/3
40	X_4	0	-1/30	1/30	1	-1/150	2/75	200/3
		0	20/3	10/3	0	44/15	4/15	18,666.66

    (a) Interpret various entries/values in the table.

    (b) If a new model say x_5 takes 6 hours of carpentry work and 2 hours of finishing
        work with estimated profit of Rs.23, is it commercially viable?   [10]

2. (a) Explain the concept of duality of L.P.P.

    (b) Write the dual of the following L.P.P and solve it.

$$\min z = \quad 24x_1 + 21x_2 + 9x_3$$
$$\text{subject to} \quad x_1 + 3x_2 + x_3 \geq 2$$
$$4x_1 + x_2 + x_3 \geq 5$$
$$x_1 \ x_2 \ x_3 \geq 0$$

                                                                                      [15]

3. M/s Mahindra and Mahindra Ltd manufactures Jeeps in 2 different plants P1 and P2.
   It supplies to 3 major markets M1, M2, M3. The plants with yearly capacities and
   markets with projected yearly demand and unit transportation costs are given here.

Plants	Markets			Capacity
	M1	M2	M3	
P1	80	50	60	100
P2	85	55	40	150
Demand	50	125	75	

    (a) Determine the minimum cost distribution making the market demand.

    (b) Suppose the consultant is forecasting that demand in market M1 and M2 is
        likely to raise to 75 and 225 units per year within next 3 years and advices the
        company to build new plant P3 with capacity of 300 units. Transportation costs
        to different markets from P3 is Rs.75, 50 and 50 respectively. Determine the
        changes in minimum cost distribution.   [20]

4. (a) Assignment problem is special case of L.P.P. Discuss it briefly.

(b) A HOD has 4 sub-ordinates and 4 tasks for completion. The sub-ordinates differ in their capabilities and tasks differ in their work contents. The estimates of time for each task sub-ordinate combination is given here.

Task	Sub-Ordinates			
	I	II	III	IV
A	17	35	26	20
B	22	37	13	35
C	47	28	27	24
D	28	35	33	19

How the tasks be assigned minimizing the man hours?

(c) How do you solve a maximization assignment problem?   [20]