KUMARAGURU college of technology
character is life

Register Number: ……

B.E DEGREE EXAMINATIONS: APRIL/ MAY 2016

(Regulation 2013)

Sixth Semester

U13GST004 : Operations Research

(Common to MCE and CSE)

(Use of approved statistical table is permitted)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following is the correct solution for the Linear programming problem using graphical method?

   Minimize Z = 3x + 5y

   Subject to constraints

   x + y = 200;

   x≤ 80;

   y ≤ 80 and x, y ≥ 0

   a) Unbounded solution b) Multiple solutions

   c) Feasible corner point d) Infeasible solution

2. Artificial variable problems can be solved by _____ , _____method.

3. Penalty cost method is _____

   a) Least cost method b) North west corner method

   c) UAM method d) Modi method

4. A necessary and sufficient condition for the existence of a feasible solution to the transportation problem is _____.

5. Expected completion time of a project is 42.8 weeks with variance 6.123 weeks and the scheduled time of completing the project is 41.5 weeks. What is the probability of completing the project within the scheduled time?

   a) 0.3 b) 0.5

   c) 1 d) 0

6. An activity is said to be _____ if a delay in its start will cause a further delay in the completion of the entire project.

7. Find which of the following is the optimum sequence to following:

Job	1	2	3	4	5	6	7
Machine 1	3	12	15	6	10	11	9
Machine 2	8	10	10	6	12	1	3

   a)

1	5	3	4	2	7	6

   b)

1	4	5	3	2	7	6

   c)

6	7	2	3	5	4	1

   d)

1	4	5	6	7	2	3

8. Annual payment in a replacement model is _____ cost of n years.

9. The average daily requirement is 120 units and the company has 250 working days a year, so that the total yearly demand is approximately 30,000 units a year. The manufacturing cost is 50 paise per part. The sum of the annual rate for interest, insurance, taxes and so forth is 20% of the unit cost and the cost of preparation is Rs. 50 per lot. Which of the following is the optimum lot size?

   a) 7745 b) 5774

   c) 5477 d) 547

10. In M/M/1:FCFS/∞/∞, ‘M’ denotes _____.

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. List the phases of Operations Research.
12. Construct the dual problem of the following Linear Programming Problem

$Max\, Z = 2x_1 + 5x_2 + 6x_3$

$Subject\ to\ the\ constra\text{int}s$

$5x_1 + 6x_2 - x_3 \le 3$

$-2x_1 + x_2 + 4x_3 \le 4$

$x_1 - 5x_2 + 3x_3 \le 1$

$-3x_1 - 3x_2 + 7x_3 \le 6$

$x_1, x_2 x_3 \ge 0.$

13. Find the initial basic feasible solution to the following transportation problem using Least Cost Method.

	D_1	D_2	D_3	D_4	Supply
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

14. Explain the term 'Degeneracy' in transportation problem.
15. What is the critical path in network analysis? Explain its importance.
16. If the expected project duration is 15 months and the specified due date is 17 months find the probability that the project will be completed before 17 months given that the variance of the project length is 4.
17. Distinguish group replacement and individual replacement.
18. A book binder has one printing press, one binding machine, and the manuscripts of a number of different books. The time required performing the printing and binding operations for each book are shown below. We wish to determine the order in which books should be processed, in order to minimize the total time required to turn out all the books.

Book	:	1	2	3	4	5	6
Printing time (hrs)	:	30	120	50	20	90	110
Binding time (hrs)	:	80	100	90	60	30	10

19. In an M/M/1:FCFS/∞/∞ model the ratio of arrival per hour and service per hour will be less than unity. Why?
20. 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. Find the traffic density.

PART C (5 x 14 = 70 Marks)
(Answer not more than 400 words)

Q.No. 21 is Compulsory

21. A firm produces an alloy having the following specifications:
    (i) Specific gravity ≤0.98
    (ii) Chromium ≥ 8%
    (iii)Melting point ≥ 450°C

    Raw materials A, B and C having the properties shown in the table can be used to make the alloy.

