

K. J. Somaiya Institute of Management Studies and Research

Program: MCA Semester- IV

Subject: Operations Research  
(EndTerm Examination)

Maximum marks: 50

Date: 18/04/2019

Duration: 3hours

**Notes:**

- 1. You have to attempt 5 questions in all.**
- 2. Make suitable assumptions if required and state them.**
- 3. Write all relevant answers in your EXCEL sheet, with sufficient detail to enable a fast evaluation of your answers.**
- 4. Keep saving the file on the desktop every ten minutes or so.**
- 5. Make only 1 Excel file with different worksheets pertaining to each question.**

**Name the file with your division and roll number only (no names). Finally, transfer the file to an exam folder, as per on-the-spot instructions given to you.**

1. M/s P.M.S industries makes two kinds of leather purses for ladies. Purse type A is of high quality and Purse type B is of lower quality. Contribution per unit was Rs. 4 and Rs. 3 for purse type A & B respectively. Each purse of type A requires 2 hours of machine time per unit & that of type B requires one hour per unit. The company has 1000 hours per week of maximum available machine time. Each type of purse requires same amount of leather (one unit of leather per purse). Supply of leather is sufficient for 800 purses of both types combined per week. Purse type A requires a fancy Zip and 400 such Zips are available per week, there are 700 ordinary zips for purse type B available per week. Assuming no market and finance constraints recommend an optimum product mix. Use excel solver and graphical method both. Also discuss sensitivity report. (10)
2. Six contractors submitted quotation for six projects. It was decided that one contractor should be given one contract as otherwise it was feared that the time for completion & quality of workmanship will be affected. The estimates given by each of them on all the contracts in thousands of Rupees are given below:

Contractor	Quotation for the Project (Rs. In thousands)					
	I	II	III	IV	V	VI
A	41	72	39	52	25	51
B	22	29	49	65	81	50
C	27	39	69	51	32	32
D	45	50	48	52	37	43
E	29	40	39	26	30	33
F	82	40	40	50	51	30

Determine the optimal allocation of the projects to the contractors and the corresponding

total cost.

(10)

3. A company has three factories at locations A, B, and C which supplies three warehouses located at D, E, and F. Monthly factory capacities are 10, 80, and 15 units respectively. Monthly warehouse requirements are 75, 20, and 50 units respectively. Unit shipping costs (in Rs.) are given below:

	Warehouse		
Factory	D	E	F
A	5	1	7
B	6	4	6
C	3	2	5

The penalty costs for not satisfying demand at the warehouses D, E, and F are Rs. 5, 3 and 2 respectively. Determine the optimal distribution schedule for the company. (10)

4. The activities of the project are tabulated below with the immediate predecessors and normal & crash time and cost

Activity	Predecessor Activity	Time (in Days)		Cost (in Rs.)	
		Normal	Crash	Normal	Crash
A	-	6	4	120	170
B	-	4	2	120	220
C	A	3	2	195	270
D	A	4	2	320	520
E	B, C	7	4	700	1075
F	D, E	5	2	650	1100
G	E	10	6	1600	2300

Draw a project network diagram and find the critical path and cost of the project. Suppose it is required to complete the project in 22 days. Find which activities to crash and by how much, to yield the minimum project cost. (10)

5. General Foundry, Inc. has long been trying to avoid the expense of installing air pollution control equipment. The local environmental protection group has recently given the

foundry 16 weeks to install a complex air filter system on its main smokestack. General Foundry was warned that it will be forced to close unless the device is installed in the allotted period. They want to make sure that installation of the filtering system progresses smoothly and on time. Activities and immediate predecessors for General Foundry

ACTIVITY	DESCRIPTION	IMMEDIATE PREDECESSORS
<i>A</i>	Build internal components	—
<i>B</i>	Modify roof and floor	—
<i>C</i>	Construct collection stack	<i>A</i>
<i>D</i>	Pour concrete and install frame	<i>B</i>
<i>E</i>	Build high-temperature burner	<i>C</i>
<i>F</i>	Install control system	<i>C</i>
<i>G</i>	Install air pollution device	<i>D, E</i>
<i>H</i>	Inspect and test	<i>F, G</i>

Time estimates (weeks) for General Foundry is as follows

ACTIVITY	OPTIMISTIC <b>a</b>	MOST LIKELY <b>M</b>	PESSIMISTIC <b>B</b>
A	1	2	3
B	2	3	4
C	1	2	3
D	2	4	6
E	1	4	7
F	1	2	9
G	3	4	11
H	1	2	3

Make Network Diagram with Expected Activity Times. Calculate Estimated Path Durations through the Network. Find out what is the probability of General Foundry meeting the 16-week deadline? (10)

- A manufacturer manufactures a product, of which the principal ingredient is a chemical X. At the moment, the manufacturer spends Rs. 1,000 per year on a sample of X, but there is a possibility that the price may soon increase to four times its present figure because of a worldwide shortage of the chemical. There is another chemical Y, which the manufacturer

could use in conjunction with a third chemical Z, in order to give the same effect as chemical X. Chemicals Y and Z would together cost the manufacturer Rs. 3,000 per year, but their prices are unlikely to rise. What action should the manufacturer take? Apply the maximin and minimax criteria for decision-making. If the coefficient of optimism is 0.6 then find the course of action using Hurwicz Principle. The profit payoff matrix is as follows: (10)

	<b>Strategies</b>	
States of Nature	A1 (Use Y and Z)	A2 (Use X)
E1 (Price of X increases)	- 3,000	- 4,000
E2 (Price of X does not increase)	- 3,000	- 1,000

7. A company management and the labor union are negotiating a new three year settlement.

Each of these has 4 strategies:

I: Hard and aggressive bargaining II: Reasoning and logical approach

III: Legalistic strategy

IV: Conciliatory approach

The costs to the company are given for every pair of strategy choice

	<b>Company Strategies</b>			
<b>Union Strategies</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
<b>I</b>	20	15	12	35
<b>II</b>	25	14	8	10
<b>III</b>	40	2	10	5
<b>IV</b>	-5	4	11	0

What strategy will the two sides adopt? Also determine the value of the game. (10)

Year	1	2	3	4	5	6	
Maintenance Cost (Rs.)	1000	1200	1600	2400	3000	3900	
Resale Value ('000 Rs.)	75	72	70	65	58	50	

8. The Simple Engineering Company has a machine whose purchase price is Rs. 80,000. The expected maintenance costs and release price in different years are as given here

After what time interval, should the machine be replaced?

(10)