B.E./B.TECH DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

GSS108: OPERATIONS RESEARCH

(Common to ECE, CSE & FT)

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

Answer all the Questions

PART A (10 x 1 = 10 Marks)

1. A feasible solution to an L.P.P. must
   a) satisfy all the constraints simultaneously
   b) satisfy only some of the constraints
   c) be a corner point of the feasible region
   d) optimize the value of objective function

2. If an equality appears in LPP then the following variable is used to convert it to standard form is
   a) Slack variable
   b) Surplus variable
   c) Unrestricted variable
   d) Artificial variable

3. The dummy source or destination in a transportation problem is added to
   a) Satisfy rim condition
   b) Prevent solution from becoming degenerate
   c) Ensure that total cost does not exceed a limit
   d) Maximize problem

4. In Hungarian algorithm the selected smallest elements of each row of cost matrix in assignment problem given atleast ------ in each row of the reduced cost matrix.
   a) one positive element
   b) one zero element
   c) one negative element
   d) one real element

5. The algorithm which is used to find out the shortest path in a distance network is
   a) Kruskal
   b) Dijkstra
   c) Floyd
   d) Both (b) and (c)

6. The number of time estimates required to use PERT model is
   a) 2
   b) 3
   c) 1
   d) Any number

7. If 3 jobs performed one at a time on each of 3 machines then the total number of possible sequence will be
   a) 6
   b) 216
   c) 27
   d) 9

8. Replacement of a existing machine aims at
   a) Reduction in the annual capital cost
   b) More automation and lesser dependence on workmen
   c) More dependence on workmen
   d) Lower average annual cost using the machine

9. In an $(M/M/I:\infty/FIFO)$ queue, When $\rho = 0.75$, $\mu = 4$ then λ is
   a) 3
   b) 4
   c) 0.75
   d) 3/16

10. The utilisation factor under multi-server model is

a) $\dfrac{\lambda}{c\mu}$

b) $\dfrac{\lambda}{\mu}$

c) $\dfrac{\lambda}{\mu}$

d) $\dfrac{\lambda}{\mu}$

PART B (10 x 2 = 20 Marks)

11. What are the four steps in formulating an linear programming problem?
12. What are the variants of simplex method?
13. How degeneracy resolved in transportation problem?
14. How a maximization assignment problem can be converted to a minimization one?
15. What is maximal flow problem?
16. Write any two differences between CPM and PERT.
17. What is no passing rule in sequencing algorithm?
18. What do you understand by present worth factor?
19. Write the Kendall's notation for representing a queuing model.
20. What is the effective arrival rate for (M/M/1) : (4/FCFS) queuing model when $\lambda = 2$ and $\mu = 5$.

PART C (5 x 14 = 70 Marks)

21. a) Solve the following L.P.P by the graphical method

$$\max Z = 3x_1 + 2x_2 \quad subject\ to$$
$$-2x_1 + x_2 \le 1 \ ; \quad x_1 \le 2 ; \quad x_1 + x_2 \le 3 \ and \ x_1, x_2 \ge 0$$

(OR)

b) Solve the following LPP by using Big-M method

$$Min\,Z = 12x_1 + 20x_2 \quad subject\ to \quad 6x_1 + 8x_2 \ge 100 \ ;$$
$$7x_1 + 12x_2 \ge 120 \quad and \quad x_1, x_2 \ge 0.$$

22. a) Solve the following transportation problem in which cell entries represent unit costs.

	To			Available
	2	7	4	5
From	3	3	1	8
	5	4	7	7
	1	6	2	14
Required	7	9	18	34

(OR)

b) The assignment cost of assigning any one operator to any machine is given in the following table and hence find the optimal assignment by Hungarian method.

