Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth semester B.Tech degree examinations (S), September 2020

Course Code: ME372

Course Name: Operations Research

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks. Marks

1 a) Write the canonical form of a linear programming problem. (4)

b) A manufacturer produces three models I, II, and III of a certain product using raw materials A and B. the following table gives the data. Formulate the problem into a LPP in order to maximise the total profit. (3)

Raw Material	Requirement per unit			Availability
	I	II	III	
A	5	2	4	5000
B	3	7	2	6000
Profit/ Unit	40	20	30	

c) Explain slack and surplus variables with examples. (3)

2 Solve the following problem using the two-phase simplex method: (10)

Maximize $Z = 5x_1 + 8x_2$,

Subject to constraints:

$3x_1 + 2x_2 \geq 3, \quad x_1 + 4x_2 \geq 4, \quad x_1 + x_2 \leq 5, \quad x_1, x_2 \geq 0$

3 a) Obtain the initial feasible solution for the following transportation problem by Vogel's approximation method: (6)

Origin	Destination					Supply
	D_1	D_2	D_3	D_4	D_5	
O_1	12	4	9	5	9	55
O_2	8	1	6	6	7	45
O_3	1	12	4	7	7	30
O_4	10	15	6	9	1	50
Requirement	40	20	50	30	40	180

b) Write the steps involved in optimizing a transportation problem by MODI method. (4)

4 Solve the following assignment problem for minimising cost: (10)

From	To				
	I	II	III	IV	V
A	1	3	2	3	6
B	2	4	3	1	5
C	5	6	3	4	6
D	3	1	4	2	2
E	1	5	6	5	4

PART B

Answer any three full questions, each carries 10 marks.

5 Find the sequence of the following jobs that will minimize the total elapsed time for the completion of all jobs. The jobs are processed in the order of A-B-C. Calculate the idle times of all machines. (10)

Machine\Jobs	1	2	3	4	5	6	7	8
A	5	6	2	3	4	9	15	11
B	4	6	3	4	5	3	6	2
C	8	10	7	8	11	8	9	13

6 a) The table below gives the probabilistic times of a project. Draw the network diagram and find the critical path. Also calculate the duration of the project. (7)

Activity	**1-2**	**1-6**	**2-3**	**2-4**	**3-5**	**4-5**	**6-7**	**5-8**	**7-8**
Optimistic time	2	2	5	1	5	2	3	2	7
Most likely time	5	5	11	4	11	5	9	2	13
Pessimistic time	14	8	29	7	17	14	27	8	31

b) Explain total float, free float and independent float. (3)

7 a) A queuing system is represented in Kendall's notation as M/M/1/∞/N/FCFS. What does it mean? (3)

b) In a bus bay, buses arrive at a rate of 30 buses per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate (i) the average number of buses in the queue and (ii) the average number of buses in the system. (7)

8 The demand for an item in a company is 24000 units per year and the company can produce the items at the rate of 4000 per month. The cost of one set up is (10)

Rs. 1000 and the holding cost of 1 unit per month is 50 paise. Shortage cost of one unit is Rs. 30 per month. Determine the optimum manufacturing quantity and the total inventory cost per year. Find the number of shortages. Also determine the manufacturing time and time between set ups.

PART C

Answer any four full questions, each carries 10 marks.

9 a) Define with example the maximax criterion, the minimax criterion and the Laplace criterion used in decision making under uncertainty. (6)

b) Given below is a regret table: (4)

Acts	Events		
	E_1	E_2	E_3
A_1	35	0	25
A_2	0	30	10
A_3	25	0	10

Suppose that the probabilities of the events in the table are $P(E_1) = 0.30$; $P(E_2) = 0.45$ and $P(E_3) = 0.25$. Calculate expected loss of each action and interpret.

10 Solve the following game: (10)

Player A	Player B	
	B_1	B_2
A_1	3	5
A_2	4	1

11 a) Explain decision tree analysis in decision making. Write two of its advantages and disadvantages. (6)

b) Write four limitations of game theory. (4)

12 a) Explain the two phases in a simulation model. (4)

b) What are random numbers and pseudo random numbers? How random numbers are they generated? (6)

13 What do you mean by Monte-Carlo simulation method in simulation? Explain the main steps in Monte Carlo simulation. (10)

14 a) Explain wait line simulation model and inventory simulation model. (8)

b) Write any four applications of simulation. (2)

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