

SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

May 2023

Course Code: CSE308

Course: OPERATING SYSTEMS

QP No. :U344-4

Duration: 3 hours

Max. Marks:100

PART – A

Answer any Four questions

4 x 20 = 80 Marks

1. (a) Describe the needs, mechanisms and benefits of system calls with their types and suitable examples for each type. State the role of APIs in invoking system calls. (12)
- (b) Consider a file copy operation in which the program gets a file name from user, opens the file, reads its content, opens another file, moves the content of first file into second and then erase the content of first file. List out all the possible system calls involved in this scenario. (8)
2. (a) Compare the methods of inter-process communication based on their characteristics with the system calls used in each method with their function, syntax, parameters and return values. (10)
- (b) Consider the following set of processes. Apply preemptive SJF and RR (time quantum=2) and find out which algorithm produces the lowest average turnaround time. Provide the Gantt chart for each scheduling. (10)

Process	Arrival time	Burst time
P0	2	2

P1	1	5
P2	4	3
P3	1	4

3. (a) State the reader-writer problem and derive a solution based on semaphore which ensures that writers don't starve when readers keeps returning to read, by allowing the waiting writer to enter critical section after every five readers have read the file. (10)
- (b) Develop a semaphore based solution for the bounded buffer producer consumer problem in which there are two buffers of equal size available. If first buffer is full then producer can put data in second buffer. Similarly, if first buffer is empty consumer may check availability of data in second buffer. Only when both buffers become full or empty, you will have to block either the producer or the consumer. (10)
4. The following table represents the list of processes with their resource needs and allocations. Construct the Need matrix comprising of current requirements. Find out whether the system is in safe state or not. Determine whether it is safe to allocate resource to P3(1,1,0) and P1(2,0,0). Justify your answer. Write the banker's algorithm.

	Max	Allocation	Available
	A B C	A B C	A B C
P0	4 3 3	1 1 2	
P1	3 2 2	2 1 2	
P2	9 0 2	4 0 1	
P3	7 5 3	0 2 0	
P4	1 1 2	1 1 2	2 1 0

5. (a) Compare paging and segmentation. (8)
- (b) Compute the number page faults for 4 frames under Optimal, LRU and FIFO page replacement algorithms for the following

page reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2 and 3.
(12)

6. (a) Explain the types of threads with the two possible thread scheduling strategies. (10)
(b) Develop a program to demonstrate the creation of child process using fork. Explain the zombie process and orphan process concepts through that program. (10)

PART - B

Answer the following

1 x 20 = 20 Marks

7. (a) Draw the process state diagram with all possible states. (5)
(b) Consider that the order of requests for disk access are as follow: 55, 58, 39, 18, 90, 160, 150, 38 and 184. The current position of the head is at 100. Calculate the seek time based on FCFS, SSTF, SCAN and CSCAN algorithms. (10)
(c) Mention the file allocation methods with a brief explanation for each method. (5)

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End Semester Examinations

July 2022

Course Code: ENG212

Course: BUSINESS COMMUNICATION & VALUE SCIENCE-III

Question Paper No. :U0197

Duration: 3 hours

Max. Marks:100

PART – A

Answer all the questions in not more than 50 words each

10 x 2 = 20 Marks

1. Expand VUCA and VUCA 2.0.
2. Enumerate two benefits of VUCA 2.0.
3. List out five steps of Maslow's Hierarchy of needs.
4. Differentiate Global and Glocal value systems with examples.
5. Give two examples for translocational impact in the business world.
6. Mention two roles of Rivers in perspective of Culture and Values.
7. Define Artificial Intelligence and mention two of its applications in everyday life.
8. Write any two revolutions in science during post-independence era.
9. Discuss a situation where you have communicated more with the machines than the human beings.

