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10ME74

Seventh Semester B.E. Degree Examination, June/July 2018
Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Hand book / Charts / Tables are not permitted.

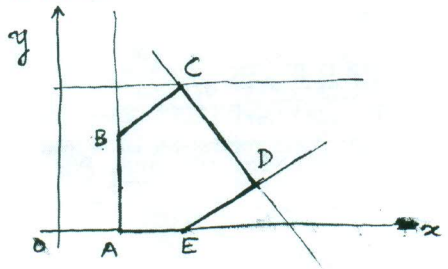
PART – A

1 a. Four products are processed successively on two machines. The manufacturing times in hours per unit of each product are tabulated below:

Machine	Time per unit (hr)			
	Product 1	Product 2	Product 3	Product 4
1	2	3	4	2
2	3	2	1	2

The total cost of producing one unit of each product is based directly on the machine time. Cost per hour for machines 1 and 2 is Rs. 10 and 5 respectively. The total hours available on machines 1 and 2 are 500 and 380. If the sales price per unit for products 1, 2, 3 and 4 are Rs. 65, 70, 55 and 45 respectively, formulate the problem as a LPP to maximize total net profit. **(10 Marks)**

b. Feasible zone ABCDE identified by a set of constraints is shown in Fig. Q1 (b). If a constraint $x \le 2y$ is added, identify the new feasible zone. Also identify and state all redundant constraints.



Co-ordinates of,
A ≡ (1, 0)
B ≡ (1, 2)
C ≡ (2, 3)
D ≡ (4, 1)
E ≡ (2, 0)

Fig. Q1 (b)

Determine maximum and minimum value of Z if $z = 3x + 5y$, after the inclusion of additional constraint. **(10 Marks)**

2 a. Solve the following LPP by Big-M method.

Min $z = 4x_1 + x_2$

Subject to constraint $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \ge 6$.

$x_1 + 2x_2 \le 4$

$x_1, x_2 \ge 0$ **(10 Marks)**

b. Consider the following LPP,

Max. $z = 5x_1 - 6x_2 + 12x_3$

Subject to constraint $x_1 + 3x_2 + 3x_3 \le 90$ and $x_1, x_2, x_3 \ge 0$

(i) Find all basic solutions and thus obtain the optimum solution.
(ii) Find the optimum solution by simplex method.
(iii) Write the dual for the given primal. **(10 Marks)**

3 a. For the following unbalanced transportation problem, penalty costs per unit of unsatisfied demand are Rs. 5, 3 and 2 for destinations 1, 2 and 3 respectively. Find the optimum solution. **(12 Marks)**

	Destination 1	2	3	
O_1	5	1	7	10
O_2	6	4	6	80
O_3	3	2	5	15
	75	20	50	

b. Solve the following assignment problem for maximization. **(08 Marks)**

		Area A_1	A_2	A_3	A_4
Salesman	S_1	200	150	170	220
	S_2	160	120	150	140
	S_3	190	195	190	200
	S_4	180	175	160	190

4 Solve the following problem using cutting plane algorithm:

Max $z = 200x_1 + 300x_2$

Subject to constraint : $2x_1 + 4x_2 \leq 17$

$3x_1 + 3x_2 \leq 15$

$x_1, x_2 \geq 0$ and integer. **(20 Marks)**

PART – B

5 a. In order to construct network, a project has been represented as shown in Fig. Q5 (a). Can it be considered as a network? If can not be considered, then state the rules which have been violated? **(08 Marks)**

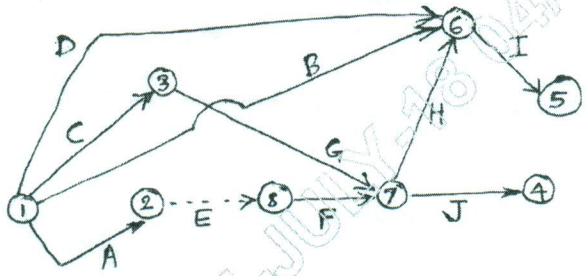


Fig. Q5 (a)

b. A project consists of twelve activities (A to L) with the following precedence:

(i) A, B, C are first ones and can start simultaneously.
(ii) A, B < D
(iii) B < E, F, H
(iv) F, C < G
(v) E, H < I, J
(vi) C, D, F, J < K
(vii) K < L.

Duration of activities are listed below:

Activity:	A	B	C	D	E	F	G	H	I	J	K	L
Duration (days):	6	4	10	1	1	3	14	6	9	2	7	5

Construct the network and find the critical path and also duration of project. **(12 Marks)**

6 a. Explain in brief the following terms related to 'Service discipline', with example:
(i) First In First Out (ii) Last In First Out (iii) Priority service
(iv) Random service. **(08 Marks)**

b. The number of customers approaching the tailor appear to be Poisson distributed with a mean of 6 customers per hour. The tailor attends the customers on FIFO basis. The tailor can attend the customers at an average of 10 per hour with the service time exponentially distributed. Find
(i) The average idle time of tailor on a 10-hour working day.
(ii) The expected number of customers waiting for tailor's services.
(iii) Probability of having exactly 3 customers in the tailor's shop.
(iv) Probability of having 3 or less customers in the shop. **(12 Marks)**

7 a. Use dominance to reduce the following game to 2×2 and then solve. **(08 Marks)**

		B			
		B_1	B_2	B_3	B_4
A	A_1	3	2	4	0
	A_2	3	4	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

b. Solve the following game graphically,

		B			
		1	2	3	4
A	A_1	2	2	3	-1
	A_2	4	3	2	6

If the given problem possesses multiple optimum solutions, find two solutions. **(12 Marks)**

8 a. Determine the optimal sequence of performing 5 jobs on 4 machines. The machining of each job is in the order ABCD and machining times are as follows:

	Machine			
Job	A (hr)	B (hr)	C (hr)	D (hr)
1	8	3	4	7
2	9	2	5	5
3	6	4	5	8
4	12	5	1	9
5	7	1	2	3

Also find the optimum time to complete all jobs. **(10 Marks)**

b. Using graphical method, determine the minimum time needed to process the two jobs on six machines. The information about the machine sequence and the time required by each job is given below: **(10 Marks)**

Job 1

Order:	A	B	C	D	E	F
Time (hr)	4	5	1	3	6	5

Job 2

Order:	B	A	C	F	D	E
Time (hr)	6	3	2	4	3	5

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