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Total No. of Pages : 04

Total No. of Questions : 15

MBA (2015 to 2017) (Sem.–3)

APPLIED OPERATIONS RESEARCH

Subject Code : MBA-301

M.Code : 70735

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A contains SIX questions carrying FIVE marks each and students has to attempt any FOUR questions.**
2. **SECTION-B consists of FOUR Subsections : Units-I, II, III & IV. Each Subsection contains TWO questions each carrying EIGHT marks each and student has to attempt any ONE question from each Subsection.**
3. **SECTION-C is COMPULSORY and consist of ONE Case Study carrying EIGHT marks.**

SECTION–A

Q1. Define Operations Research.

Q2. Discuss decision making under certainty.

Q3. Discuss applications of Linear Programming.

Q4. What is the basic feasible solution in Linear Programming?

Q5. Define Game Theory.

Q6. Define Queuing Theory.

SECTION-B

UNIT-I

Q7. What is Project Management? Discuss its managerial applications.

Q8. A book binder has one printing press, one binding machine and manuscripts of 7 different books. The time required for performing printing and binding operations for different books are shown below :

Book	1	2	3	4	5	6	7
Printing time (hours)	20	0	80	20	120	15	65
Binding time (hours)	25	60	75	30	90	35	50

Decide the optimum sequence of processing of books in order to minimize the total time required to bring out all books.

UNIT-II

Q9. Use Simplex Method to solve the following L.P.P.:

Max. $Z = 4X_1 + 10X_2$ Subject to the constraints :

$2X_1 + X_2 \leq 50.$ $2X_1 + 5X_2 \leq 100.$ $2X_1 + 3X_2 \leq 90;$ $X_1 \geq 0$ and $X_2 \geq 0$

Q10. What is duality ? Write dual of the following problem :

Mini. $z = 3X_1 - 2X_2 + 4X_3$ Subject to the constraints;

$3X_1 + 5X_2 + 4X_3 \geq 7,$ $6X_1 + X_2 + 3X_3 \geq 4,$ $7X_1 - 2X_2 - X_3 \leq 10,$

$X_1 - 2X_2 + 5X_3 \geq 3,$ $4X_1 + 7X_2 - 2X_3 \geq 2$

Where X_1, X_2 and $X_3 \geq 0$

UNIT-III

Q11. Solve the following game using Game theory:

		Player B	
		B_1	**B_2**
Player A	A_1	9	2
	A_2	8	6
	A_3	6	4

Q12. Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information processing time on machines is given in hours and passing out is not allowed :

Job	A	B	C	D	E	F	G
Machine 1	3	8	7	4	9	8	7
Machine 2	4	3	2	5	1	4	3
Machine 3	6	7	5	11	5	6	12

UNIT-IV

Q13. Discuss the role of Replacement Models in solving managerial problems.

Q14. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows exponential distribution and service time distribution is also exponential with an average 36 minutes. Calculate the following :

(i) The mean queue size (line length), and

(ii) The probability that the queue size exceeds 10.

If the input of trains increases to an average 33 per day, what will be the change in (i) and (ii)

SECTION-C

Q15. Solve the following case :

State Electricity Board

The state electricity board is planning to construct a new plant for the next 10 years. It is possible to construct four types of electric power facilities-steam plants using coal for energy, hydroelectric plants with no reservoir, hydroelectric plants with small reservoirs (enough water storage capacity to meet daily fluctuations in power demands and water flow), and hydroelectric plants with large reservoirs (with enough water storage to meet seasonal fluctuations in power demand and water flow).

The consumption of electricity is based on three characteristics. The first is the total annual usage-the requirement in the area is estimated to be 4,000 million kilowatt-hours by the 10th year. The second characteristic is the peak usage of power-usually on a hot summer day at about 2 PM. Any plan should provide enough peaking capacity to meet a projected peak need of 3,000 million kilowatts in the 10th year. The third characteristics is guaranteed power output measured as the averaged daylight output in midwinter when the consumption is high and water levels for the hydroelectric power are low. The 10-year requirement for the 2,000 million kilowatts of guaranteed power.

The various possible power plants vary in terms of how they satisfy characteristics. For example, hydroelectric plants with reservoirs are able to provide substantial peaking capacity, whereas steam plants and hydroelectric plants with no reservoir are poor in this respect.

The characteristics of the various types of the plants are shown in Table below. Each is measured in terms of a unit of capacity. The unit of capacity is defined as to be the capacity to produce 1 billion kilowatt-hours per year. Note that the types of plants vary substantially in their investment costs. The annual operating costs of the various types of plants also vary considerably. For example, the cost of coal makes the annual costs of the steam plants quite high, whereas the annual costs of operating the hydroelectric plants are relatively less. The final column in the table shows the discounted total costs, including both the investments costs and discounted annual operating costs.

Table : Characteristics of electric plants per unit (1 billion kilowatt-hours) of Annual output

Type	Guaranteed output (millions of kilowatts)	Peak output (millions of kilowatt)	Investment costs (Rs '000)	Discounted Total Cost (Rs '000)
Steam	0.15	0.20	1200	2600
Hydroelectric: No reservoir	0.10	0.10	1600	1680
Hydroelectric: Small reservoir	0.10	0.40	2400	2560
Hydroelectric: Large reservoir	0.80	0.90	4000	4400

Answer the following questions :

(i) Help the company in developing a 10-year plan that would detail the capacity of each type that it should built.

(ii) Develop an LP model and solve it to minimize the total discounted cost. However, there is a restriction that no more than Rs. 14,000 million can be used for investment in plants over 10 years.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.