10. Explain Culture shock due to cross culture communication.

PART -B

Answer any four of the following in about 300 words each

4 x 15 = 60 Marks

11. Analyze a SWOT to achieve your goals. Identify your strengths and weaknesses, leverage opportunities and counteract the threats/Challenges in the present Business Era.
12. Elevate the thoughts of VUCA into VUCA 2.0 in the perspective of Higher Education Abroad.
13. Discuss on the trajectory of rivers from the cultural heritage to the commercial profit in the present digital scenario.
14. Science is the corner stone in the development of nation- Elucidate.
15. Produce a user manual for any gadget, you have recently purchased. Include Logo, Caption, safety guidelines, functions and capabilities of the product, variants, instructions for installation, use & troubleshooting and warranty statement.
16. Draft a Feasibility Report to start an Eco-friendly product manufacturing unit. Eco-friendly products are not harmful to the environment these products are made from organic and all-natural ingredients. They also come in recyclable compostable or biodegradable packaging. Your report should contain- terms of reference, work done, findings, recommendations and conclusion.

PART-C

Answer the following in about 400 words

1 x 20 = 20 Marks

17. Design your college in the year 2040- include infrastructure building and faculty, Library, playground and sports, syllabus and mode of teaching, classrooms and labs ... Use drawings. If necessary?

SASTRA DEEMED UNIVERSITY

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End Semester Examinations

December 2022

Course Code: CSE318

Course: ALGORITHM DESIGN STRATEGIES & ANALYSIS

QP No. :U014R

Duration: 3 hours

Max. Marks:100

PART-A

Answer all the questions

10 x 2 = 20 Marks

1. Define Theta (Θ) notation.
2. Find the recurrence for the following algorithm.
Algorithm Fibonacci(n)
 If $n=1$ then
 Return 0
 Else If $n=2$ then
 Return 1
 Else
 Return Fibonacci($n-1$) + Fibonacci($n-2$)
 End If
End Fibonacci
3. Predict the algorithm design strategy used in solving following problems. (a) Kruskal's Algorithm for Minimum Spanning Tree (b) Floyd-Warshall Algorithm for Shortest Path Problem (c) String Editing Problem (d) 8-Queen Problem.
4. What is the use of State Space Tree?
5. Mention the maximum numbers of unique binary search trees can be generated for a given number of elements 'n'.

6. Differentiate between strongly connected and weakly connected graphs with an example.
7. Can Dijkstra's algorithm find correct shortest path for the graph which containing negative-cost cycle? Justify your answer with an example.
8. Distinguish between Deterministic vs Non-deterministic algorithms.
9. What is Clique of a graph? Give an example.
10. Define Hamiltonian cycle. State travelling salesperson problem.

PART-B

Answer all the questions

4 x 15 = 60 Marks

11. Design a greedy algorithm for solving fractional knapsack problem. Solve the following fractional knapsack problem by tracing the algorithm.

Bag Capacity:	$C = 28 \text{ Kg}$
Number of Items:	$n = 7$
Weights:	$w[1..7] = \{2, 5, 6, 11, 1, 9, 1\}$
Profits:	$p[1..7] = \{9, 5, 2, 7, 6, 16, 3\}$

(OR)

12. (a) Solve the following recurrence by using recursion tree method. (8)

$$T(n) = \begin{cases} T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + n, & n > 1 \\ \theta(1), & n = 1 \end{cases}$$

- (b) State Master Theorem for solving recurrences. Can we solve the following recurrence by using Master Theorem? If so, solve and find the complexity. If not, justify the reason. (7)

$$T(n) = 3 T\left(\frac{n}{4}\right) + n \log_2 n$$

13. Apply the dynamic programming strategy to construct the optimal Binary Search Tree for the following keys with given frequencies.

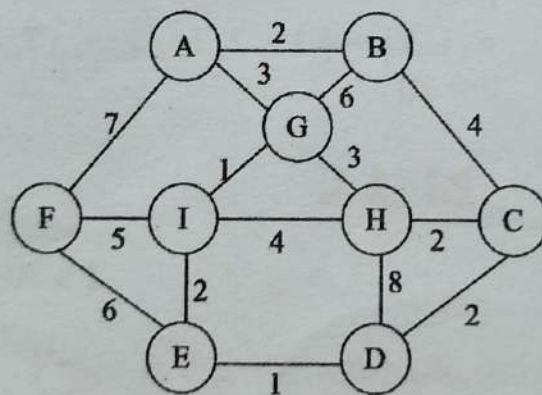
Keys[1..4] :	{	10,	20,	30,	40	}	
p[1..4] :	{	3,	3	1,	1	}	
q[0..4] :	{	2,	3,	1,	1,	1	}

(OR)

