



B.TECH DEGREE EXAMINATIONS: APRIL 2015

(Regulation 2009)

Seventh Semester

INFORMATION TECHNOLOGY

GSS108: Operations Research

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Mathematical model of LP problem is important because
 - a) It helps in converting the verbal description and numerical data into mathematical expression
 - b) Decision-makers prefer to work with formal models.
 - c) It captures the relevant relationship among decision factors.
 - d) It enables the use of algebraic technique.
2. While solving a LP problem, infeasibility may be removed by
 - a) Adding another constraint
 - b) Adding another variable
 - c) Removing a constraint
 - d) Removing a variable
3. If an opportunity cost value is used for an unused cell to test optimality, it should be
 - a) Equal to zero
 - b) Most negative number
 - c) Most positive number
 - d) Any value
4. To proceed with MODI algorithm for solving an assignment problem, the number of dummy allocations need to be added are
 - a) n
 - b) 2n
 - c) n-1
 - d) 2n-1
5. The slack for an activity is equal to
 - a) LF - LS
 - b) EF – ES
 - c) LS – ES
 - d) LS – EF
6. In PERT the span of time between the optimistic and pessimistic time estimates of an activity is
 - a) 3σ
 - b) 6σ
 - c) 12σ
 - d) 24σ
7. The problem of replacement is felt when job performing units fail
 - a) Suddenly
 - b) Gradually
 - c) Both (a) and (b)
 - d) (a) but not (b)
8. The average annual cost will be minimized by replacing a machine when
 - a) Average cost to date is equal to the current maintenance cost
 - b) Average cost to date is greater than the current maintenance cost
 - c) Average cost to date is less than the current maintenance cost
 - d) Average cost to date is much greater than the current maintenance cost

9. Which of the cost estimates and performance measures are not used for economic analysis of a queuing system
- a) Cost per server unit of time b) cost per unit of time for a customer waiting in the system
- c) average number of customers in the system d) average waiting time of customers in the system
10. A calling population is considered to be infinite when
- a) all customers arrive at once b) arrivals are independent of each other
- c) arrivals are dependent upon each other d) arrivals are to be increased

PART B (10 x 2 = 20 Marks)

11. What are the constraints in linear programming?
12. Why it is necessary to introduce artificial variable in LPP?
13. Distinguish between transportation problem and assignment problem
14. What do you understand by degeneracy in a transportation problem?
15. Give the difference between the shortest route problem and minimal spanning tree problem.
16. List the rules for constricting a project network.
17. State the conditions under which group replacement is superior to individual replacement.
18. What are the situation which make the replacement of items necessary?
19. List the elements of a queuing system.
20. Describe some of the performance measures used in analyzing queues.

PART C (5 x 14 = 70 Marks)

21. a) Solve the problem by Big 'M' method

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

Subject to

$$3x_1 + x_2 \geq 9$$

$$x_1 + x_2 \leq 1$$

$$x_1, x_2 \geq 0$$

(OR)

- b) A product consists of two components A and B. These components require two different raw materials X and Y. 100 units of X and 200 units of Y are available for production. The materials are processed in three departments. The requirement of production time in hours and materials in units are given in the table below.

Departments	Raw material input per run in unit		Output of components per run (units)	
	X	Y	A	B
1	7	5	6	4
2	4	8	5	8
3	2	7	7	3

Formulate a programme to determine the number of production runs for each department, which will maximize the total number of components A and B for the product. Solve by simplex method.

22. a) A product is produced by four factories A, B, C and D. The unit production costs in them are Rs 2, Rs 3, Rs 1 and Rs 5 respectively. Their production capacities are 50, 70, 30 and 50 units respectively. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 units respectively. Unit transport cost in rupees from each factory to each store is given in the table below.

	1	2	3	4
A	2	4	6	11
B	10	8	7	5
C	13	3	9	12
D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum.

(OR)

- b) A company has five jobs V, W, X, Y and Z and five machines A, B, C, D and E. The given matrix shows the return in Rs. of assigning a job to a machine. Assign the jobs to machines so as to maximize the total returns.

Machines.
Returns in Rs.

Jobs	A	B	C	D	E
V	5	11	10	12	4
W	2	4	6	3	5
X	3	12	5	13	6
Y	6	14	4	10	7
Z	7	9	8	12	5

23. a) The utility data for a network is given below. Determine the total, free and independent floats and identify the critical path.

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration (Days)	2	8	10	6	3	3	7	5	2	8

(OR)

- b) The PERT time estimates for the activities of a project are given below. Determine the probability of completing the project in 25 weeks. Also find the completion time for a probability of completion of 90%.

Activity	to	tm	tp
1-2	7	8	9
1-3	5	7	8
2-6	6	9	12
3-4	4	4	4
3-5	7	8	10
3-6	10	13	19
4-5	3	4	6
5-6	4	5	7

5-7	7	9	11
6-7	3	4	8

24. a) Find the optimal sequence for the following sequencing problem of four jobs and five machines when passing is not allowed. The processing time given is in hours.

Jobs		1	2	3	4
Machines	A	6	5	4	7
	B	4	5	3	2
	C	1	3	4	2
	D	2	4	5	1
	E	8	9	7	5

(OR)

- b) (i) The maintenance cost and resale value per year of a machine whose purchase price is Rs.7000/- is given below: (6)

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.:	900	1200	1600	2100	2800	3700	4700	5900
Resale value in Rs.:	4000	2000	1200	600	500	400	400	350

When should be replaced?

- (ii) Let the value of the money be 10% per year and suppose that machine A is replaced after every 3 years whereas machine B is replaced after every six years. The yearly cost of both machines are given as under: (8)

Age :	1	2	3	4	5	6
Machine A:	1000	200	400	1000	20	400
Machine B:	1700	100	200	300	400	500

Determine which machine should be purchased?

25. a) Cars arrival at a petrol pump, having one petrol unit, in Poisson fashion with an average of 10 cars per hour. The service time is distributed exponentially with a mean of 3 minutes. Find (i) average number of cars in the system (ii) average waiting time in the queue (iii) average queue length (iv) probability that the number of cars in the system is 2.

(OR)

- b) A super market has two girls ringing up sales at counters. If the service time for each customer is exponential with mean of 4 minutes, and if people arrive in a Poisson fashion at the rate of 10 per hour. Find (a) What is the probability of having to wait for service?
 (b) What is the expected percentage of idle time for each girl?
 (c) If a customer has to wait, what is the expected length of waiting time?
