Please check that this question paper contains 09 questions and 03 printed pages within first ten minutes.

MORNING

[Total No. of Questions: 09] [Total No. of Pages: 03]

09 MAY 2023

Uni. Roll No. .....

Program: B.Tech.
Semester: 5th
Name of Subject: Operation Research
Subject Code: HSMME-101
Paper ID: 16379
Scientific calculator is Allowed.

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Describe the applications of OR.
b) Explain the industrial applications of Queuing Theory.
c) Describe unbalanced transportation problem.
d) Explain free float.
e) How saddle point helps to make an inference in the game theory?
f) Find the dual of

Maximize $Z = 23x + 32y$
Subject to $10x + 6y \leq 2500$
$5x + 10y \leq 2000$
$1x + 2y \leq 500$
Both x and y are ≥ 0.

Part – B **[Marks: 04 each]**

Q2. Differentiate between CPM and PERT.

Q3. A patient consult a doctor to check up his ill health. Doctor examines him and advises him that he is having deficiency of two vitamins, vitamin A and vitamin D. Doctor advises him to consume vitamin A and D regularly for a period of time so that he can regain his health. Doctor prescribes tonic X and tonic Y, which are having vitamin A, and D in certain proportion. Also advises the patient to consume at least 40 units of vitamin A and 50 units of vitamin daily. The cost of tonics X and Y and the proportion of vitamin A and D that present in X and Y are given in the table below. Formulate l.p.p. to minimize the cost of tonics.

Vitamins	*Tonics*		*Daily requirement in units.*
	X	*Y*	
A	2	4	40
D	3	2	50
Cost in Rs. per unit	5	3	

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Q4. Solve the transportation problem given below:

(Cost in Rs. per unit)
Destinations

Origins	A	B	C	Available capacity
X	2	1	2	20
Y	3	4	1	40
Requirement	20	15	25	60

Q5. Differentiate between transportation problem and assignment problem.

Q6. Solve the game given below:

		Player B		
		I	II	III
Player A	I	1	9	2
	II	8	5	4

Q7. The owner of a chain of four grocery stores has purchased six crates of fresh strawberries. The estimated probability distribution of potential sales of the strawberries before spoilage differs among the four stores. The following table gives the estimated total expected profit at each store, when it is allocated various numbers of crates:

	Stores.			
Number of Crates	1	2	3	4
0	0	0	0	0
1	4	2	6	2
2	6	4	8	3
3	7	6	8	4
4	7	8	8	4
5	7	9	8	4
6	1	10	8	4

For administrative reasons, the owner does not wish to split crates between stores. However he is willing to distribute zero crates to any of his stores.

Part – C **[Marks: 12 each]**

Q8. In a departmental store one cashier is there to serve the customers. And the customers pick up their needs by themselves. The arrival rate is 9 customers for every 5 minutes

and the cashier can serve 10 customers in 5 minutes. Assuming Poisson arrival rate and exponential distribution for service rate, find:
(a) Average number of customers in the system.
(b) Average number of customers in the queue or average queue length.
(c) Average time a customer spends in the system.
(d) Average time a customer waits before being served.

OR

There are seven activities in a project and the time estimates are as follows:

Activities	*Time in weeks*		
	t_O	t_L	t_P
A	2	6	10
B	4	6	12
C	2	3	4
D	2	4	6
E	3	6	9
F	6	10	14
G	1	3	5

The logical of activities are:
1. Activities A and B start at the beginning of the project.
2. When A is completed C and D start.
3. E can start when B and D are finished.
4. F can start when B, C and D are completed and is the final activity.
5. G can start when F is finished and is the final activity.

(a) What is the expected time of the duration of the project?
(b) What is the probability that project will be completed in 22 weeks?

Q9. What are assumption in the formulation of Linear Programming Problem? Also give limitations of Linear Programming.

OR

A company has five jobs V, W, X, Y and Z and five machines A, B, C, D and E. The given matrix shows the return in Rs. of assigning a job to a machine. Assign the jobs to machines so as to maximize the total returns.

Machines.
Returns in Rs.

Jobs	*A*	*B*	*C*	*D*	*E*
V	5	11	10	12	4
W	2	4	6	3	5
X	3	12	5	14	6
Y	6	14	4	11	7
Z	7	9	8	12	5

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