14. Illustrate the branch and bound strategy for solving the following 0/1 knapsack problem.

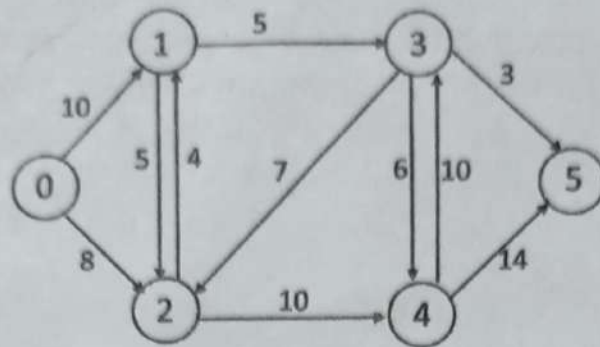
Bag Capacity:	m= 15 Kg
Number of Items:	n = 4
Weights:	w[1..4] = {2, 4, 6, 9}
Profits:	p[1..4] = {10, 10, 12, 18}

15. Which algorithm design strategy used in Prim's algorithm? Write Prim's algorithm and find the minimum spanning tree for the following graph by tracing Prim's algorithm.



(OR)

16. What is the objective of Max Flow Problem? Write pseudocode for Ford-Fulkerson Algorithm for solving Max Flow Problem. Trace the Ford-Fulkerson algorithm and find out the maximum flow which can be transferred from source vertex (0) to sink vertex (5) for the following graph.



17. Discuss the NP-Hard and NP-Complete classes of problems. Describe Clique Decision Problem. Prove that Clique Decision Problem is NP-Hard with an example.

(OR)

18. State Bin-Packing Problem. List out the four approximation algorithms for solving Bin-Packing Problem. Find the optimal numbers of bins required for the following bin-packing problem. Apply all the four types of approximation algorithms.

Number of Objects: $n = 7$

Weight List: $w[1..7] = \{ 11, 2, 15, 5, 6, 17, 7 \}$

Bin Capacity: $c = 20$

PART-C

Answer the following

1 x 20 = 20 Marks

19. (a) Compare the following algorithm design strategies: brute-force method, backtracking approach and branch & bound approach. (6)
- (b) Discuss the advantages and drawbacks of divide and conquer approach, dynamic programming approach and greedy approach. (6)
- (c) Prove that the Travelling Salesperson Problem is NP-Complete. (8)

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End Semester Examinations

May 2023

Course Code: CSE318

Course: ALGORITHM DESIGN STRATEGIES & ANALYSIS

QP No. :U013-4

Duration: 3 hours

Max. Marks:100

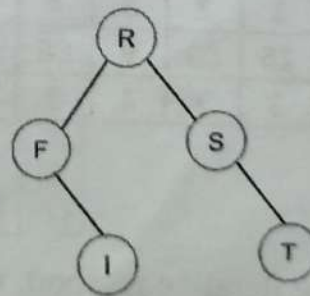
PART-A

Answer all the questions

10 x 2 = 20 Marks

1. List out any six algorithm-design strategies.
2. Prove that $4n^2 + 3n + 5 \in O(n^2)$.
3. Backtracking approach uses _____ search, whereas Branch & Bound approach uses _____ search.
4. Find the search cost for the following BST with the given probability of key elements.

$n=5$	0	1	2	3	4	5
Keys[1..5]		F	I	R	S	T
P[1..5]		0.15	0.1	0.05	0.1	0.2
Q[0..5]	0.05	0.1	0.05	0.05	0.05	0.1



5. What is negative weight cycle in a graph? Which algorithm is used to check whether a graph containing negative weigh cycle or not?
6. Say True or False.
(a) BFS - used in sorting vertices of DAG in topological order.

(b) DFS - used in finding the shortest distance from a starting vertex to all other vertices in an undirected graph.

