Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: MA484

Course Name: OPERATIONS RESEARCH

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks

1 a) Solve the following LPP (10)

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to

$$x_1 + 2x_2 + x_3 \leq 430$$
$$3x_1 + 2x_3 \leq 460$$
$$x_1 + 4x_2 \leq 420$$
$$x_1, x_2, x_3 \geq 0$$

b) Define (i) Slack variable (ii) Surplus variable (iii) Artificial variable (5)

2 a) Define Duality in Linear Programming. Explain the physical interpretation of duality. (5)

b) Apply the principle of duality to solve the following LPP. (10)

Minimize $Z = 2x_1 + 2x_2$

Subject to

$2x_1 + 4x_2 \geq 1$

$x_1 + 2x_2 \geq 1$

$2x_1 + x_2 \geq 1$

$x_1, x_2 \geq 0$

3 a) Write the dual of the following primal LP Problem. (5)

Maximize $Z = 3x_1 + x_2 + 3x_3 - x_4$

Subject to

$2x_1 - x_2 + 3x_3 + x_4 = 1$

$x_1 + x_2 - x_3 + x_4 = 3$

$x_1, x_2, x_3, x_4 \geq 0$

b) Using Big M method solve (10)

Maximize $z = 6x_1 - 3x_2 + 2x_3$

Subject to

$$2x_1 + x_2 + x_3 \leq 16$$
$$3x_1 + 2x_2 + x_3 \leq 18$$
$$x_2 - 2x_3 \geq 8$$
$$x_1, x_2, x_3 \geq 0$$

PART B

Answer any two full questions, each carries 15 marks

4 a) Determine an initial basic feasible solution to the following transportation problem by using North- West Corner method (NWCM) (5)

	D1	D2	D3	D4	Supply
S1	21	16	15	03	11
S2	17	18	14	23	13
S3	32	27	18	41	19
Demand	06	10	12	15	

b) Solve the transportation problem where all entries are unit costs. (10)

	D1	D2	D3	D4	D5	Capacity
O1	73	40	09	79	20	08
O2	62	93	96	08	13	07
O3	96	65	80	50	65	09
O4	57	58	29	12	87	03
O5	56	23	87	18	12	05
Demand	06	08	10	04	04	

5 a) For the following data, assign the jobs such that the profit is maximum (8)

		Machine				
		A	B	C	D	E
job	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

b) Solve the following Travelling salesman problem (7)

From City \ To City	1	2	3	4	5
1	∞	10	25	25	10
2	1	∞	10	15	2
3	8	9	∞	20	10
4	14	10	24	∞	15
5	10	8	25	27	∞

6 a) A company has three jobs on hand. Each of these must be processed through two departments, the sequential order for which Department A – press shop, (7)

Department B – is finishing. The table below lists the number of days required by each job in each department.

		*job*1	*job*2	*job*3
DepartmentA	:	8	6	5
DepartmentB	:	8	3	4

Find the sequence in which three jobs should be processed so as to take minimum time to finish all the three jobs. Find i) the minimum total time.

ii) the idle time of both departments

b) Solve the following transhipment problem (8)

		S1	S2	D1	D2	supply
	S1	0	2	2	1	8
	S2	1	0	2	3	3
	D1	2	2	0	2	
	D2	1	3	2	0	
				7	4	

PART C

Answer any two full questions, each carries 20 marks

7 a) The following table lists the jobs of a network along with their time estimates. (10)

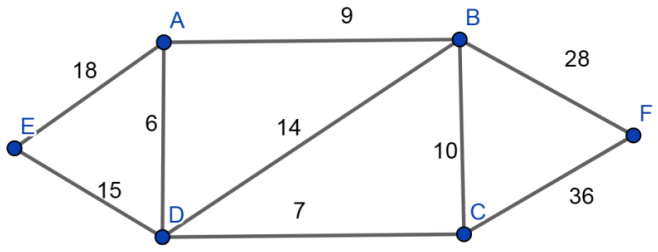
Job ***(i – j)***	:	1-2	1-6	2-3	2-4	3-5	4-5	5-8	6-7	7-8
Duration t_0	:	3	2	6	2	5	3	1	3	4
t_m	:	6	5	12	5	11	6	4	9	19
t_p	:	15	14	30	8	17	15	7	27	28

(i) Draw the project network and calculate the length and variance of the critical path.

(ii) What is the probability that the jobs on the critical path will be completed in 41 days?

(iii) What is the probability that the jobs on the critical path will be completed in 34 days?

b) Find the shortest path E to F for the following graph using Dijkstra'salogorithm. (10)



8 a) Use dynamic programming solve Maximise $Z = y_1.y_2.y_3$ Subject to the constraints (10)

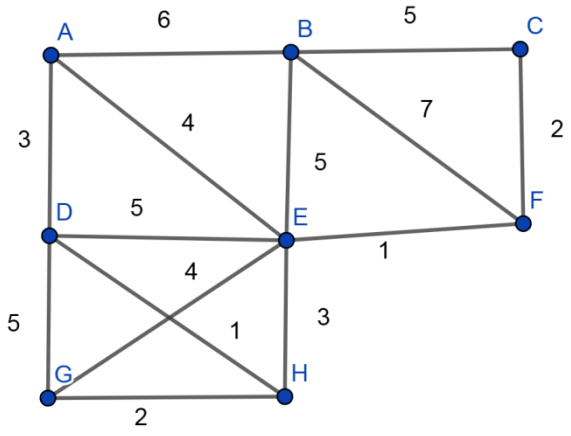
$y_1 + y_2 + y_3 = 5$ and $y_1, y_2, y_3 \geq 0$

b) A vessel is to be loaded with stocks of four items. Each unit of item has weight of w and value r. The maximum cargo weight the vessel can take is 8 and the details of three items are as follows (10)

item	w	r
1	2	1
2	3	2
3	4	5
4	5	6

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

9 a) Apply Prim's method starting from A to obtain a minimum spanning tree for the graph. Give a trace of the process (10)



b) Using dynamic programming solve the LPP (10)

Maximise $Z = 2x_1 + 5x_2$

Subjected to

$2x_1 + x_2 \leq 430$

$2x_2 \leq 460$

$x_1, x_2 \geq 0$

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