

CJ/2023  
Reg. No. \_\_\_\_\_  
(To be filled by the candidate)

**20MSS41**  
**(2021 – Batch Only)**

COIMBATORE INSTITUTE OF TECHNOLOGY  
(Government Aided Autonomous Institution)  
COIMBATORE 641 014

**M.Sc. SOFTWARE SYSTEMS DEGREE EXAMINATIONS, JULY 2023**  
(Fourth Semester)

**20MSS41 RESOURCE MANAGEMENT TECHNIQUES**

Time : 3 Hours

Max:100marks

**INSTRUCTIONS**

1. Answer all Questions in Part A and as per choice in Part B & Part C
2. Statistical tables (tables of areas under Normal Curve) Permitted.

**PART-A**

	M	BI	(10x2=20)	CO
1. State the condition for an unbounded solution of Linear Programming Problem.	2	LO		CO1
2. Define slack and surplus variables.				
3. State the principal assumptions made in sequencing problem.	2	LO		CO3
4. Define replacement policy and when does a problem of replacement arise in replacement problem.	2	LO		CO3
5. What are the different costs that are associated with inventory control?	2	LO		CO2
6. Define safety stock and lead time in inventory.	2	LO		CO2
7. What do you mean by "Balking" and "Reneging" in a Queue?	2	LO		CO4
8. Define Kendall's notation in queueing theory.	2	LO		CO4
9. Distinguish between PERT and CPM.	2	LO		CO5
10. Define crash time and critical path.	2	LO		CO5

**PART-B**

11.	A firm manufactures 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 atleast 2 tonnes of X and atleast 3 tonnes of Y per day to another company. Each tonnes of X required 20 machine hours production time and each tonnes of Y required 50 machine 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.120 per tonne of Y. It is required to determine the production schedule for maximum profit and to calculate this profit. (OR)	(5x13=65)
12.	Solve the following linear programming problem by simplex method: Maximize $z = 20x_1 + 6x_2 + 8x_3$ , subject to the constraints $8x_1 + 2x_2 + 3x_3 \leq 250$ ; $4x_1 + 3x_2 \leq 150$ ; $2x_1 + x_3 \leq 50$ and $x_1, x_2, x_3 \geq 0$ .	13 IO CO1
		Contd...

13. a) Find the sequence that minimizes the total elapsed time required to complete the following tasks on machines  $M_1, M_2$  and  $M_3$  in the order  $M_1, M_2, M_3$ . Also, find the minimum total elapsed time and idle times on the machines.

Task	A	B	C	D	E	F	G
$M_1$	3	8	7	4	9	8	7
$M_2$	4	3	2	5	1	4	3
$M_3$	6	7	5	11	5	6	12

7 IO CO3

- b) Find the sequence that minimizes the total elapsed time required to complete the following tasks on machines  $M_1$  and  $M_2$  in the order  $M_1, M_2$ . Also, find the minimum total elapsed time.

Task	A	B	C	D	E	F	G	H	I
$M_1$	2	5	4	9	6	8	7	5	4
$M_2$	6	8	7	4	3	9	3	8	11

6 IO CO3

(OR)

14. a) A taxi owner estimates from his past records that the costs per year for operating a taxi whose purchase price when new is Rs.60,000 are as given below.

Age	1	2	3	4	5
Operating Cost(Rs)	10000	12000	15000	18000	20000

7 IO CO3

After 5 years the operating cost is Rs.6000 k where  $k = 6,7,8,9,10$  ( $k$  denoting the age in years). If the resale value decreases by 10% of purchase price each year, what is the best replacement policy? Cost of the money is zero.

- b) The cost of a new machine is Rs 5000. The maintenance cost of  $n^{\text{th}}$  year is given by  $C_n = 500(n-1)$ ;  $n = 1,2,3..$ . Suppose that money is worth 5% per year, after how many years will it be economical to replace the machine by a new one.

6 IO CO3

15. a) A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs.20. The ordering cost per order is Rs.15 and the carrying charges are 15% of the average inventory per year. Suggest a more economical purchasing policy for the company and what advice would you offer , how much it would save the company per year.
- b) The annual demand for an item is 3200 units. The unit cost is Rs.6 and inventory carrying charge is 25% per annum, setup cost is Rs.150. Find the optimum quantity to be produced per setup , total cost , number of orders per year ,time between orders.

