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

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

Subject to $\quad 4x_1 - x_2 \le 8$

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

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

$$x_1, x_2, x_3 \ge 0$$

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

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

Subject to $\quad x_1 + 4x_2 \le 420$

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

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

$$x_1, x_2, x_3 \ge 0$$

(OR)

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

Warehouse

	A	B	C	D	E	F	Available
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	

Factory rows: 1, 2, 3, 4

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

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

Subject to $\quad 2x_1 + 4x_2 \geq 1$

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

$$2x_1 + x_2 \geq 1$$

and $x_1, x_2 \geq 0$

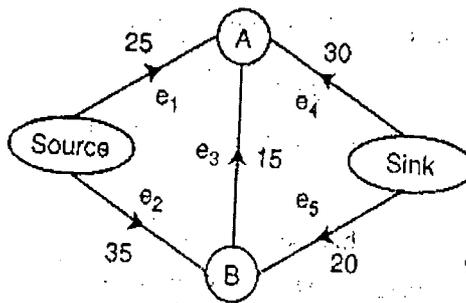**(OR)**

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

Maximize $\quad Z = x_1 + x_2$

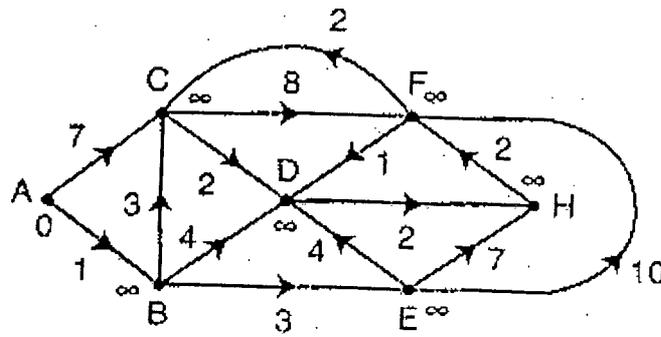Subject to $\quad 3x_1 + 2x_2 \leq 6$

$$x_1 + 4x_2 \leq 4$$

$$x_1 + x_2 \geq 0$$

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

(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

(4)

(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 is the below. If the discount rate is 0.90. Find at what age the machine should be replace

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

(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 replaced on group basic is Rs 2 per bulb. The company has one thousand bulbs o type installed. Determine the optimum replacement policy.

15. (a). A general Insurance company has three cliam adjusters in its branch office. P with claims against the company are found to arrive in Poisson fashion at an av rate 0f 20 per 8 – hour day. The amount of time that an adjuster spends with a cla is found to have negative exponential distribution with mean service time 40 min 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 following tasks on the machines in the order 1 – 2 – 3. Find also the minimum t elapsed time (hours) and the idle times on the machines.

Task Time on	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

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