R18

Code No: 155CQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, July/August - 2023

OPERATIONS RESEARCH

(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Define operations research. [2]
b) Explain the Slack variables and Surplus variables with respect to LPP. [3]
c) Compare the transportation and assignment problems. [2]
d) What is meant by unbalanced assignment? How it is balanced? [3]
e) What is meant by net present value in replacement model? [2]
f) Find the sequence for the following problem in the order AB. [3]

Jobs / Machine	I	II	III	IV
A	8	5	3	9
B	5	8	7	4

g) Explain the meaning of EOQ. [2]
h) Find the saddle point for the following game. [3]

		B		
		I	II	III
A	I	4	6	5
	II	- 4	11	4
	III	12	7	6

i) State the components of queuing system. [2]
j) State the features of dynamic programming problem. [3]

PART – B

(50 Marks)

2. A mining company is taking a certain kind of ore from to mines X and Y. The ore is divided into three quality groups A, B and C. Every week the company has to supply 240 tones of A, 160 tones of B and 440 tones of C. The cost per day for running the mine X is Rs 3000, while it is Rs 2000 for the mine Y. Each day X will produce 60 tones of A, 20 tones of B and 40 tones of C. The corresponding figures for Y are 20, 20 and 80. Develop the most economical production plan by finding the number of days for which the mines X and Y should work per week. (Use graphical method to solve the problem.) [10]

OR

3. Solve the following LPP using Big M method.

Min $Z = 3x_1 + 8x_2$

Subject to $x_1 + x_2 = 200$

$x_1 \leq 80$

$x_2 \geq 60$

$x_1 \geq 0, x_2 \geq 0.$ [10]

4. Solve the following transportation problem. [10]

	To				Supply
	10	7	3	6	3
From	1	6	8	3	5
	7	4	5	3	7
Demand	3	2	6	4	

OR

5. The owner of a small machine shop has four machinists available to assign to jobs for the day. Five jobs are offered with expected profit for each machinist on each job as follows.

		Jobs				
		A	B	C	D	E
M/Cs	M_1	12	28	0	51	32
	M_2	12	34	11	23	9
	M_3	37	42	61	21	31
	M_4	0	14	37	27	30

Assign the five jobs to four machines, such that total profit should be maximized. Also calculate maximum profit. [10]

6. A machine operator has to perform three operations, turning, threading, and knurling on different jobs. The time required to perform these operations (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimize the total time required to work out all the jobs. Also find the minimum elapsed time. [10]

		Jobs					
		1	2	3	4	5	6
M/Cs	Turning	3	12	5	2	9	11
	Threading	8	6	4	6	3	1
	Knurling	13	14	9	12	8	13

OR

7. A series lamp circuit contains 10000 bulbs. When any bulb fails it is replaced. The cost of replacing a bulb individually is Rs.1 only. If all the bulbs are replaced simultaneously, the cost per bulb would be Rs 0.35. The percent of surviving, say S(t) at the end of month 't' and P(t) probabilities of failures during the month are given below:

T	0	1	2	3	4	5	6
S(t)	100	97	90	70	30	15	0
P(t)n	--	0.03	0.07	0.2	0.4	0.15	0.15

What is the optimal replacement? [10]

8. Two players P and Q play the game. Each of them has to choose one of the three colours: White(W), Black (B) and Red (R) independently of the other. Thereafter the colours are compared. If both Pand Q has chosen white (W, W), neither wins anything If player P selects white and Player Q black (W,B), player P loses Rs.2/- or player Q wins the same amount and so on. The complete payoff table is shown below. Find the optimum strategies for P and Q and the value of the game. Consider the order of merit of colors as B>R>W. [10]

		Q: W	Q: B	Q: R
P	W	0	-2	7
P	B	2	5	6
P	R	3	-3	8

OR

9.a) What is the purpose of maintaining inventory or objective of inventory Cost control?
b) Derive the expression for EOQ for Wilson-Haris model. [5+5]

10. A man is engaged in buying and selling identical item. He operates from a ware house that can hold 500 items. Each month he can sell any quantity that he chooses up to the stock at the beginning of the month. Each month he can buy as much as he wishes for delivery at the end of the month. So long as his stock does not exceed 500 items. For the next four months he has the following error free forecasts of the cost sale prices.

Month	I	1	2	3	4
Cost	C_i	27	24	26	28
Sale price	P_i	28	25	25	27

If he currently has a stock of 200 units, what quantity should he sell and buy next four months. Find the solution using dynamic programming. [10]

OR

11. Assume in a hotel a server is to look after supply of three tables, which would accommodate in total 6 customers. Assume customers who arrive when all the six seats of the three tables are full. Customers arrive at the average rate of 4 per hour and spend an average of 15 minutes in the hotel. Find
a) The probability a customer can directly sit in a seat up on his arrival.
b) Expected number of customers waiting for a seat.
c) The time a customer can expect to spend in the hotel. [10]

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