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06ME74

Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016
Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of tables is permitted.***

PART – A

1 a. Define operations research and explain briefly the phases of operations research study. **(05 Marks)**

b. Consider the production details of a machine shop as given in the table:

Products	Processing time in minutes		Profit / unit in □
	Machine M_1	Machine M_2	
A	1	2	3/-
B	1	1	4/-
Available processing time/day	450 min	600 min	

i) Formulate the problem as an LPP.
ii) Determine graphically how many units of A & B should be produced to maximize the total profit. **(10 Marks)**

c. Determine graphically what type of solution is obtained for the following LPP:

Maximize $z = 2x_1 + 3x_2$

ST: $x_1 - x_2 \le 0$

$x_1 \le 4$

and $x_1, x_2 \ge 0$ **(05 Marks)**

2 a. What is linear programming? Define slack, surplus and artificial variables. **(04 Marks)**

b. Solve the following LPP by Big M method:

Minimize $z = 12x_1 + 20x_2$

ST: $6x_1 + 8x_2 \ge 100$

$7x_1 + 12x_2 \ge 120$

and $x_1, x_2 \ge 0$ **(12 Marks)**

c. Write the dual of the following primal:

Maximize $z = 3x_1 + 5x_2$

ST : $2x_1 + 6x_2 \le 50$

$3x_1 + 2x_2 \le 35$

$5x_1 - 3x_2 \le 10$

$x_2 \le 20$

and $x_1, x_2 \ge 0$ **(04 Marks)**

3 a. What is meant by 'penalty' in VAM? What is its significance? **(02 Marks)**

b. Consider the following transportation problem:
Note : Cell entries in Rupees.

		To			Supply
		1	2	3	
From	A	5	1	7	10
	B	6	4	6	80
	C	3	2	5	15
Demand		75	20	50	

If the penalty costs for every unsatisfied demand unit are Rs.5, 3 and 2 for destinations 1, 2 and 3 respectively. Determine the optimal solution. **(10 Marks)**

c. Solve the following travelling salesman problem:
Note : Cell entries in Rupees **(08 Marks)**

		To city			
		1	2	3	4
From city	1	0	30	80	50
	2	40	0	140	30
	3	40	50	0	20
	4	70	80	130	0

4 a. Determine the optimum sequence for the five jobs and the minimum elapsed time. Also find the idle time for the three machines. **(10 Marks)**

Jobs		1	2	3	4	5
Processing	A	3	8	7	5	4
time in Hrs	B	4	5	1	2	3
on Machines	C	7	9	5	6	10

b. Determine graphically the optimal scheduling to minimize the total processing time for the two jobs. Find the total elapsed time. For each machine, specify the job that should be done first. **(10 Marks)**

Job 1	Sequence Time (Hrs)	C	A	E	F	D	B
		2	3	4	5	6	1
Job 2	Sequence Time (Hrs)	B	A	E	F	C	D
		3	2	5	3	2	3

PART – B

5 a. Explain 'service channels' and 'service displine' with respect to queuing systems. **(06 Marks)**

b. A self-service restaurant employs one cashier at its counter. Nine customers arrive on an average every five minutes while the cashier can serve ten customers in five minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find

i) Average number of customers in the system.
ii) Average number of customers in the queue.
iii) Average time a customer spends in the system.
iv) Average time a customer waits.
v) Utilization factor.
vi) Probability of waiting for more than 4 minutes. **(14 Marks)**

6 a. The precedence relationships of tasks in a project are: A < D; A < E; B < F; D < F; C < G; C < H; F < I; G < I.
The time in days for each task are:

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

Draw a network to represent the project and find the minimum time of completion of the project. Also identify the critical path. **(10 Marks)**

b. The time estimates in weeks for the activities of a PERT network are given below:

Activity	1 – 2	1 – 3	1 – 4	2 – 5	3 – 5	4 – 6	5 – 6
t_0	1	1	2	1	2	2	3
t_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

i) Draw the project network.
ii) Determine the expected project length.
iii) Calculate the standard deviation and variance of the project length.
iv) What is the probability that the project will be completed at least 4 weeks earlier than expected time? **(10 Marks)**

7 a. Reduce the following game by dominance and find the game value. **(10 Marks)**

		Player B			
		I	II	III	IV
Player A	1	3	2	4	0
	2	3	4	2	4
	3	4	2	4	0
	4	0	4	0	8

b. Solve the following (2×5) game by graphical method: **(10 Marks)**

		Player B				
		1	2	3	4	5
Player A	I	-5	5	0	-1	8
	II	8	-4	-1	6	-5

8 a. Define the following terms:
i) Pure integer programming problem.
ii) Mixed integer programming problem.
iii) Zero-one programming problem. **(03 Marks)**

b. Solve the following problem using Gomory's cutting plane method:
Maximize $z = 5x_1 + 7x_2$
ST : $-2x_1 + 3x_2 \leq 6$
$6x_1 + x_2 \leq 30$
$x_1, x_2 \geq 0$ and integer. **(17 Marks)**

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