Reg No.:_______________ Name:__________________________

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

SECOND SEMESTER MCA DEGREE EXAMINATION, APRIL 2018

**Course Code: RLMCA 108**

**Course Name: OPERATIONS RESEARCH**

Max. Marks: 60 Duration: 3 Hours

## PART A

***Answer all questions, each carries 3 marks.*** Marks

| | | |
|---|---|---|
| 1 | Explain the use of artificial variables in solving a linear programming problem | (3) |
| 2 | What is meant by duality in linear programming problems. Write the fundamental principle of duality | (3) |
| 3 | Describe the Matrix Minima method. | (3) |
| 4 | Explain (i) Saddle point (ii) Two person zero sum game | (3) |
| 5 | Explain single server Poisson queuing model with infinite capacity. | (3) |
| 6 | Explain pure birth and death process | (3) |
| 7 | What you mean by simulation? Explain. | (3) |
| 8 | Write the steps for generating random numbers. | (3) |

## PART B

***Each question carries 6 marks.***

9 a) A company produces two articles A and B. There are two different departments through which the articles are processed such as assembly and finishing. The potential capacity of the assembly department is 60 hours per week and that of the finishing department is 48 hour per week. The production of one unit of A requires 4 hours in assembly and 2 hours in finishing. Each of the unit B requires 2 hours in assembly and 4 hours in finishing. If profits in Rs. 8 for each unit of A and Rs. 6 for each unit of B, find out the number of units of A and B to be produced each week to get the maximum profit. Use graphical method. (6)

OR

b) Solve the following LPP :- (6)

Maximise $Z = x_1+x_2+x_3$

Subject to $4x_1+5x_2+3x_3 \leq 5$

$10x_1+7x_2+x_3 \leq 12$; $x_1, x_2, x_3 \geq 0$

10 a) (i) Write the dual of the following LPP :- (6)

Maximise $Z = x_1+x_2+x_3$

Subject to $4x_1+5x_2+3x_3 \leq 15$

$10x_1+7x_2+x_3 \leq 12$; $x_1, x_2, x_3 \geq 0$

(ii) State the complementary slackness theorem.

OR

b) Using dual simplex method , solve the following LPP, (6)

Minimise $Z = 3x_1+x_2$

Subject to $x_1+x_2 \geq 1$

$2x_1+3x_2 \geq 2$ ; $x_1,x_2 \geq 0$

11 a) Solve the following transportation problem, (6)

| | | Warehouses | | | |
|---|---|---|---|---|---|
| | | **W1** | **W2** | **W3** | **Supply** |
| | **F1** | 16 | 20 | 12 | **200** |
| **Factories** | **F2** | 14 | 8 | 18 | **160** |
| | **F3** | 26 | 24 | 16 | **90** |
| **Demand** | | **180** | **120** | **150** | |

OR

b) Solve the following Assignment problem, (6)

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| A | 10 | 12 | 19 | 11 |
| B | 5 | 10 | 7 | 8 |
| C | 12 | 14 | 13 | 11 |
| D | 8 | 15 | 11 | 9 |

12 a) Solve the following 2x4 game graphically, (6)

| | | Player B | | | |
|---|---|---|---|---|---|
| | | B1 | B2 | B3 | B4 |
| Player A | A1 | 2 | 1 | 0 | -2 |
| | A2 | 1 | 0 | 3 | 2 |

OR

b) Solve the following game using dominance property. (6)

| | | Player B | | | |
|---|---|---|---|---|---|
| | | B1 | B2 | B3 | B4 |
| Player A | A1 | 3 | 2 | 2 | 0 |
| | A2 | 3 | 4 | 2 | 4 |
| | A3 | 4 | 5 | 4 | 0 |
| | A4 | 0 | 1 | 0 | -4 |

13 a) What are the elements of a queuing system? What are the fundamental characteristics of a queueing system? (6)

OR

b) At a one man barber shop, customers arrive according to poisson distribution with a mean arrival rate of 5 per hour and his hair cutting time was exponentially distributed with an average hair cut time being 10 minutes. It is assumed that because of his excellent reputation customers were always willing to wait. Calculate the following , (6)

(i) Average number of customers in the shop and the average number of customers waiting for haircut.

(ii) The average number of customers who have to wait prior to getting into barber's chair.

(iii) The percentage of time, an arrival can walk right in, without having to wait.

14 a) Explain Monte-Carlo simulation. (6)

OR

b) Customers arrive at a milk booth for the required service. Assume that inter arrival and service times are constant and given by 1.8 and 4 time units, respectively. Simulate the system by hand computations for 14 time units. What is the average waiting time per customer? What is the percentage idle time of the facility? (Assume that the system starts at t = 0 ) (6)

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