7. Relate decision problems with optimization problems.

8. Differentiate P and NP classes of problems.

9. State Cook's theorem.

10. Match the following problems with their corresponding algorithm.

Algorithm	Problem
Floyd-Warshall	Minimum Spanning Tree
Prim's	Network Flow Problem
Ford-Fulkerson	Single Source Shortest Path
Dijkstra's	All Pairs Shortest Path

PART-B

Answer all the questions

4 x 15 = 60 Marks

11. Design an algorithm using greedy approach to find a sequence of jobs, which is completed within their deadlines and gives maximum profit. Illustrate the algorithm for the following input.

n = 8	Jobs With Profit & Deadlines							
Jobs	1	2	3	4	5	6	7	8
Profits	26	59	9	86	20	15	74	95
Deadlines	3	2	4	5	4	1	3	6

(OR)

12. (a) Using iterative method, determine a good asymptotic upper bound on following recurrence (10)

$$T(n) = \begin{cases} 7T\left(\frac{n}{2}\right) + n^2, & n > 1 \\ \theta(1), & n = 1 \end{cases}$$

- (b) State Master Theorem for solving recurrences. Can we solve the following recurrence by using Master Theorem? If so, solve and find the complexity. If not, justify the reason. (5)

$$T(n) = T\left(\frac{2n}{3}\right) + 1$$

13. (a) Define optimal binary search tree. Write dynamic programming algorithm for constructing optimal binary search tree. (10)
 (b) Construct the optimal binary search tree for the following root table (r) which is obtained by applying dynamic programming approach for the key elements: Keys[1..5] = {F, I, R, S, T}. (5)

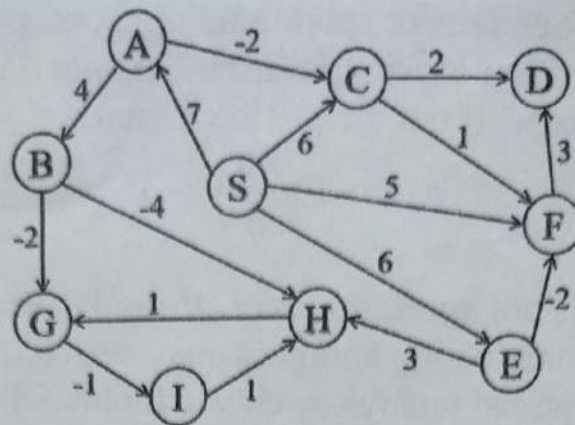
0	1	2	3	4	5	r
0	1	1	2	2	2	0
	0	2	2	2	4	1
		0	3	4	5	2
			0	4	5	3
				0	5	4
					0	5

(OR)

14. Illustrate the branch and bound strategy to solve the Travelling Salesperson Problem for the graph with following cost matrix. Assume the starting city is 'A'.

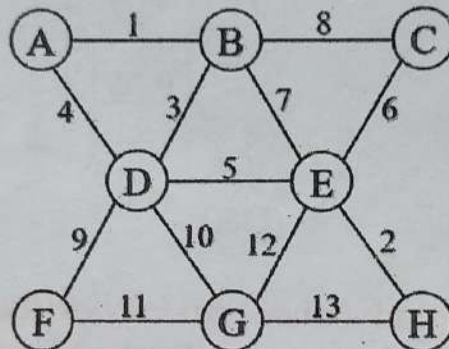
Cost Matrix					
	A	B	C	D	E
A	∞	20	30	10	11
B	15	∞	16	4	2
C	3	5	∞	2	4
D	19	6	18	∞	3
E	16	4	7	16	∞

15. Find the shortest distance from the vertex 'S' to all other vertices by applying Bellman-Ford algorithm for the following weighted graph. (10)



(OR)

16. Write Kruskal's algorithm for obtaining minimum spanning tree (MST). Apply the algorithm and find MST for the following graph.



17. How to prove a problem belongs to NP-Complete? Prove that Travelling Salesperson Problem is NP-Complete.

(OR)

18. Discuss on approximation algorithms, scheduling independent tasks problem and LPT schedule. Consider $n=7$ independent tasks with processing times (in hours) given by 1, 4, 5, 7, 8, 9 and 10. (a) Schedule these tasks with, $m=2$ processors using LPT schedule algorithm. Show the timeline and give the tasks finishing time. (b) Find the optimal finishing time for $m=2$ processors. (c) Compute the relative error of LPT schedule found in (a) expressed as percent.

