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Avinashilingam Institute for Home Science and Higher Education for Women

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category 'A' by MHRD (now MoE)
Re-accredited with 'A++' Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Bachelor's Degree Arrear Examination – May 2025
IV Semester

Batch : 2022 Arrear | **Time: 3 Hours**
Major : Computer Science | **Max. Marks: 100**

21BCSI04 DSE - IV Optimization Techniques

Course Outcomes:

1. Formulate a real-world problem as a mathematical programming model with application software.
2. Solve the linear problems and analyze the simplex and dual simplex principles.
3. Apply optimality and allocation methods for resources
4. Demonstrate network scheduling concepts and apply critical path analysis and time estimates for real time project completion.
5. Apply sequencing algorithm for job scheduling.

Part – A **10 x 1 = 10**

Choose the Correct Answer

1. In graphical representation the bounded region is known as _____ region. CO1 K1
   (a) Solution (b) basic solution
   (c) feasible solution (d) optimal
2. Dual simplex method is applicable to the problem which are optimal_____. CO1 K1
   (a) in nature (b) and feasible in nature
   (c) and basic feasible in nature (d) but infeasible in nature
3. The dummy source or destination in a transportation problem is added to _____. CO2 K1
   (a) satisfy rim condition
   (b) prevent solution from becoming degenerate
   (c) ensure that total cost does not exceed a limit
   (d) all of the above
4. The simple and efficient method to find initial basic feasible solution is: CO2 K2
   (a) North-West Corner Method (b) Least Cost Method
   (c) Vogel's Approximation Method (d) Row Minima Method
5. In an assignment problem involving four workers and three jobs, total number of assignments possible are _____. CO3 K2
   (a) 4 (b) 3 (c) 12 (d) 7
6. The minimum number of lines covering all zeros in a reduced cost matrix of order n can be _____. CO3 K1
   (a) at the most n (b) at the least n (c) n - 1 (d) n + 1
7. Activity which does not require any resources or time is called _____. CO4 K2
   (a) dummy (b) Predecessor (c) successor (d) none of them
8. The Objective of network analysis is to _____. CO4 K1
   (a) Minimize total project duration
   (b) Minimize total project cost
   (c) Minimize production delays, interruption and conflicts
   (d) All of the above
9. A sequencing problem involving six jobs and three machines requires evaluation of _____ sequences. CO5 K2
   (a) 6!+6!+6! (b) $(6!)^3$ (c) 6 * 6 * 6 (d) (6 + 6 + 6)
10. In sequencing algorithm CO5 K3
    (a) the selection of an appropriate order for a series of jobs is to be done on a finite service facilities
    (b) all the jobs must be processed on a first-come-first service basis
    (c) a service facility can process more than one job at a time
    (d) all the service facilities are not of differe

Part B 5 x 6 = 30

Answer ALL questions

Each answer should not exceed 400 words or two pages

11 (a) Using Graphical solution find the maximum value of $z = 5x_1 + 3x_2$ subject to the constraints $3x_1+5x_2 \leq 15$, $5x_1+2x_2 \leq 10$ where $x_1, x_2 \geq 0$ CO1 K2

(OR)

11 (b) Use dual simplex to solve the following LPP Maximize z= -2x1-x2 subject to the constraints $3x_1+x_2>=3, 4x_1+3x_2>=6, x_1+2x_2>=3$ where $x_1, x_2>=0$ CO1 K2

12 (a) Determine an initial basic feasible solution to the following transportation problem using North-West Corner method. CO2 K2

	D1	D2	D3	D4	Availability
O1	5	3	6	2	19
O2	4	7	9	1	37
O3	3	4	7	5	34
Demand	16	18	31	25	

(OR)

12 (b) Describe the steps of Transportation Algorithm using MODI method. CO2 K3

13(a) A department head has four tasks to be performed and three subordinates, the subordinates differ in efficiency. The estimates of the time, each subordinate would take to perform, is given below in the matrix. How should he allocate the tasks one to each man, so as to minimize total man-hours? CO3 K1

Tasks	**Men**		
	1	**2**	**3**
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

(OR)

13 (b) Describe the steps of the Hungarian Assignment method. CO3 K2

14 (a) Explain Critical Path Analysis with Forward and Backward Calculations. CO4 K1

