Register Number: ……..

B.E/ B.TECH DEGREE EXAMINATIONS:APRIL/MAY 2014

(Regulation 2009)

Sixth Semester

GSS108: OPERATIONS RESEARCH

(Common to Computer Science And Engineering / Fashion Technology)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Most common method to solve linear programming problems which have only two variables in the objective function is
   a) Simplex method b) Revised simplex method
   c) Graphical method d) Dual simplex method
2. In a simplex problem, the variables that are introduced into the constraints having greater than or equal to sign to converted into equality are called as
   a) Surplus variables b) Slack variables
   c) Artificial variables d) Dummy variables
3. A maximization transportation problem is converted to a minimization transportation problem by
   a) Subtracting every element of the maximization table from the highest element of the maximization table b) Subtracting every element of the maximization table from the lowest element of the maximization table
   c) Adding every element of the maximization table with the highest element of the maximization table d) Adding every element of the maximization table with the lowest element of the maximization table
4. If 'm' is the number of rows and 'n' is the number of columns in the initial solution table of a transportation problem, then degeneracy does not exist in the problem if the number of allocations in the initial solution table is equal to
   a) m – n + 1 b) n – m + 1
   c) m – n – 1 d) m + n – 1
5. The logic rule of network states that before an activity begins, all activities:
   a) Preceding it must be completed b) Succeeding it must be completed
   c) On the burst events are to be completed d) On the dual events are to be completed
6. If an activity is repeated a number of times, the most probable time is likely to occur:
   a) One time more than the optimistic or pessimistic time b) Two times more than the optimistic or pessimistic time
   c) Three times more than the optimistic or pessimistic time d) Four times more than the optimistic or pessimistic time
7. In order to find the optimal sequence, an n jobs × 3 machines problem is to be converted to an n jobs × 2 machines problems. If the three machines are A, B, and C and if the order of processing is ACB, the conditions to be satisfied are
   a) (Min on A ≥ Max on C) and (Min on B ≥ Max on C) b) (Min on A ≥ Max on B) and (Min on C ≥ Max on B)
   c) (Min on C ≥ Max on A) and (Min on B ≥ Max on A) d) (Min on A ≥ Max on C and B)

8. An equipment should be replaced at the end of the period with (as per the replacement model ignoring time value of money)
   a) Minimum average annual cost b) Minimum total annual cost
   c) Minimum operating cost d) Minimum maintenance cost
9. The way in which customers from a queue are selected for service is called as
   a) Queuing selection order b) Queuing schedule
   c) Queuing discipline d) Queuing managing order
10. In the Kendall's notation used for representing queuing models (a/b/c) : (d/e/f), f stands for
    a) Arrival distribution b) Service distribution
    c) Number of service channels d) Calling source or population

PART B (10 x 2 = 20 Marks)

11. State the four steps in formulating a linear programming model.
12. For finding the solution space on the graph when a linear programming problem is solved using graphical method, what is the criterion for marking the arrows on the line representing the constraints?
13. State the procedure adopted to convert a maximization assignment problem to a minimization one.
14. How is degeneracy resolved in a transportation problem?
15. What is total slack in network analysis?
16. State the Fulkerson's network numbering rules.
17. Define the term sequencing?
18. State the two replacement policies for items that fail suddenly.
19. Schematically represent a typical queuing situation with its key elements.
20. Give an example for FCLS in queuing.

PART C (5 x 14 = 70 Marks)

21. a) A chemical company has two bottling plants situated at two cities A and B. Each plant produces 3 types of chemicals: type – I, type – II, type – III. The number of bottles produced per day is as follows:

CHEMICAL TYPE	PLANT AT CITIES	
	A	B
I	1500	1500
II	3000	1000
III	2000	5000

A market survey indicates that there will be a demand of 20,000 bottles of type – I chemical, 40,000 bottles of type – II chemical, and 44,000 bottles of type – III chemical. The operating costs per day of the plant A and B are Rs. 60,000 and Rs. 40,000 respectively. For how many days each plant should run in the month of May so as to have a minimum production cost, while still meeting the market demand. Obtain the solution by graphical method.