		Operators			
		I	II	III	IV
	A	10	5	13	15
	B	3	9	18	3
Machine	C	10	7	3	2
	D	5	11	9	7

23. a) (i) Consider the details of a distance network as shown below. (8)

Arc	1-2	1-3	2-4	3-4	4-5	3-5
Distance	3	10	5	6	4	15

Construct the distance network. Here the arc (3, 5) is directional, so that no traffic is allowed from node 5 to node 3. All the other arcs allow two-way traffic. Apply Floyd's algorithm to find the shortest path and the distance from node 1 to node 5 and node 2 to node 5.

(ii) Find the minimum spanning tree of the following network with distance in miles using PRIM algorithm (6)

Arc	1-2	1-4	1-5	2-3	2-4	3-4	3-6	4-6	4-7	4-5	5-7	5-8	6-7
Distance	4	2	3	6	6	5	9	8	10	4	5	7	3

Arc	6-10	7-8	7-9	8-9	9-10
Distance	6	1	3	2	5

(OR)

b) (i) A project has the following time schedule: (8)

Activity	Time (week)	Activity	Time (week)
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-9	1
4-9	5	8-10	8
		9-10	7

Construct network and find total float for each activity and also find critical path and its duration.

(ii) Consider the pipe network given below showing the flow capacities between various pairs of locations in both ways. Find the maximal flow from node 1 to node 6. (6)

Arc	1-2	1-3	1-4	2-3	2-4	2-5	3-4	3-6	4-5	4-6	5-6
Flow f_{ij}	30	60	15	20	25	5	20	50	10	35	30
Flow f_{ji}	20	40	25	15	20	10	40	40	40	35	30

24. a) Find the sequence for the following 8 jobs that will minimizes the total elapsed time for the competition of all jobs. Each job is processed in the same order.

Time for Machines	Job							
	1	2	3	4	5	6	7	8
A	8	10	7	8	11	8	9	13
B	4	6	7	4	5	3	6	2
C	5	6	2	3	4	9	15	11

The entries give the time in hours on the machine.

(OR)

b) (i) The cost of a machine is Rs. 6100 and its scrap value isRs.100. The maintenance costs (6) found from experience are as follows:

Year :	1	2	3	4	5	6	7	8
Maintenence Cost (RS)	100	250	400	600	900	1200	1600	2000

When should the machine be replaced?

(ii) The following failure rates have been observed for a certain type of light bulbs: (8)

End of week :	0	1	2	3	4	5	6	7	8
Prob. of Failure to date :		.05	.13	.25	.43	.68	.88	.96	.96	1.00

The cost of replacing individual bulbs is Rs. 2.25. The decision is made to replace all the bulbs simultaneously at fixed intervals, also replace individual bulbs as they fail. If the cost of group replacement is 60 paise per bulb and the total number of bulbs is 1000, what is the best interval between group replacements?

25. a) 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 a phone call is assumed to be distributed exponentially, with mean 3 minutes.

    a) What is the probability that a person arriving at the booth will have to wait?

    b) What is the average length of the queue that forms from time to time?

    c) The telephone department will install a second booth when convinced that an arrival would have to wait for at least 3 minutes for phone. By how much should the flow of arrivals increase in order to justify a second booth?

    d) What is the probability that an arrival will have to wait for more than 10 minutes before the phone is free?

    e) What is the probability that he will have to wait for more than 10 minutes before the phone is available and the call is also complete.

    f) Find the fraction of a day that the phone will be in use.

(OR)

b) (i) An electricity band has 3 bill counters providing service exponentially distributed at (7) the rate of 12 customers per hour. If receives on the average 24 customers per hour, in a Poisson distribution.

    (i) Find The probability that a customer will be sent immediately.

    (ii) Find the probability that a customer will have to wait.

    (iii) What is the average total time that a customer must spend at the bill counter?

(ii) At a railway station, only one train is handled at a time. The railway yard is (7) sufficient only for 2 trains to wait while the other is given signal to leave the station. Trains arrive at the station at an average rate of 6 per hour and the railway station can handle them at an average of 6 per hour. Assuming Poisson arrivals and exponential service distribution, find the probabilities for the number of trains in the system. Also find the average waiting time of a new train coming into the yard.

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