KUMARAGURU college of technology
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Register Number:……

M.E DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

INDUSTRIAL ENGINEERING

P14MAT102**:** Advanced Operations Research

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Consider the following statements [K_2]

   1) Simplex method is used to solve LPP

   2) The initial basic feasible solution of a transportation problem can be obtained by MODI method

   3) Hungarian algorithm is used to solve assignment problem

   4) Least cost method is used to get initial basic solution to a transportation problem

   Which of these statements are correct?

   a) 1,3,4 b) 1,2

   c) 2,4 d) 1,2,3

2. Match list I with list II (answer using the following codes) [K_1]

List I	List II
A) Big M method	1) transportation problem
B) two (decision) variables LPP	2) assignment problem
C) square (cost) matrix	3) graphical method
D) Vogel's approximation method	4) artificial variable

Codes:

	A	B	C	D
a.	4	3	2	1
b.	4	3	1	2
c.	2	3	1	4
d.	2	1	3	1

3. The steps involved in finding the solution of integer programming problem by cutting plane algorithm(for maximization): [K_3]

1. Apply Simplex method to get optimum solution.
2. Check the optimality condition.
3. Express negative fractions as sum of a negative integer and a non-negative fraction.
4. Find Gomorian constraint and obtain solution by dual Simplex method.
5. Check the integerality conditions.

Choose the correct sequence

a) 1-3-5-4-2 b) 1-2-4-3-5

c) 1-3-2-4-5 d) 1-5-3-4-2

4. Assertion (A): Addition and deletion of a new constraint may change the optimum solution in an LPP [K_2]

Reason (R): There will be changes in the optimum solution of an LPP due to discrete variations in the parameters.

a) both A and R are individually true but R is the correct explanation of A

b) both A and R are individually true but R is not the correct explanation of A

c) A is true but R is false

d) A is false but R is true

5. Match list I with list II (answer using the following codes)odes:

List I	List II
A) Dijkstra's algorithm	1) PERT
B) Kruskal's algorithm	2) shortest path
C) probabilistic model	3) minimum spanning tree
D) deterministic model	4) CPM

	A	B	C	D
a.	4	3	2	1
b.	3	2	4	1
c.	2	3	1	4
d.	4	1	2	3

6. Mean value of beta distribution is given by [K_2]

a) $\mu = \frac{t_o + 4t_m + t_p}{6}$

b) $\mu = \frac{t_o + t_m + t_p}{6}$

c) $\mu = \frac{t_o + 4t_m + t_p}{3}$

d) $\mu = \frac{t_o + t_m + t_p}{3}$

7. Consider the following statements: [K_2]

1. Individual replacement policy states that an item is replaced immediately after its failure.
2. In group replacement all items are replaced, irrespective of whether they have failed or not.
3. In group replacement all items are replaced, if all items have failed.

Which of the following statements are not correct?

a) 1,3
b) 3
c) 2
d) 1,2

8. Assertion (A) : Total float of an activity is the difference between the latest finish and the earliest finish of the activity. [K_2]

Reason(R) : Total float of an activity is the amount of time by which the activity may be delayed without affecting the duration of the project.

a) both A and R are individually true but R is the correct explanation of A
b) both A and R are individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

9. The steps involved in finding the minimum total elapsed time in a sequencing problem of 2 jobs and n machines in graphical method [K_2]

1. Draw the set of axis.
2. Construct various blocks starting from origin till finish and draw lines
3. Mark processing times for jobs.
4. Obtain the optimum path and total elapsed time.

a) 1-2-3-4
b) 1-3-2-4
c) 1-4-3-2
d) 4-3-2-1

10. Departure of customer from queue without receiving the service is known as [K_3]

a) balking of customer
b) reneging of customer
c) jockeying of customer
d) bulk arrival of customer

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PART B (10 x 2 = 20 Marks)

11. Define degeneracy in LPP. [K_3]
12. What is alternative optimum solution in a transportation problem? How to identify that there is an alternative optimum solution. [K_2]
13. Define sensitivity analysis. [K_3]
14. State fundamental theorem on duality. [K_2]
15. Define minimal spanning tree. [K_2]
16. Distinguish between float and slack. [K_2]
17. Identify the costs which influence the project schedule. [K_4]
18. Define 'present worth factor'. [K_2]
19. Write Little's formulae for the waiting line model (M/M/1) (N/FIFO). [K_4]
20. What is 'no passing rule' in sequencing problems? [K_2]