(OR)

14 (b) Construct the network diagram having the following data CO4 K3

Activity	A	B	C	D	E	F	G	H	I	J
Preceding Activity	None	A	A	B	A	B, E	C	D, F	G	H, I

15 (a) Write the optimum sequence algorithm for processing n jobs through two machines. CO5 K3

(OR)

15 (b) Write the optimum sequence algorithm for processing n jobs through m machines. CO5 K1

Part C 5 x 12 = 60

Answer ALL questions

Each answer should not exceed 800 words or four pages

16 (a) Use Penalty (or Big M) method to Maximize $z=3x_1+2x_2$ subject to the constraints: $2x_1+x_2 \leq 2$, $3x_1+4x_2 \geq 12$ where $x_1, x_2 \geq 0$ CO1 K2

(OR)

16 (b) Use Simplex method to solve Minimize $z = x_2 - 3x_3 + 2x_5$ subject to the constraints $3x_2 - x_3 + 2x_5 \leq 7$, $-2x_2 + 4x_3 \leq 12$, $-4x_2 + 3x_3 + 8x_5 \leq 10$ where $x_2, x_3, x_5 \geq 0$ CO1 K3

17 (a) Consider the following transportation problem.

Source	Destination				Availability
	1	2	3	4	
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Requirement	60	40	30	110	240

Determine the initial basic feasible solution using the i) Row minima method ii) VAM CO2 K1

(OR)

17 (b) Find the starting solution in the following transportation problem by Vogel's Approximation Method. Also obtain the optimum solution using MODI method. CO2 K3

	D1	D2	D3	D4	Supply
S1	3	7	6	4	5
S2	2	4	3	2	2
S3	4	3	8	5	3
Demand	3	3	2	2	

18 (a) Determine the optimum assignment schedule. CO3 K1

Surplus cities	Deficit Cities				
	a	b	c	d	e
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

(OR)

18 (b) A departmental head has four subordinates and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task, is given in the matrix below. How should the tasks be allocated, one to a man, so as to minimize total man-hours? CO3 K3

Tasks	**Men**			
	E	**F**	**G**	**H**
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

19 (a) A Project Constraints are: A < D, E; B, D < F; C < G; B, G < H; F, G < I.
The time taken by each task are:

Task	A	B	C	D	E	F	G	H	I
Time (in Days)	23	8	20	16	24	18	19	4	10

Draw network diagram, calculate total float for each activity, highlight critical path and find the project completion time. CO4 K1

(OR)

19 (b) A small project is composed of seven activities whose time estimates are listed in the table

Activity		Estimated duration (weeks)		
I	j	Optimistic	Most Likely	Pessimistic
1	2	1	1	7
1	3	1	4	7
1	4	2	2	8
2	5	1	1	1
3	5	2	5	14
4	6	2	5	8
5	6	3	6	15

(i) Draw Project network CO4 K2

(ii) Find expected duration and variance of each activity. What is expected project length?

(iii) Calculate the variance and standard deviation of project length. What is the probability that the project will be completed?

1) At least 4 weeks earlier than expected?

2) No more than 4 weeks later than expected?

(iv) If the project due date is 19 weeks, what is the probability of meeting the due date?

Given:	z:	0.50	0.67	1.00	1.33	2.00
	P:	0.3085	0.2514	0.1587	0.0918	0.0228

20 (a) In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time T. What is the value of T? What are the idle times of the two machines? Illustrate the problem using Gantt chart.

Job	:	J1	J2	J3	J4	J5	J6
Machine A	:	1	3	8	5	6	3
Machine B	:	5	6	3	2	2	10

CO5 K3

(OR)

20 (b) We have 4 jobs each of which has to go through the machines Mj (j = 1, 2, ...,6) in the order M1, M2, ..., M6. Processing time (in hours) is given below:

	Machines					
	M1	M2	M3	M4	M5	M6
Job A :	18	8	7	2	10	25
Job B :	17	6	9	6	8	19
Job C :	11	5	8	5	7	15
Job D :	20	4	3	4	8	12

Determine a sequence of these four jobs that minimizes the total elapsed time. Also find the idle times of each machine. CO5 K1

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