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M.Com. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Second Semester

Commerce – Core

QUANTATIVE TECHNIQUES

(For those who joined in July 2021-2022)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Objective function of an LP problem is
 - (a) a constant
 - (b) a function to be optimized
 - (c) an inequality
 - (d) quadratic equation

2. Graphical method cannot be applied when the number of variables is more than
- (a) Two (b) Three
(c) Four (d) One
3. The element at the point of intersection of key row and key column is called
- (a) M
(b) Key element
(c) Entering variable
(d) Leaving variable
4. The iterative method used to determine the optimum assignment schedule is called as
- (a) Hungarian method
(b) Modi method
(c) NWC method
(d) VAM method
5. Degeneracy occurs in a transportation problem when
- (a) Demand exceeds supply
(b) when one used cell becomes unused
(c) When less than $m+n-1$ cell are used
(d) When number of rows not equal to number of columns

6. In performing a simulation it is advisable to
- (a) Use the results of early decisions to suggest the next decision to try
(b) Use the same number of trial for each decision
(c) Simulate all possible decisions
(d) Simulate all possible solutions
7. In the business and management decision making the operation research study helps to have
- (a) Better Control
(b) Better System
(c) Better Decision
(d) All the above
8. Critical Path represents
- (a) The path that operates from the starting node to the end node
(b) It is a mixture of all the paths
(c) It is the longest path
(d) It is the shortest path
9. The Operations research technique which helps in minimizing total waiting and service costs is
- (a) Queuing Theory
(b) Decision Theory
(c) Game Theory
(d) Transportation Cost

10. The group replacement policy is suitable for identical low cost items which are likely to _____.

- (a) fail suddenly
- (b) fail completely and suddenly
- (c) fail over a period of time
- (d) be progressive and retrogressive

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Give an account of the various applications of Operation Research.

Or

(b) A firm makes two products X and Y and has a total production capacity of 9 tonnes per day, X and Y requiring the same production capacity. The firm has a permanent contract to supply at least 2 tonnes of X and atleast 3 tonnes of Y per day to another company. Each tonne of X required 20 machine hours production time and each tonne of Y requires 50 machines hours production time, the daily maximum possible number of machine hours is 360. All the firm's output can be sold and the profit made is Rs.80 per tonne of X and Rs. 20 per tonne of Y. It is required to determine the production schedule for maximum profit and to calculate this profit.

12. (a) Use Vogel's Approximation method to obtain an initial basic feasible solution of the transportation problem given below.

	D	E	F	G	Availability
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

Or

(b) A computer Centre has four expert programmers. The centre needs four application programmes to be developed. The head of the computer centre, after studying carefully the programmes to be developed, estimates the computer time (in minutes) required by the respective experts to develop the application programmes as follows. Assign the programmers to the programmes in such a way that the total computer time is minimum.

Programmers	Programmes			
	A	B	C	D
1	120	100	80	90
2	80	90	110	70
3	110	140	120	100
4	90	90	80	90

13. (a) Describe in detail the basic elements of queuing system.

Or

- (b) A Machine owner finds from his past records that the maintenance costs per year of a machine whose purchase price is Rs. 8,000 are as given below:

Year :	1	2	3	4	5	6	7	8
Maintenance cost :	1,000	1,300	1,700	2,200	2,900	3,800	4,800	6,000
Resales price :	4,000	2,000	1,200	600	500	400	400	400

Determine at which time it is profitable to replace the machine.

14. (a) Briefly describe the various methods of finding initial basic feasible solution under Transportation Problem.

Or

- (b) Explain the Hungarian method of solving Assignment Problem.

15. (a) How will you calculate the optimal solution using Corner Point Method?