PART-C

Answer the following

1 x 20 = 20 Marks

19. (a) Is Ford-Fulkerson algorithm follows greedy approach? Justify your answer with an example. (6)
- (b) What are the four different types of approximation algorithms available for Bin-Packing Problem? Explain any one algorithm with an example. (6)
- (c) Apply dynamic programming approach for solving the following 0/1 knapsack problem. (8)

No. of Items: n = 6						
Item	1	2	3	4	5	6
Weight[1..6]	4	2	3	1	6	7
Profit[1..6]	6	4	5	3	9	7
Bag Capacity: W = 10						

SASTRA DEEMED UNIVERSITY

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End Semester Examinations

July 2022

Course Code: **MGT207**

Course: **INTRODUCTION TO INNOVATION, IP
MANAGEMENT & ENTREPRENEURSHIP**

Question Paper No. : **U0834**

Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions

10 x 2 = 20 Marks

1. Explain the innovation space with examples.
2. State some of the components of innovative organization.
3. How can creativity be enhanced?
4. Mention the various ways to convert data to information and information to knowledge.
5. Discuss the different creativity thinking styles.
6. Explain turnkey projects with a suitable example.
7. Discuss about the process of seeking opportunity from the environment.
8. Mention the principles of effectuation.
9. Explain the need for intellectual property rights.

10. What do you mean by Geographic indications?

PART – B

Answer any FOUR questions

4 x 15 = 60 Marks

11. "Incrementalism never allows innovation to flourish". Comment on this statement and explain about the various types of innovation space with special mention of dimensions of innovation.
12. "Innovation doesn't come just from giving people incentives; it comes from creating environments where their ideas can connect". Illustrate the concept of building organizational environment through need analysis and other online tools.
13. Compare and contrast open innovation with collaboration for starting a new venture, with suitable practical examples.
14. Explain about how an entrepreneur can start his business. Also mention about the strategies that can be employed for making his products reach the global level.
15. Synthesize how an industrial design application gets accepted through the various processes. Explain about the steps briefly.
16. "Say no to stealing". Identify the concept and explain about the acts available copyright and the remedies towards it.

PART – C

Answer the following

1 x 20 = 20 Marks

17. According to a U.S. bank study, "more than eight out of 10 new businesses fail because of poor cash-flow management". Do you agree? Can you overcome it with proper Financial planning? Demonstrate it for a new firm with illustration of ratio analysis tools.

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End Semester Examinations

May 2023

Course Code: MGT207

**Course: INTRODUCTION TO INNOVATION, IP
MANAGEMENT & ENTREPRENEURSHIP**

QP No. :U263-4

Duration: 3 hours

Max. Marks:100

PART – A

Answer all the questions

10 x 2 = 20 Marks

1. State the characteristics of innovation.
2. Describe the innovation space with examples.
3. Explain about the types of innovation on the basis of marketing and distribution.
4. List how data can be converted to information and information to knowledge.
5. Enumerate the techniques for idea creation.
6. Explain why companies seek strategic alliance with suitable example.
7. Cite the effectuation process.
8. Mention about some of the empathizing tools employed in design thinking.
9. Define a trademark.

10. What do you mean by Geographic indications? Give an example.

PART – B

Answer any FOUR questions

4 x 15 = 60 Marks

11. "Innovation is the ability to see the change as an opportunity and not a threat". Comment on this statement and explain about the various types of innovation with illustrative examples.
12. "Design thinking has the essential ability to combine empathy, creativity and rationality to meet user needs and drive business success". Justify the statement with clear explanation about the design thinking process.
13. "Innovation doesn't come just from giving people incentives; it comes from creating environments with creativity where their ideas can connect". Illustrate the concept of building organizational environment through enhancing creativity.
14. Describe the various stages of business. Also mention about the strategies that can be employed for making the domestic products reach the global level.
15. "The safest course is always to say no to stealing, and get permission from the owner". Interpret the concept of copyright infringement and the remedies towards it.
16. Summarize the procedure of how an industrial design application gets accepted through the various processes.

PART – C

Answer the following

1 x 20 = 20 Marks

17. A startup data from CB Insights looks at the most common reasons behind startup failures in 2022, and found that running out of cash was behind 44% of failures attributing to poor financial planning. Do you agree? Can you overcome it with proper financial planning? Demonstrate it for a new firm with illustration of ratio analysis tools.