Property	Raw material		
	A	B	C
Specific gravity	0.92	0.97	1.04
Chromium	7%	13%	16%
Melting point	440°C	490°C	480°C

    Cost of the various raw materials per unit ton are Rs.90 for A, Rs.280 for B and Rs.40 for C. Find the proportions in which A,B and C be used to obtain an alloy of desired properties while the cost of raw materials is minimum.

22. a) A company has three plants at locations A, B and C, which supply to warehouses located at D, E, F, G and H. monthly plant capacities are 800, 500, and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs (in rupees) are given below:

		To				
		D	E	F	G	H
From	A	5	8	6	6	3
	B	4	7	7	6	5
	C	8	4	6	6	4

Determine an optimum distribution for the company in order to minimize the total transportation cost.

(OR)

b) A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The set – up cost per change depends on the item presently on the machine and the set – up to be made, according to the following table:

		To				
		A	B	C	D	E
From	A	∞	4	7	3	4
	B	4	∞	6	3	4
	C	7	6	∞	7	5
	D	3	3	7	∞	7
	E	4	4	5	7	∞

If the processes each type of item once and only once each week, determine, how should sequence the items on his machine in order to minimize the total set – up cost?

23. a) The following table tests the jobs of a network with three time estimates.

Job		**Duration**	
i, j	**Optimistic**	**Most likely**	**Pessimistic**
1-2	3	6	15
1-6	2	5	14
2-3	6	12	30
2-4	2	5	8
3-5	5	11	17
4-5	3	6	15
6-7	3	9	27
5-8	1	4	7
7-8	4	10	28

(i) Draw the project network.
(ii) What is the approximate probability that the jobs on the critical path will be completed by the date of 42 days?
(iii) Also construct the project schedule.

(OR)

b) The following is the table showing details of a project:

Activity	**Predecessor**	**Time (in weeks)**		**Crash(In ,000Rs)**	
		Normal	**Crash**	**Normal**	**Crash**
		10	7	20	30
B	-	8	6	15	20
C	B	5	4	8	14
D	B	6	4	11	15
E	B	8	5	9	15
F	E	5	4	5	8
G	A,D,C	12	8	3	4

Indirect cost is Rs.400 per day. Estimate the optimum duration and the associated minimum project cost.

24. a) The following failure rates have been observed for certain items:

End of month	: 1	2	3	4	5
Probability of failure to date:	0.10	0.30	0.55	0.85	1.00

The cost of replacing an individual item is Rs.1.25. The decision is made to replace all items simultaneously at fixed intervals and also replace individual items as they fail. If the cost of group replacement is 50 paise, Estimate the best interval for group replacement? At what group replacement per item would a policy of strictly individual replacement become preferable to the adopted policy.

(OR)

b) A book binder has one printing press, one binding machine and the manuscripts of a number of different books. The times required performing the printing and binding operations for each book are known. Determine the order in which the books should be processed in order to minimize the total time required to process all the books. Also estimate the total time required.

	Processing time in minutes				
Book	1	2	3	4	5
Printing time	40	90	80	60	50
Binding time	50	60	20	30	40

Suppose that an additional operation is added to the process namely finishing. The time required for operation are given below:

Book	1	2	3	4	5
Finishing time	80	100	60	70	110

Determine, what is the order in which books should be processed? Find also the minimal total elapsed time.

25. a) Determine the optimal order quantity for a product which the price breaks are as follows

Quantity	Unit cost (Rs.)
$0 \le Q_1 \le 500$	10.00
$500 \le Q_2 \le 750$	9.25
$750 \le Q_3$	8.75

The monthly demand for the product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs.350.

(OR)

b) A supermarket has 2 girls attending to service. The customers arrive in a Poisson fashion at the rate of 10/hr. The average service time for each customer is 4 minutes. Estimate the

(i) P (customer has to wait for the service)
(ii) Average queue length.
(iii) Average time spent by the customer in a queue.
(iv) Expected percentage of idle time for each girl.
(v) Average number of units in the system
(vi) Expected waiting time of a customer who has to wait
(vii) Expected number of idle girls at any time?

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