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Total No. of Pages: 05

Total No. of Questions: 15

MBA (2012 & Onward) (Sem. – 3)
APPLIED OPERATIONS RESEARCH

M Code: 70735

Subject Code: MBA-301

Paper ID: [C1169]

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A** contains **SIX** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
2. **SECTIONS-B** consists of **FOUR** Subsections: **UNITS-I, II, III & IV**. Each Subsection contains **TWO** questions each carrying **EIGHT** marks each and students have to attempt any **ONE** question from each Subsection.
3. **SECTION-C** is **COMPULSORY** and consist of **ONE** Case Study carrying **EIGHT** marks.
4. Analyse the facts given in the Case and answer the given questions.

SECTION A

1. Define Operations research. What is the scope of Operations Research?
2. What is Linear Programming? Explain Graphical method of Linear Programming.
3. Define Game Theory. What is the difference between Pure and Mixed Strategy Games?
4. Define Queing Theory. What are the applications of Queue Model?
5. A manufacturing company is engaged in producing three types of products; A, B and C. The production department produces, each day, components sufficient to make 50 units of A, 25 units of B and 30 units of C. The management is confronted with the problem of optimizing the daily production of the products in the assembly department, where only 100 man-hours are available for assembling the products. The following additional information is available:

Type of Product	Profit Contribution per unit of products (Rs)	Assembly Time per Product (hrs)
A	12	0.8
B	20	1.7
C	45	2.5

The company has a daily order commitment for 20 products of A and a total 15 units of products of B and C. Formulate this problem as an LP model so as to maximize total the profit.

6. A firm manufactures three types of products. The fixed and variable costs are given below:

Product	Fixed Cost (Rs.)	Variable Cost per unit (Rs.)
A	25,000	12
B	35,000	9
C	53,000	7

The likely demand (units) of the products is given below:

Poor demand: 3,000

Moderate demand: 5,000

High demand: 11,000

If the sale price of each type of product is Rs. 25, then prepare the payoff matrix.

SECTION B

UNIT I

7. What is the difference between PERT and CPM? Explain various types of floats used in project management.
8. The following table gives data on normal time and cost and crash time and cost for a project.

Activity	Normal		Crash	
	Time (weeks)	Cost (Rs.)	Time (weeks)	Cost (Rs.)
1-2	3	300	2	400
2-3	3	30	3	30
2-4	7	420	5	580
2-5	9	720	7	810
3-5	5	250	4	300
4-5	0	0	0	0
5-6	6	320	4	410
6-7	4	400	3	470
6-8	13	780	10	900
7-8	10	1,000	9	1,200

Indirect cost is Rs. 50 per week.

- a) Draw the network diagram for the project and identify the critical path.
- b) What is the normal project duration and associated costs?
- c) Find out the total float associated with each activity.
- d) Crash the relevant activities systematically and determine the optimal project completion time and cost.

UNIT II

9. What is duality? Obtain the dual of the following LP problem:

$$\text{Minimize } Z = X_1 - 3X_2 - 2X_3$$

Subject to the constraints

- i) $3X_1 - X_2 + 2X_3 \leq 7$
- ii) $-4X_1 + 3X_2 + 8X_3 = 10$
- iii) $2X_1 - 4X_2 \geq 12$

Where $X_1, X_2 \geq 0$ and X_3 is unrestricted in sign.

10. A company makes two kinds of leather belts (Belt A and Belt B). Belt A is a high quality belt and belt B is of lower quality. The respective profits are Rs. 4 and Rs. 3 per belt. The production of each of type A requires as much time as a belt of type B, and if all the belts were of type B, the company would make 1,000 belts per day. The supply of leather is sufficient for only 800 belts per day (both A and B combined). Belt A requires a fancy buckle and only 400 of these are available per day. There are only 700 buckles a day available for belt B.

What should be the daily production of each type of belt? Formulate this problem as a Linear Programming model and solve it using the Simplex method.

UNIT III

11. a) What is the optimal strategy of a game? A company's management and the labour 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.

Union strategy	I	II	III	IV
I	20	15	12	35
II	25	14	8	10
III	40	2	10	5
IV	-5	4	11	0

12. A manufacturing company processes 6 different jobs on two machines A and B. Number of units of each job and its processing times on A and B are given in the following table. Find the optimum sequence, the total minimum elapsed time and idle time for each machine.

Job Number	No. of units of each job	Processing Time (Hours)	
		Machine A	Machine B
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

UNIT IV

13. A firm is considering the replacement of a machine, whose cost price is 12,200, and its scrap value is Rs. 200. From experience the running (maintenance and operating) costs are found to be as follows:

Year	1	2	3	4	5	6	7	8
Running cost (Rs.)	200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced?

14. A television repairman finds that the time spent on his job has an exponential distribution with a mean of 30 minutes. If he repairs the sets in the order in which they come in, and if the arrival of sets follows a Poission distribution with an approximate average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

SECTION C (Compulsory)

15. Solve the following case study:

Kaushik Mills decided to increase its production capacity by building a new feed mill. The project consisted of a number of separate tasks, some of which could not be started before others were complete. Table below lists the activities, along with expected times for each as 'agreed upon by management and the precedence relationship'.

The management wanted to advance the schedule as much as possible in order to save valuable time in getting the new mill into operation. The president of the mills commented, "Every week saved is worth Rs. 70,000 in lost contribution if we can get going".

Some of the construction activities could be sped up. For example the firm's architects could by working overtime, design the new plant in 10 weeks instead of the originally estimated 12 weeks. This advancement could cost the mills an additional Rs. 25,000 per week that is advanced.

The president of mills had already held discussions with mill contractors, an independent firm which was a potential contractor for one of the project's major task, for building the plant. Kaushik mills intended to do the other tasks either, itself or through its agents. During the talks with mill contractors, the management has explored a number of bonus and penalty clauses. One of these, that for every week that the plant was built ahead of 10 weeks, the mills would pay contractors an additional Rs. 75,000.

Activity	Description	Expected time (weeks)	Precedence Activity	Minimum time (weeks)	Crash (Rs/week)
A	Design plant	12	–	10	25,000
B	Select plant site	8	A	18	–11
C	Select plant builder	6	A	11	3,000
D	Select operating personnel	13	A	13	–11
E	Prepare the building site	4	B, C	4	–11
F	Make or buy mill equipment	101	C	8	30,000
G	Prepare mill operations manual	6	C	4	1,500
H	Build the plant	101	E, F	6	75,000
I	Train plant operation	8	D, G	8	–11
J	Test the plant	8	H, I	8	–11
K	Obtain a production license	4	J	4	–11