

M.E. DEGREE EXAMINATIONS: DECEMBER 2009

First Semester

INDUSTRIAL ENGINEERING

MAT502: Applied Operations Research

Time: Three Hours

Maximum Marks: 100

Answer All the Questions:-

PART A (10 x 2 = 20 Marks)

1. Define optimum solution
2. Define basic feasible solution.
3. Find the dual of the LPP

$$\text{Max } Z = 3x_1 - x_2 + x_3$$

$$\text{Subject to } 4x_1 - x_2 \leq 8$$

$$8x_1 + x_2 + 3x_3 \geq 12$$

$$5x_1 - 6x_3 \leq 13$$

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

4. Define integer linear Programming.
5. Define Total Float.
6. What is the difference between PERT and CPM?
7. Write the formula for cost slope.
8. Write the types of replacement policy
9. Given $\lambda = 1/48$, $\mu = 1/36$ Find ρ .
10. Define total elapsed time and idle time on machines.

PART B (5 x 16 = 80 Marks)

11. (a). Using Simplex method find the non-negative values of x_1 , x_2 and x_3 which

$$\text{Maximize } Z = 3x_1 + 2x_2 + 5x_3$$

$$\text{Subject to } x_1 + 4x_2 \leq 420$$

$$3x_1 + 2x_3 \leq 460$$

$$x_1 + 2x_2 + x_3 \leq 430$$

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

(OR)

(b). Solve the following transportation problem using vogel's method.

		Warehouse						
		A	B	C	D	E	F	Available
Factory	1	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
Requirement		4	4	6	2	4	2	

12. (a). Use duality to solve the following LPP.

$$\text{Minimize } Z = 2x_1 + 2x_2$$

$$\text{Subject to } 2x_1 + 4x_2 \geq 1$$

$$-x_1 - 2x_2 \leq -1$$

$$2x_1 + x_2 \geq 1$$

$$\text{and } x_1, x_2 \geq 0$$

(OR)

(b). Use revised simplex method to solve the LPP.

$$\text{Maximize } Z = x_1 + x_2$$

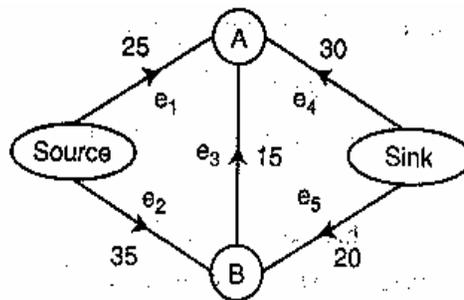
$$\text{Subject to } 3x_1 + 2x_2 \leq 6$$

$$x_1 + 4x_2 \leq 4$$

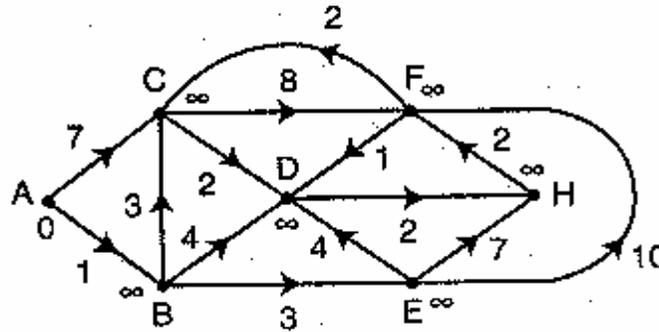
$$x_1 + x_2 \geq 0$$

13. (a) (i). Find two maximal flows for the network shown.

(4)



- (ii). Use Dijkstra's shortest path algorithm to determine the shortest path between A and H in the following graph. (12)



(OR)

- (b). Three time estimates (in months) of all activities of a project are as given below:

Time in Months

Activity	a	m	b
1 – 2	0.8	1.0	1.2
2 – 3	3.7	5.6	9.9
2 – 4	6.2	6.6	15.4
3 – 4	2.1	2.7	6.1
4 – 5	0.8	3.4	3.6
5 – 6	0.9	1.0	1.1

- (i) Find the expected duration and standard deviation of each activity
- (ii) Construct the project network
- (iii) Determine the critical path, expected project length and expected variance of the project length.
- (iv) What is the probability that the project will be completed.
 1. Two months later than expected
 2. Not more than 3 months earlier than expected
 3. What due date has about 90% chance of being met?

14. (a). The purchase price of a machine is Rs 6000/- and its running cost is given in the table below. If the discount rate is 0.90. Find at what age the machine should be replaced.

Year	1	2	3	4	5	6	7	8
Running Cost	500	600	800	1000	1200	1500	2000	2200

(OR)

- (b). The failure pattern of bulb is as follows:

Life in Months	1	2	3	4	5	6
Prob. Of failure	.08	.12	.20	.30	.20	.10

The cost of replacing an individual bulb when it fails is Rs 5/- and the cost when replaced on group basis is Rs 2 per bulb. The company has one thousand bulbs of this type installed. Determine the optimum replacement policy.

15. (a). A general Insurance company has three claim adjusters in its branch office. People with claims against the company are found to arrive in Poisson fashion at an average rate of 20 per 8 – hour day. The amount of time that an adjuster spends with a claimant is found to have negative exponential distribution with mean service time 40 minutes. Claimants are processed in the order of their appearance.

1. How many hours a week can an adjuster expect to spend with claimants?
2. How much time, on the average, does claimant spend in the branch office?

(OR)

- (b). Find the sequence that minimizes the total elapsed time required to complete the following tasks on the machines in the order 1 – 2 – 3. Find also the minimum total elapsed time (hours) and the idle times on the machines.

Task	A	B	C	D	E	F	G
Machine 1	3	8	7	4	9	8	7
Machine 2	4	3	2	5	1	4	3
Machine 3	6	7	5	11	5	6	12
