



B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(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)

- In two phase simplex method, artificial variables will:
 - Not be considered in both the phases
 - Be considered in the first phase only
 - Be considered in second phase only
 - Be considered in both the first and second phase
- Graphical method is used to solve LP problems with:
 - Two variables
 - Four variables
 - Six variables
 - Eight variables
- While attempting to solve an assignment problem:
 - The number of rows should be less than the number of columns
 - The number of rows should be greater than the number of columns
 - There should be minimum three rows and three columns
 - The number of rows should be equal to the number of columns
- An effectiveness matrix has been shown with zero elements in position. Positive non-zero elements have been shown elsewhere. How many times compulsory allocation is made while attempting for maximal assignment?

K_1	0	K_2	K_3	K_4
0	0	K_5	K_6	K_7
0	K_8	0	K_9	0
0	K_{10}	0	K_{11}	0
K_{12}	K_{13}	0	0	0

- Zero
 - One
 - Two
 - Three
- In arrow scheme of networking, the circles before and after the arrow are called
 - Nodes
 - Events
 - Cycles
 - Paths
 - On network schedule graphs, the length of the arrow represent the
 - Duration of the activity
 - Cost of the activity
 - Flexibility of the activity
 - Criticality of the activity
 - The conditions to be satisfied to convert n jobs \times 3 machine sequencing problem to a n job \times 2 machine sequencing problem (processing order ABC) is:
 - Maximum processing time on machine A \geq Minimum processing time on machine B
 - Minimum processing time on machine A \geq Maximum processing time on machine B **and / or** Minimum processing time on machine C \geq Maximum processing time on machine B
 - Maximum processing time on machine C \geq Minimum processing time on machine B

‘A’ and 2 tons of ‘C’ grade ores. How many days in a week each mine should be operated to fulfill the company’s order to operate most economically.

(OR)

b) Solve by Simplex Method

$$\text{Max } Z = x_1 - x_2 + 3x_3 \text{ (Objective function)}$$

$$\text{Subjected to } x_1 + 0.5x_2 + 0.5x_3 \leq 5$$

$$x_1 - 0.5x_3 \leq 1$$

$$x_1 - x_2 + 1.5x_3 \geq 0$$

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

22. a) In a (3 x 3) transportation problem, let x_{ij} be the amount shipped from source i to destination j and C_{ij} the corresponding per unit transportation cost. The supplies at source 1, 2, 3 are 15, 35, 90 units respectively and the demands at destinations 1, 2, 3 are 25, 35, 80 units. Assume that the starting solution obtained by the ‘North West Corner’ method gives the optimal basic solution to the problem. Let the associated values of multipliers (u and v values) for sources 1, 2, 3 be -2, 3, 5 respectively and those for destinations 1, 2, 3 be 2, 5, 10 respectively.

- Find the total optimal transportation cost.
- What are the smallest values of C_{ij} for the non-basic variables which will keep the above solution optimal?

(OR)

b) A company has 4 plants, W, X, Y & Z each of which can produce any one of the four products P, Q, R & S. The production cost and sales revenue differ from one plant to another. Determine the optimal combination of plant – product which will maximize the profit of the company. Details of production cost and sales revenue have been shown.

Sales revenue (in thousands of rupees)				
	Product			
	P	Q	R	S
Plant W	70	60	66	75
Plant X	73	63	68	72
Plant Y	55	58	60	62
Plant Z	63	68	71	76

Production Cost (in thousands of rupees)				
	Product			
	P	Q	R	S
Plant W	62	58	60	71
Plant X	71	58	62	71
Plant Y	50	51	53	59
Plant Z	61	66	65	70

23. a) The normal cost and duration, crash cost and duration of activities of a project are given in table. If the overhead cost is Rs.4500 per day, determine the optimal cost schedule for the project by drawing the graph of 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

(OR)

- b) (i) State the Fulkerson network numbering rules and explain the same with a (7) suitable network.
- (ii) List the logic rules and computer rules to draw networks and explain each rule (7) with a suitable example.

24. a) The following failure rates are for a resistor in an electrical system. The number of resistors in the electrical system is 1000 at the beginning.

End of week	1	2	3	4	5	6	7	8
Cumulative probability of failure	0.03	0.15	0.24	0.44	0.67	0.85	0.95	1.00

- The cost of replacing an individually failed resistor is Rs. 1.30
- If all the resistors are replaced in a group, the cost per resistor is 32 paisa.

If a decision is made to replace all the resistors at a time at fixed intervals and replace the individual resistors as and when they fail in service, what will be the optimal group replacement period? At what group replacement price per resistor will a policy of strictly individual replacement become preferable to the adopted group replacement policy?

(OR)

- b) There are six jobs which are supposed to undergo processing on five machines A, B, C, D and E in the order ABCDE. The processing time in minutes is given in table. Determine the optimal sequence, minimum elapse time and idle time of each machine.

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

25. a) Draw a diagram of a queuing system with its key elements and explain each element with suitable examples.

(OR)

- b) (i) Explain Kendall's notation for representing queuing models. (4)
- (ii) Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of the phone cell is assumed to be distributed exponentially with a mean of 3 minutes. (10)
- What is the probability that a person arriving at the booth will have to wait?
 - What is the average length of the queues that form from time to time?
 - The telephone department will install a second booth when convinced that an arrival would expect waiting for at least 3 minutes for the phone. By how much should the flow of arrival increase in order to justify a second booth?