Or

- (b) A small scale industry manufactures electrical regulators, the assembly of which is being accomplished by a small group of skilled workers, both men and women. Due to the limitations of space and finance, the number of workers employed cannot exceed 11 and

their salary bill not more than Rs. 60,000 per month. The male members of the skilled workers are paid Rs. 6,000 per month, while the female worker doing the same work as the male member gets Rs. 5,000 per month. Data collected on the performance of these workers indicate that a male member contributes Rs. 10,000 per month to total return of the industry while the female worker contributes Rs. 8500 per month. Determine the number of male and female workers to be employed in order to maximize the monthly total return.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)

16. (a) Enumerate the various types of Operation Research Techniques.

Or

- (b) A diet for a sick person must contain atleast 4,000 units of vitamins, 50 units of minerals and 1,400 units of calories. Two foods A and B are available at a cost of Rs. 4 and Rs. 3 per unit respectively. If one unit of A contains 200 units of vitamins, 1 unit of mineral and 40 units of calories and one unit of food B contains 100 units of vitamins, 2 unit of mineral and 40 units of calories, find what combination of food be used to have the least cost?

17. (a) Five different machines can do any of the five required jobs, with different profits resulting from each assignment as shown in the following table. Find out the maximum profit possible through optimal assignment.

Job	Machines				
	A	B	C	D	E
1	30	37	40	28	40
2	40	24	27	21	36
3	40	32	33	30	35
4	25	38	40	36	36
5	29	62	41	34	39

Or

- (b) Solve the following assignment problem of minimizing total time for doing all the jobs.

Operators	Jobs				
	1	2	3	4	5
1	6	2	5	3	6
2	2	5	8	7	7
3	7	8	6	9	8
4	6	2	3	4	5
5	9	3	8	9	7
6	4	7	4	6	8

18. (a) Find the basic feasible solution to the following problem by adopting North West Corner Method, Least Cost Method and Vogel's Approximation Method

Factory	Warehouse				Supply
	W ₁	W ₂	W ₃	W ₄	
F ₁	21	16	25	13	11
F ₂	17	18	14	23	13
F ₃	32	27	18	41	19
Demand	6	10	12	15	43

Or

- (b) A company is spending Rs. 1,000 on transportation of its units from three plants to four distribution centres. The supply and demand of units with unity cost of transportation are given below :

Plant	Distribution Centres				Supply
	D ₁	D ₂	D ₃	D ₄	
P ₁	19	30	50	12	7
P ₂	70	30	40	60	10
P ₃	40	10	60	20	18
Demand	5	8	7	15	

What can be the maximum saving by optimal scheduling?

19. (a) In a departmental store one cashier is there to serve the customers. And the customers pick up their needs by themselves. The arrival rate is 9 customers for every 5 minutes and the cashier can serve 10 customers in 5 minutes. Assuming Poisson arrival rate and exponential distribution for service rate, find:
- Average number of customers in the system.
 - Average number of customers in the queue or average queue length.
 - Average time a customer spends in the system.
 - Average time a customer waits before being served.

Or

- (b) Draw a network diagram of the following schedule of activities and find its critical path. Also calculate slack time for each event

Activity	1-2	1-3	1-4	2-6	3-7	
Duration (in days)	2	2	1	4	5	
Activity	3-5	4-5	5-9	6-8	7-8	8-9
Duration (in days)	8	3	5	1	4	3

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20. (a) Following data are available for a firm which manufactures and C

Product	Time required (in hours)		Profit
	Assembly	Finishing	
A	10	2	800
B	4	5	600
C	5	4	300
Capacity	2000	1000	

Express the above data in the form of LPP and find out the maximum profit from the production.

Or

- (b) Dr. Strong is a dentist who schedules all his patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, the probabilities and the time actually needed to complete the work:

Category of service	Time required (in minutes)	Probability (category)
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Check-up	15	0.20

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Simulate the Dentist's clinic for four hours and determine the average waiting time of the patients as well as the idleness of the doctor. Assume that all the patients should report at the clinic at exactly their schedule of arrival time starting at 8.00 AM. use the following random numbers for handling the above problem. 40, 82, 11, 34, 25, 66, 17, 99
