Code No: 155CQ

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, August - 2022
OPERATIONS RESEARCH
(Mechanical Engineering)

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

Answer any five questions
All questions carry equal marks
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1. 10 grams of Alloy A contains 2 grams of copper, 1 gram of zinc and 1 gram of lead. 10 grams of Alloy B contains 1 gram of copper, 1 gram of zinc and 1 gram of lead. It is required to produce a mixture of these alloys, which contains at least 10 grams of copper, 8 grams of zinc and 12 grams of lead. Alloy B costs 1.5 times as much per kg as alloy A. Find the amounts of alloys A and B, which must be mixed in order to satisfy these conditions in the cheapest way. [15]

2. Maximize $Z = a + 1.5b + 5c + 2d$
$3a + 2b + c + 4d \leq 63$
$2a + b + 5c + d \leq 42$
$2a + 6b - 4c + 8d = 0$
$a + 3b - 2c + 4d = 0$ where $a, b, c, d \geq 0$ [15]

3.a) Solve the following transportation problem, in which cell entries represent unit costs:

		To			
		A	B	C	Available
From	I	2	7	4	5
	II	3	3	1	8
	III	5	4	7	7
	IV	1	6	2	14
	Required	7	9	18	

b) What is meant by degeneracy in transportation? [10+5]

4. A department has five employees with five jobs to be performed. The time (in hours) each men will take to perform each job is given in the effectiveness matrix:

Jobs	Employees				
	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours? [15]

5. We have six jobs, each of which must go through machines A, B and C in the order ABC. Processing time (in hours) are given in the following table:

Job	1	2	3	4	5	6
Machine: A	8	3	7	2	5	1
Machine: B	3	4	5	2	1	6
Machine: C	8	7	6	9	10	9

Determine a sequence for the five jobs that will minimize the elapsed time, idle time on machine A, B and C. [15]

6. State Group of replacement policy.
The following failure rates have been observed for a certain type of light bulbs

End of week	Probability of failure date
1	0.05
2	0.13
3	0.25
4	0.43
5	0.68
6	0.88
7	0.96
8	1.00

The cost of replacing an individual failed bulb is Rs.1.25. The decision is made to replace all bulbs simultaneously at fixed intervals and also to replace individual bulbs as they fall in service. If the cost of group replacement is 30 paise per bulb, what is the best interval between group replacements? At what group replacement price per bulb would a policy of strictly individual replacement become preferable to the adopted policy? [15]

7. Find the optimal quantity for a product where the annual demand for the product is 500 units. The cost of storage per unit per year is 10% of the unit cost and the ordering cost per order is Rs. 180.00. The unit costs are given below.

Quantity Unit	Quantity Unit cost
$0 \le Q1 < 500$	Rs. 25
$500 \le Q2 < 1500$	Rs. 24.80
$1500 \le Q3 < 3000$	Rs. 24.60
$3000 \le Q4$	Rs. 24.40

[15]

8. What is Kendall Notation. Give the classification of queuing system based on Kendall Notation. Customers arrive at box office windows being manned by a single individual according to a poisson input process with a mean rate of 20/hr the time required to same a customer has an exponential distribution with a mean of 90 s. Find the average waiting time of customers. Also determine the average number of customers in the system and average queue length. [15]

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