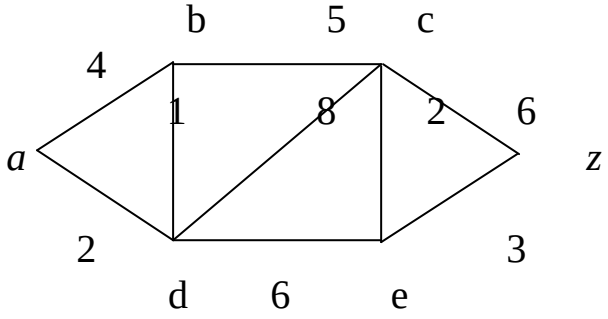
PART C (6 x 5 = 30 Marks)

21. Apply graphical method to solve the LPP: [K_5]

    Maximize $z = 2x_1 + 3x_2$, subject to $x_1 - x_2 \le 2,\ \ x_1 + x_2 \ge 4$ *and* $x_1, x_2 \ge 0$

22. A company produces three products P,Q and R from three raw materials A,B and C. One unit of product P requires 2 units of A and 3 units of B. A unit of product of Q requires 2 units of B and 5 units of C and one unit of R requires 3 units of A, 2units of B and 4 units of C. The company has 8 units of material A, 10 units of material B and 15 units of material C available to it. Profits per unit of products P,Q and R are Rs. 3, Rs. 5 and Rs. 4 respectively. Formulate this as an LPP and write the dual of it. [K_6]

23. Apply Floyd's algorithm to generate the final distance matrix and precedence matrix for the distance network : [K_4]



24. An engineering company is offered a material handling equipment A. It is priced at Rs. 60,000 including cost of installation, and the costs for operation and maintenance are estimated to be Rs. 10,000 for each of the first five years, increasing every year by Rs. 3,000 in the sixth and subsequent years. The company expects a return of 10 percent on all its investment. Evaluate the optimal replacement period? [K_5]

25. Obtain 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 (hrs) : [K_5]

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

26. Calculate the earliest start, earliest finish, latest start and latest finish time of each activity of the below and determine the critical path of the project: [K_4]

Activity:	1-2	1-3	1-5	2-3	2-4	3-4	3-5	3-6	4-6	5-6

Duration
(in weeks): 8 7 12 4 10 3 5 10 7
4

PART D (4 x 10 = 40 Marks)

27. A company has four plants, each of which can manufacture any one of the four products A, B, C or D. Production costs differ from one plant to another and so do the sales revenue. Given the revenue and the cost data below, determine which product should each plant produce to maximize profit. [K_4]

Sales revenue (in’000 Rs) Production
cost (in’000 Rs)

Plant

Plant

1 2 3 4 1 2
3 4

A 50 68 49 62 A 49 60
45 61

28. Employ revised Simplex method to solve the LPP: [K_3]

Maximize $Z = 3x_1 + 5x_2$, subject to $x_1 \leq 4, x_2 \leq 6 \quad 3x_1 + 2x_2 \leq 18$ *and* $x_1, x_2 \geq 0$

29.	The following table gives the activities in a construction project and other relevant information:		[K_5]

Activity	Immediate Predecessor	Time (months)		Direct cost (Rs. '000)	
		Normal	Crash		
A	-	4	3	60	90
B	-	6	4	150	250
C	-	2	1	38	60
D	A	5	3	150	250
E	C	2	2	100	100
F	A	7	5	115	175

Indirect costs vary as follows:

30.	Let there be an automobile inspection situation with three inspection stalls. Assume that cars wait in such a way that when stall becomes vacant, the car at the head of line pulls up it. The station can accommodate four car waiting at one time. The arrival pattern is Poisson with a mean of one car every minute during the peak hours. The service time is exponential with a mean of 6 minutes. Find the average number of customers in the system during peak hours and the average waiting time in the system.		[K_5]

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