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End Semester Examinations

July 2022

Course Code: MAT330R01

Course: OPERATIONS RESEARCH

Question Paper No. :U1081

Duration: 3 hours

Max. Marks:100

PART - A

Answer all the questions

10 x 2 = 20 Marks

1. Solve graphically the following L.P.P

Maximize $z = x_1 + x_2$

subject to

$$x_1 + x_2 \leq 1$$

$$-3x_1 + x_2 \geq 3$$

$$x_1, x_2 \geq 0.$$

2. Express the following LPP in the canonical form

Maximize $z = 3x_1 + x_2$

subject to

$$x_1 + 2x_2 \geq -5$$

$$3x_1 + 5x_2 \leq 6$$

$$x_1, x_2 \geq 0.$$

3. How would you resolve the following situation in a LPP?

(a) Minimization

(b) Equalities in constraints.

4. Explain the use of artificial variable in LPP.

5. Determine the starting solution using North west corner rule.

1	2	6	7
0	4	2	12
3	1	5	11
10	10	10	

6. Distinguish between a transportation model and assignment model.

7. The annual demand for an item of 3200 units, the unit cost is Rs.6/- and inventory carrying charges 25% per annum. If the cost of one procurement is Rs.150/-. Determine the economic order quantity.

8. A dealer supplies you the following information with regard to a product dealt in by him.

Annual demand : 5000 units
 Buying cost : Rs.250 per order
 Inventory carrying cost : 30% per year.
 Price : Rs.100 per unit.

The dealer considering the possibility of allowing home back orders to occur for the product. He has estimated that the annual cost of back ordering (allowing shortages) the product will be Rs.10 per unit. What should be the optimum number of units of the product he should buy in one lot?

9. In a railway marshaling yard, goods train arrives at a rate of 30 trains per day. Assuming that inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate the mean queue size.

10. A driver in a bank window has a mean service time of 2 minutes, while the customers arrive at a rate 20 per hour. Assuming that these represent rates with a Poisson distribution. Determine the proportion the teller will be idle.

Answer all

11. Food X
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12. Use the
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 $3x_1 +$

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PART - B

Answer all the questions

4 x 15 = 60 Marks

11. Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paise per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B and costs 20 paise per gram. The daily minimum requirements of vitamin A and vitamin B are 100 units and 120 units respectively. Find the minimum cost of the product mix.

(OR)

12. Use the dual simplex method to solve the following problem:

Minimize $Z = 10x_1 + 6x_2 + 2x_3$

subject to constraints

$$-x_1 + x_2 + x_3 \geq 1$$

$$3x_1 + x_2 - x_3 \geq 2$$

13. A company has three warehouses in cities A, B, and C. These warehouses have the following quantities of the product in stock

Distributor ship	A	B	C
Capacity	100 units	80 units	80 units.

The four customers have the demand as follows:

(i) 60 units (ii) 120 units (iii) 50 units (iv) 40 units. If the cost 20 paise per km to transport this product from a distributor to the customer. The distance between ware houses and customers can be obtained from a map or suitable route as follows:

Ware house	Customer				
		1	2	3	4
	A	270	230	310	690
	B	100	450	400	320
	C	300	540	350	570

Which ware house should deliver how much product to which customer so that the total transportation cost becomes a minimum?

(OR)

14. A Company has 6 jobs to be processed by 6 mechanics. The following table gives the return in rupees when the i th job assigned to j th mechanic ($i, j = 1, 2, \dots, 6$). How should the jobs be assigned to the mechanics so as to maximize the overall return?

	Job						
		I	II	III	IV	V	VI
Mechanic	1	9	22	58	11	19	27
	2	43	78	72	50	63	48
	3	41	28	91	37	45	33
	4	74	42	27	49	39	32
	5	36	11	57	22	25	18
	6	13	56	53	31	17	18

15. The demand for a particular item is 18000 units per year. The holding cost per unit is Rs. 1.20 per year and the cost of one procurement is Rs.400. No shortages are allowed, and the replacement rate is instantaneous. Determine (a) optimum order quantity, (b) Number of order per year, (c) Time between orders and (d) Total cost per year when the cost of one unit is Re.1.

