

Indian Statistical Institute, Bangalore

MS (QMS) First Year

First Semester - Operations Research I

Final Exam  
Maximum marks: 50

Date: November 19, 2018  
Duration: 2 hours

1.

a) Define slack variable, surplus variable, artificial variable.

b) When is BIG M method useful in solving L. P. P?

c) A company can produce 3 products: A, B, C. The products build a contribution of Rs.8, Rs.5 and Rs.10 respectively. The products use a machine which has 400hrs capacity. Each unit of products use 2, 3 and 1 hr respectively of machine capacity. Only 150 units are available of a special component which is used singly in products A and C. 200kgs only of special alloy is available and product A uses 2kgs/unit, product C uses 4kgs/unit of this alloy. There is an agreement with trade association that no more than 50 units of product B shall be produced. Formulate the company's L. P. P. [6 + 2 + 7 = 15]

2.

a) What are the different types of sensitivity analysis required to be done in L. P. P.

b) A company manufacturing 4 products currently, arrived at final simplex table as below:

$C_B$	$C_j$ $X_j$ Basis	12	20	18	40	0	0	$X_B$
		$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	
12	$X_1$	1	$7/3$	$5/3$	0	$4/15$	$-1/15$	$4/3$
40	$X_4$	0	$-1/30$	$1/30$	1	$-1/150$	$2/75$	$1/15$
		0	$20/3$	$10/3$	0	$44/15$	$4/15$	$Z = 56/3$

The management has an option to launch a new product with estimated profit of Rs.15. The estimated labour for this is 6 hrs in section 1 and 2 hrs in section 2. Find out if it is worthwhile to launch this product. [5 + 5 = 10]

3. An organization has 4 vendors to supply 3 of its sub-contract items A, B and C. The vendors V1, V2, V3 and V4 have provided the quotations as per the unit price matrix below:

Vendors \ Items	A	B	C
V1	6	4	6
V2	5	2	8
V3	4	4	4
V4	1	6	3

The total quantities of items A, B and C required are 400, 600 and 200 respectively. Vendors V1, V2, V3 & V4 refuse to supply orders whose quantities are less than 100, 150, 300 and 100 respectively. However, these are willing to supply more as much as the customer wishes. How should the orders be placed if the company as a policy desires to satisfy all the vendors with minimum order quantities to maintain good vendor relationship.

[15]

4. 5 teachers are available for evaluating scripts of 5 different subjects. While the teachers are competent to evaluate all the subjects, the speed of evaluation varies depending on the subject allotment as given below:

number of scripts evaluated / hr

Subject Teacher	Mechanics	Design I	Design II	Stress Analysis	FMEA
A	14	18	21	22	16
B	12	22	25	21	25
C	26	14	13	12	17
D	16	20	22	21	18
E	24	22	20	14	12

The university is interested in speedy declaration of results which would depend on elapsed time. Develop the assignment of scripts to teachers that would minimize the total man hours of time for evaluation. If 2700 scripts are available in each subject what will the total man hours for evaluation? What will be the elapsed time to completion of evaluation? Round of calculations to the next higher hour. [15]

-----