(OR)

b) Max $Z = x_1 - x_2 + 3x_3$ (Objective function)
Subjected to $2x_1 + x_2 + x_3 \leq 10$ – (1)
$2x_1 - x_3 \leq 2$ – (2)
$2x_1 - 2x_2 + 3x_3 \geq 0$ – (3)
$x_1, x_2, x_3 \geq 0$.

22. a) There are 5 jobs and 5 machines. The associated cost of allocating a job to the machines is given in the table.

Machines

Jobs	M1	M2	M3	M4	M5
J1	11	17	8	16	20
J2	9	7	12	6	15
J3	13	16	15	12	16
J4	21	24	17	28	26
J5	14	10	12	11	15

It is required to assign one job to each of the 5 machine. Determine the optimal assignment of jobs so that the total cost to process all the jobs is minimized.

(OR)

b) Solve the following transportation problem.

Cell entries represent the unit cost of shipping.

	I	II	III	IV	V
A	12	4	9	5	9
B	8	1	6	6	7
C	1	12	4	7	7
D	10	15	6	9	1

The availability at sources I, II, III, IV, V are 40, 20, 50, 30, 40 respectively. The requirement at destinations at A, B, C, D are 55, 45, 30, 50 respectively.

- Find the optimal solution using MODI method.

23. a) The activities involved in a project with their respective time estimates are given in table.

Activity (Weeks)	1-2	1-3	2-3	3-4
t_0	1	2	2	3
t_m	1	5	2	6
t_p	7	14	14	15

- Find the expected duration and variance of the project. (5)
- What is the probability that the project will be completed at least 2 weeks later than expected? (5)
- What is the probability of the entire project? (4)

(OR)

b) The normal cost and duration, crash cost and duration of activities of a project are given in table. If the overhead cost is Rs. 45/day, determine the optimal cost schedule for the project by drawing the project duration Vs total cost.

Activity	Normal		Crash	
	Cost	Duration	Cost	Duration
1-2	360	3	440	1
2-3	240	4	320	2
2-4	100	7	140	3
3-4	80	5	140	2

24. a) Apply Johnson's rule to find the optimal sequence and determine the make span.

Job		1	2	3	4
Processing time (hours)	Machine A	4	6	3	5
	Machine B	2	5	3	7

(OR)

b) The owner of a stone crushing machine determines from his past records that the cost per year for operating the machine is as shown in table. The purchase price of this machine was Rs. 65,000 when new.

Age	1	2	3
Operating cost Rs.	10,000	12,000	14,000

After 3 years, the operating cost is Rs. 4,000 B, where B = 4, 5, 6 (B indicating age in years). If the resale value decreases by 15 percent of the purchase price every year, what is the optimal replacement policy?

25. a) In a big CNC-machine shop, there is only one CNC-programmer to write programs. Since the programmer's work varies in length (the length of the program to be written), the programming rate is randomly distributed approximating a Poisson distribution with mean service rate of 7 programs per hour. The jobs for programming arrive at a rate of 4 per hour during the entire 8 hour work day. If the programmer is valued at Rs. 35 per hour, determine the following:

- Programmer utilization (4)
- The time (in percentage) that an arriving job for programming has to wait (4)
- Average system time (3)
- Average cost due to waiting on the part of the programmer. (3)

(OR)

b) Customers arriving at an industrial consultant's office are according to Poisson's distribution at the rate of 28 per hour. The waiting room can accommodate not more than 14 customers. Consultation time per customer is exponential with a mean rate of 20 per hour. (7)

- Find the effective arrival rate at the consultant's office. (7)
- What is the expected waiting time of a customer in the consultant's office?

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