(OR)

16. The annual demand for a product is 3600 units, with an average of 12 units per day. The lead time is 10 days. The ordering cost per order is Rs. 20 and the annual carrying cost is 25% of the value of the inventory. The price of the product per unit is Rs.3.
- (a) What will be the EOQ? (b) Find the purchase cycle time. (c) Find the total inventory cost per year. (d) If a safety stock of 100 units is considered necessary, what will be the re-order level and the total cost of inventory which will be relevant to inventory decisions?
17. Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The duration of a phone call is assumed to be exponentially with mean 3 minutes.

- (a) What is the probability of a person arriving at the booth will have to wait?
- (b) The telephone department will install a second when convinced that an arrival would expect waiting for at least 3 minutes for phone. By how much should the flow of arrivals increase in order to justify a second booth.
- (c) Find the average number of units in the system.
- (d) Estimate the fraction of a day that the phone will be in use.
- (e) What is the probability that it will take him more than 10 minutes altogether to wait for phone?

(OR)

18. A firm engaged in both shipping and receiving activities. The management is always interested in improving the efficiency of new innovations in loading and unloading procedure. The arrival distribution of trucks is found to be Poisson with arrival rate of 3 trucks per hour. The service time distribution is exponential with unloading rate of 4 trucks per hour. Determine (a) The expected number of trucks in the queue. (b) the expected waiting time of the truck in the queue. (c) probability that the loading and unloading docks and workers will be idle. (d) what reductions in waiting time are possible if loading and unloading is standardized.

PART - C

Answer the following

1 x 20 = 20 Marks

19. (a) Use two-phase simplex method to maximize

$$\text{Maximize } z = 3x_1 + 2x_2 + 2x_3$$

subject to

$$5x_1 + 7x_2 + 4x_3 \leq 7$$

$$-4x_1 + 7x_2 + 5x_3 \geq -2$$

$$3x_1 + 4x_2 - 6x_3 \geq 29/7$$

$$x_1, x_2, x_3 \geq 0.$$

- (b) Summary of various jobs of a project is given below:

Jobs	Duration	Jobs	Duration
A	13	G	7
B	5	H	12
C	8	J	8
D	10	K	9
E	9	L	4
F	7	M	17

The constraints governing the jobs are as follows; (i) A & B are start jobs (ii) A controls C, D, E (iii) B controls F & K (iv) G depends on C (v) H depends on C (vi) E & F control J & M. (vii) L depends on K (viii) M also controlled by L (ix) G, H, J & M are the last jobs, draw a network and find the project duration. What is the critical path?

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End Semester Examinations

May 2023

Course Code: MAT330R01

Course: OPERATIONS RESEARCH

QP No. :U345-4

Duration: 3 hours

Max. Marks:100

PART - A

Answer all the questions

10 x 2 = 20 Marks

1. Express the following LPP in the canonical form

$$\text{Minimize } Z = 3x_1 + 5x_2 + x_3$$

such that

$$3x_1 + 4x_2 - 5x_3 \leq 8$$

$$2x_1 + 6x_2 + x_3 \geq 7$$

$$x_1 - 2x_2 + 5x_3 \leq 5$$

$$x_1, x_2, x_3 \geq 0.$$

2. While solving LPP by two phase method, in the first phase how the auxiliary LPP is constructed?
3. What do you mean by unbalanced and balanced transportation problem? Explain how would you convert the unbalanced problem in to a balanced one?
4. Find the starting solution of the following transportation model by least cost method:

1	2	6	7
0	4	2	12
3	1	5	11
10	10	10	

5. What is the difference between assignment problem and transportation problem?
6. What do you understand by restricted assignments? Explain how one should overcome it?
7. The annual demand for an item is 3200 units. The unit cost is Rs.6/- and inventory carrying charges 25 % per annum. If the cost of one procurement is Rs. 150 /-. Determine the Economic order quantity.
8. A dealer supplies you the following information with regard to a product dealt in by him.

Annual Demand	: 5000 units
Buying Cost	: Rs. 250.00 per order
Inventory carrying cost	: 30 % per year
Price	Rs. 100 per unit.

The dealer is considering the possibility of allowing home back orders to occur for the product. He has estimated that the annual cost of back ordering (allowing shortages) the product will be Rs. 10/- per unit. What should be the optimum number of units of the product he should buy in one lot?
9. A pipe line is due for repairs. It will cost Rs.10000/- and lasts for 3 years. Alternatively, a new pipeline can be laid at a cost of Rs. 50,000 and lasts for 10 years. Assuming cost of capital to be 10% ignoring salvage value. What is the present worth factor?
10. Cars arrive at a petrol pump, having one petrol unit of Poisson fashion with an average of 10 cars per hour. Service time is distributed exponentially with a mean of 3 minutes. Find the average number of cars in the system.

