Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(S), OCTOBER 2019

Course Code: MA484

Course Name: OPERATIONS RESEARCH

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15marks.

1 a) What is Linear Programming? What are its major components? (5)

b) Solve the following Linear Programming Problem using Simplex method. (10)

Maximize Z $= x_1 + x_2 + x_3$
Subject to
$3x_1 + 2x_2 + x_3 \leq 3$
$2x_1 + x_2 + 2x_3 \leq 2$
$x_1, x_2, x_3 \geq 0$

2 a) Write the dual of the following primal LP Problem. (7)
Minimize $Z = 2x_1 + 3x_2 + 4x_3$
Subject to
$2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 = 3$
$x_1 + 4x_2 + 6x_3 \leq 5$
$x_1, x_2 \geq 0, x_3 \text{ is unrestricted}$

b) Solve the following linear programming problem using the result of its dual problem. (8)
Minimize $Z = 24x_1 + 30x_2$
Subject to
$2x_1 + 3x_2 \geq 10$
$4x_1 + 9x_2 \geq 15$
$6x_1 + 6x_2 \geq 20$
$x_1, x_2 \geq 0$

3 a) Apply the principle of duality to solve the following LPP. (8)
Minimize $Z = 2x_1 + 2x_2$
Subject to
$2x_1 + 4x_2 \geq 1$
$x_1 + 2x_2 \geq 1$
$2x_1 + x_2 \geq 1$
$x_1, x_2 \geq 0$

b) Solve the following Linear Programming Problem using Big-M- Method. (7)

Maximize $Z = 4x_1 + 6x_2$
Subject to $x_1 + 2x_2 \leq 2$, $8x_1 + 6x_2 \geq 24$, $x_1, x_2 \geq 0$

PART B

Answer any two full questions, each carries 15marks.

4 a) With reference to a transportation problem define the following terms (5)
(i) Feasible solutions (ii) Basic feasible solution (iii) Optimal solution

b) Obtain the optimum solution to the following Transportation problem . (10)

	DI	D2	D3	D4	Capacity
O1	1	2	3	4	6
O2	4	3	2	0	8
O3	0	2	2	1	10
Demand	4	6	8	6	

Where O_i and D_j denote i^{th} origin and j^{th}destination respectively

5 a) Solve the following assignment problem (8)

	I	II	III	IV
A	2	3	4	5
B	4	5	6	7
C	7	8	9	8
D	3	5	8	4

b) A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The set up cost per change depends on the item presently on the machine and the set up to be made according to the following table (7)

To item

From item	A	B	C	D	E
A	∞	4	7	3	4
B	4	∞	6	3	4
C	7	6	∞	7	5
D	3	3	7	∞	7
E	4	4	5	7	∞

If we processes each type of item once and only once each week. How should he sequence the item on his machine in order to minimize the total set up cost.

6 a) We have five jobs, each of which must go through the two machines A and B in the order A,B. Processing times in hours are given in the table below. (7)

Job	:	1	2	3	4	5
TimeofMachineA	:	5	1	9	3	10
TimeofMachineB	:	2	6	7	8	4

Determine a sequence for five jobs that will minimize the elapsed time. Also find
(i) total minimum elapsed time .
(ii) idle time for machine A
(iii) idle time for machine B.

b) Solve the following transhipment problem. (8)

	S1	S2	D1	D2	supply
S1	0	2	3	4	5
S2	2	0	2	4	25
D1	3	2	0	1	
D2	4	4	1	0	
			20	10	

PART C

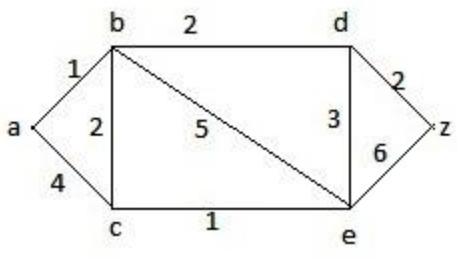
Answer any two full questions, each carries 20 marks.

7 (a) Tasks A, B, C,……., H, I constitute a project. The precedence relationships are A<D; A<E; B<F; D<F; C<G; C<H; F<I; G<I. Draw a network to represent the project and find the minimum time of completion of the project when time, in days, of each task is as follows: (10)

Task :	A	B	C	D	E	F	G	H	I
Time :	8	10	8	10	16	17	18	14	9

Also identify the critical path and determine the total, free and independent floats

b) Find the shortest path 'a' to 'z' for the following graph using Dijkstra's algorithm. (10)



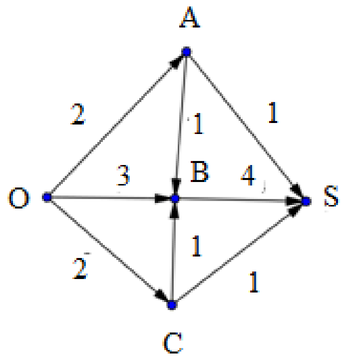
8 (a) Use dynamic programming solve Minimise $Z = y_1^2 + y_2^2 + y_3^2$ subject to the constraints (10)

$y_1 + y_2 + y_3 \geq 15$ and $y_1, y_2, y_3 \geq 0$

(b) Using dynamic programming solve the LPP Maximise $Z = x_1 + 9x_2$ such that (10)

$2x_1 + x_2 \leq 25, x_2 \leq 11, x_1, x_2 \geq 0$

9 a) In the network shown below find the maximum flow and verify your answer using max flow min cut theorem (10)



b) A vessel is to be loaded with stocks of three items. Each unit of item has weight of w and value r. The maximum cargo weight the vessel can take is 5 and the details of three items are as follows (10)

item	w	r
1	1	30
2	3	80
3	2	65

Develop recursive equation for the above case and find the most valuable cargo load without exceeding the maximum cargo weight by using dynamic programming

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