7 IO CO2

(OR)

16. a) A company uses annually 50000 units of an item, each cost Rs.1.20 per unit with ordering cost Rs.45 and inventory carrying cost are 15 % of annual average inventory value. If the company operates for 250 days per year and procurement time is 10 days the safety stock is 500 units then find the economic order quantity, reorder level, maximum inventory, minimum inventory and average inventory.
- b) Find the optimal order quantity for a product for which the price break is as follows

7 IO CO2

Quantity	unit cost
$0 \leq Q_1 < 800$	Rs.1
$800 \leq Q_2$	Rs.0.98

6 IO CO2

The yearly demand for the product is 1600 units per year, the cost of placing an order is Rs 5 per order and the carrying charges are 10% per year.

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17. a) On an average 96 patients per 24 hour day require the service of an emergency clinic. Also on average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs.100 per patient treated to obtain an average servicing time of 10 minutes, and that each minute of decrease in this average time would cost Rs.10 per patient treated, how much would have to be budgeted by the clinic to decrease the average size of the queue from  $1\frac{1}{3}$  patients to  $\frac{1}{2}$  patient?

7 IO CO4

- b) In a public telephone booth the arrivals are on the average 15 per hour. A call on the average takes three minutes if there is just one phone.  
 Find i) Expected number of callers in the booth at any time  
 ii) The proportion of the time the booth is expected to be idle.

6 IO CO4

(OR)

18. a) At a public telephone booth in a post office arrivals are considered to be Poisson with an average inter arrival time of 12 minutes. The length of the phone call may be assumed to be distributed exponentially with an average of 4 minutes. Calculate  
 (i) the probability that a fresh arrival will not have to wait for the phone.  
 (ii) the probability that an arrival will have to wait more than ten minutes before the phone is free.  
 (iii) the average length of Queues formed from time to time.  
 b) A car park contains 5 cars. The arrival of cars is Poisson at a mean rate of 10 per hour. The length of time each car spends in the car park is negative exponential distribution with mean of 2 hours. How many cars are in the car park on average?

7 IO CO4

6 IO CO4

19. A project consists of 11 activities, the precedence relationships are A < C, D, I;  
 B < G, F ; D < G, F ; F < H, K ; G , H < J; I , J , K < E and has the following time schedule

13 IO CO5

Activity	A	B	C	D	E	F	G	H	I	J	K
Duration in weeks	5	3	10	2	8	4	5	6	12	8	9

- a) Draw the network for the above project.  
 b) Find the earliest starting time, earliest finishing time, latest starting time, latest finishing time, total float, free float and independent float for each activity.

Identify the critical path and duration of the project.

(OR)

Contd...

20. The following table list the jobs of a network along with their time estimates

Jobs	1-2	2 -3	2 -4	3 - 4	4 - 5	5- 6
$t_o$	0.8	3.7	6.2	2.1	0.8	0.9
$t_m$	1.0	5.6	6.6	2.7	3.4	1.0
$t_p$	1.2	9.9	15.4	5.1	3.6	1.1

13 IO CO5

- (i) Find the expected duration and variance of each activity.
- (ii) Construct the project network.
- (iii) What is the probability that the project will be completed two months later than expected?
- (iv) What is the probability that the project will be completed not more than 3 months earlier than expected?
- (v) What due date has about 90% chance of being met?

### PART – C

(1x15=15)

21. a) Solve the assignment problem for maximization given the profit matrix.

		Machines			
		P	Q	R	S
Jobs	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

7 HO CO1

b) Solve the transportation problem starting with the initial solution obtained by Vogel's approximation method.

Source	Destination				Supply
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	
S <sub>1</sub>	11	20	7	8	50
S <sub>2</sub>	21	16	20	12	40
S <sub>3</sub>	8	12	18	9	70
Demand	30	25	35	40	

8 HO CO1

22. Determine the least cost schedule, if the Indirect cost is Rs. 100 per day and hence find the minimum duration.

Jobs	Normal		Crash	
	time	cost	time	cost
1-2	8	100	6	200
1-3	4	150	2	350
2-4	2	50	1	90
2-5	10	100	5	400
3-4	5	100	1	200
4-5	3	80	1	100

15 HO CO3

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