PART - B

Answer all the questions

4 x 15 = 60 Marks

11. Use Big M method to solve

$$\text{Minimize } Z = 4x_1 + 3x_2$$

such that

$$2x_1 + x_2 \geq 10$$

$$-3x_1 + 2x_2 \leq 6$$

$$x_1 + x_2 \geq 6$$

$$x_1, x_2 \geq 0$$

(OR)

12. A gear manufacturing company received an order for three specific types of gears for regular supply. The management is considering to devote the available excess capacity to one or more of three types, say A, B and C. The available capacity on the machines which might limit output and the number of machine hours required for each unit of the respective gear is also given below:

Machine Type	Available machines Hours / week	Productivity in machine hours /unit		
		Gear A	Gear B	Gear C
Gear Hobbing m/c	250	8	2	3
Gear Shaping m/c	150	4	3	0
Gear grinding mix	50	2	---	1

The unit profit would be Rs.20, Rs. 6 and Rs. 8 respectively for the gears A, B and C. Find how much of each gear the company should product in order to maximize profit?

13. Solve the transportation problem with unit transportation costs, demands and supplies as given below:

Destination

	D ₁	D ₂	D ₃	D ₄	Supply
S ₁	6	1	9	3	70
S ₂	11	5	2	8	55
S ₃	10	12	4	7	70
Demand	85	35	50	45	

(OR)

14. Construct the network for the project whose activities and the three time estimates of these activities (in weeks) are given below. Compute (a) find the critical path (b) Expected duration of each activity (c) Expected variance of each activity (d) Expected variance of the project length.

Activity	t ₀	t _m	t _p
1 – 2	3	4	5
2 – 3	1	2	3
2 – 4	2	3	4
3 – 5	3	4	5
4 – 5	1	3	5
4 – 6	3	5	7
5 – 7	4	5	6
6 – 7	6	7	8
7 – 8	2	4	6
7 – 9	1	2	3
8 – 10	4	6	8
9 – 10	3	5	7

15. 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. You have asked to suggest a more economical purchasing policy for the company. What advice would you offer, and how much would it save the company per year?

(OR)

16. Find the optimal quantity for a product where the annual demand for the product is 500 units. The cost of storage per unit per year is 10% of the unit cost and the ordering cost per order is Rs.180.00. The unit costs are given below.

Quantity	Unit cost
$0 \leq Q_1 < 500$	Rs. 25
$500 \leq Q_2 < 1500$	Rs. 24. 80
$1500 \leq Q_3 < 3000$	Rs. 24. 60
$3000 < Q_4 < 500$	Rs. 24. 40

17. Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between One arrival and next. The duration of the phone call is assumed to be exponentially distributed with mean 3 minutes.

- What is the probability that a person arriving at the booth will have to wait?
- The telephone department will Install a second booth when convinced that an arrival would expect waiting for at least 3 minutes for phone. By how much the flow of arrivals increase in order to justify the second booth/
- Find the average number of units in the system.
- Estimate the fraction of the day that the phone will be in use.
- What is the probability that it will take more than 10 minutes altogether to wait for phone and complete the call?

(OR)

18. a) Machine A costs Rs.9000, Annual operating cost is Rs.200 for the first year and then increases by Rs. 2000 every year. Determine the optimum replacement policy.

b) Machine B costs Rs.10000, Annual operating cost is Rs. 400 for first year and then increased by Rs. 800 every year. You now own a machine A which is one-year-old. Should you replace it with B? If so, when?

PART C

Answer the following

1 x 20 = 20 Marks

19. a) Use Two – Phase simplex method to

Minimize $z = -2x_1 - x_2$

Subject to the constraints

$$x_1 + x_2 \geq 2$$

$$x_1 + x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

b) A company has four machines to do three jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table.

		Machines			
		1	2	3	4
JOBS	A	18	24	28	32
	B	8	13	17	19
	C	10	15	19	22

What are job assignments which will minimize the cost?
