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Question Paper Code : 70163

M.B.A. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Second Semester
BA5201 – APPLIED OPERATIONS RESEARCH
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What are the major assumptions of Linear programming ?
2. Define sensitivity analysis.
3. What is a unbalanced TP ? How is it solved ?
4. How is the Hungarian method better than other methods for solving an assignment problem ?
5. State the role of lower bound and upper bound in the branch and bound method.
6. What do you mean by dominance Rule and Saddle Point ?
7. What techniques are used to solve decision-making problems under uncertainty ?
8. What is Monte-Carlo simulation ?
9. Define a waiting line.
10. What are the situations which make the replacement of items necessary ?

PART – B **(5×13=65 Marks)**

11. a) A manufacturer has two products P_1 and P_2 both of which are produced in two steps by machines M_1 and M_2. The process times per hundred for the products on the machines are :

	M_1	M_2	Contribution (Per 100 units)
P_1	4	5	10
P_2	5	2	5
Available hour	100	–80	

The manufacture is in a market upswing and can sell as much as he can produce of both products. Formulate the Mathematical model and determine optimal productivity, using simplex method.

(OR)

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b) A company produces, three products : P, Q and R from three raw materials A, B and C. One unit of product P requires 2 units of A and 3 units of B. A unit of product Q requires 2 units of B and 5 units of C and one unit of Product R requires 3 units of A, 2 units of A, 2 units of B and 4 units of C. The company has 8 units of material A, 10 units of material B and 15 units of material C available to it, profits per unit of products P, Q and R are Rs. 3, Rs. 5 and Rs. 4 respectively.

a) Formulate this problem as an LP problem. **(7)**
b) How many units of each product should be produced to maximize profit ? **(3)**
c) Write the dual of this problem. **(3)**

12. a) Consider the following Unbalanced transportation problem :

		To			
		1	2	3	**Supply**
From	1	5	1	7	10
	2	6	4	6	80
	3	3	2	5	15
Demand		75	20	50	

Since there is not enough supply, some of the demands at these destination may not be satisfied. Suppose there are penalty costs for every unsatisfied demand unit which are given by 5, 3 and 2 for destinations 1, 2 and 3 respectively. Find the optimal solution.

(OR)

b) A construction company has requested bids for sub contracts on five different projects. Five companies have responded, their bids are represented below :

Bid Amounts ('000s Rs.)

		I	II	III	IV	V
Bidders	1	41	72	39	52	25
	2	22	29	49	65	81
	3	27	39	60	51	40
	4	45	50	48	52	37
	5	29	40	45	26	30

Determine the minimum cost assignment of subcontracts to bidders, assuming that each bidder can receive only one contract.

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13. a) Solve the following all integer programming problems, using Gomory's cutting plane algorithm.

i) Max $z = x_1 + 2x_2$ (6)

Subject to

i) $2x_2 \leq 7$

ii) $x_1 + x_2 \geq 7$

iii) $2x_1 \geq 11$

and $x_1, x_2 \geq 0$ and integers

ii) Max $z = 3x_1 + 2x_2 + 5x_3$ (4)

Subject to

i) $5x_1 + 3x_2 + 7x_3 \leq 28$

ii) $4x_1 + 5x_2 + 5x_3 \leq 30$

and $x_1, x_2, x_3 \geq 0$ integers

iii) Max $z = 4x_1 + 3x_2$ (3)

Subject to

i) $x_1 + 2x_2 \leq 4$

ii) $2x_1 + x_2 \leq 6$

and $x_1, x_2 \geq 0$ and integers

(OR)

b) Explain the assumptions underlying game theory. Describe the role of theory of games for scientific decision-making.

14. a) a) Compute EOQ and the total variable costs for the following items :

Actual demand = 500 units

Unit Price = Rs. 20

Order Cost = Rs. 16

Storage rate = 2% per annum

Interest rate = 12% per annum

Obsolescence rate = 6% per annum

b) Determine the total variable cost that would result for the item if an incorrect price of Rs. 12.80 were used.

(OR)

b) a) What are the various assumptions of EOQ formula ?

b) Identify the two basic decisions addressed by inventory management and discuss why the responses to these differ for continuous and periodic inventory systems.

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15. a) Explain the basic queuing process. What are the important random variates in Queuing system to be investigated ?

(OR)

b) Explain how the theory of replacement is used in the following problems

i) Replacement of items whose maintenance cost varies with time.

ii) Replacement of items that fail completely.

PART – C **(1×15=15 Marks)**

16. a) The mean rate of arrival of planes at an airport during the peak period is 20 per hour and the actual number of arrivals in any hour follows a Poisson distribution. The airport can land 60 planes per hour on an average in good weather and 30 planes per hour in bad weather, but the actual number landing in any hour follows a Poisson distribution with these respective averages. When there is congestion, the planes are forced to fly over the field in the stack awaiting the landing of other planes that arrived earlier.

a) How many planes would be flying over the field in the stack on an average in good weather and in bad weather ?

b) How long would a plane be in the stack and in the process of landing in good and in bad weather ?

(OR)

b) A truck owner from his past experience estimated that the maintenance cost per year of a truck whose purchase price is Rs. 1,50,000 and the resale value of truck will be as follows :

Year	Maintenance Cost (Rs.)	Resale value (Rs.)
1	10,000	1,30,000
2	15,000	1,20,000
3	20,000	1,15,000
4	25,000	1,05,000
5	30,000	90,000
6	40,000	75,000
7	45,000	60,000
8	50,000	50,000

Determine the time at which it is profitable to replace the truck.

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