SASTRA

First CIA Exam – Feb 2024

Course Code: CSE318

Course Name: Algorithm Design Strategies & Analysis

Duration: 90 minutes Max Marks: 50

PART A

Answer all the questions **10 x 2 = 20 Marks**

1. How to quantify the efficiency of an algorithm?
2. Define Theta notation.
3. Find the complexity of below codes.

```
function(int n) {
    for (int i=1; i<=n; i++) {
        for (int j=1; j*j<=n; j++) {
            printf("*");
            break;
        }
    }
}
```

4. Compare the divide & conquer approach with dynamic programming approach.
5. Solve the following recurrence using Master theorem.

$$T(n) = 8T(n/2) + \Theta(n^3)$$

6. Prove that $(3n^2 + 7n)^2 \in O(n^4)$
7. Find the order of growth of the following sum.

$$\sum_{i=1}^{n} \sum_{j=1}^{i} (i + j)$$

8. Find the recurrence by analyzing the following simple algorithm.

```
Algorithm MyFun(n)
    If n<=2 Then
        Return n
    Else
        Return 2*MyFun(n/3)*MyFun(2*n/3)
    End If
End MyFun
```

9. What is optimization problem? Which algorithm design strategy is used mostly for solving optimization problem?

10. Consider a set of unordered elements. Problem is to search an element from the list. Suggest a best searching algorithm and justify the reason.

PART B

Answer all the questions **3 x 10 = 30 Marks**

11. By applying divide & conquer strategy algorithm, solve the following maximum sub array problem. Show the step-by-step results of algorithm.

Index	1	2	3	4	5	6	7	8	9	10	11	12	13
Array	-3	-8	1	-2	1	5	-3	-4	3	10	-2	4	-1

12. (a) Using recursion tree method, solve the following reccurence.

$T(n) = T(n-1) + T(n-2) + O(1)$ if $n>2$

$T(n) = \Theta(1)$ if $n=1$ or $n=2$

(b) Illustrate the greedy algorithm to find a sequence of jobs, which is completed within their deadlines and gives maximum profit for the following input.

n=8	Jobs With Profit & Deadlines							
Jobs	1	2	3	4	5	6	7	8
Profits	18	31	24	5	53	42	67	39
Deadlines	3	2	1	2	5	5	4	3

13. Consider a modification of the rod-cutting problem in which, in addition to a price p_i, for each rod, each cut incurs a fixed cost of c. The revenue associated with a solution is now the sum of the prices of the pieces minus the costs of making the cuts. Give a dynamic programming algorithm to solve this modified problem. The algorithm should return the maximum revenue. Using this algorithm, find the maximum revenue for the 5-inch rod with the following price list and the fixed cut cost of Rs.5 per cut.

Length of Rod = 5					
Length	1	2	3	4	5
Price	2	3	7	8	9

SASTRA

School of Computing
Second CIA Exam – March 2024
Course Code: CSE318
Course Name: Algorithm Design Strategies & Analysis
Duration: 90 minutes Max Marks: 50

PART A

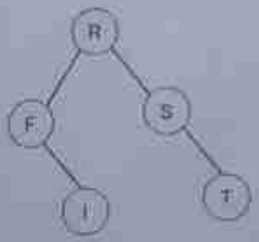
nswer all the questions **10 x 2 = 20 Marks**

1. Compare the backtracking strategy with brute-force approach.
2. Predict the algorithm design strategy used in the following algorithms. (a) 0/1 Knapsack Problem (b) Sum of Subset Problem (b) String Editing Problem (d) Kruskal's Algorithm
3. Relate the hamiltonian cycles problem with the Travelling Salesman Problem.
4. Mention the bounding conditions used for backtracking in sum of subset problem.
5. Say True or False
   (a) In the adjacency matrix representation of directed graph, the matrix is symmetric.
   (b) In the adjacency matrix representation of undirected graph, the number of 1's is twice the number of vertices.
6. Match the following.

Prim's Algorithm	Topological Order
BFS	Priority Queue
DFS	SET concept
Kruskal's Algorithm	Queue

7. Find the search cost for the following BST with the given probability of key elements.

n=5	0	1	2	3	4	5
Key[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



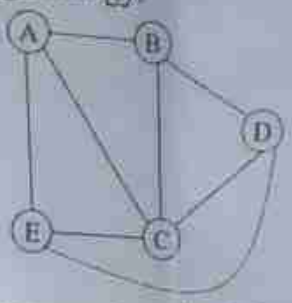
8. Write the recursive formula of optimal sub structure property for the 0/1 knapsack problem.
9. Describe the n-Queen problem.
10. What is the use of State Space Tree?

PART B

Answer any three questions 3 x 10 = 30 Marks

11. (a) Write the algorithm using backtracking strategy for the sum of subset problem. *(5 Marks)*

(b) Find all the hamiltonian cycles present in the following graph by applying backtracking strategy. *(5 Marks)*

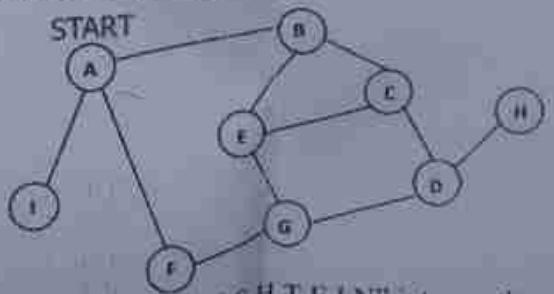


12. (a) Write dynamic programming algorithm for constructing optimal binary search tree. *(5 Marks)*

(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 Marks)*

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

13. Which traversal algorithm used for finding shortest distance from the given starting vertex to all other vertices in a unweighted graph. Write the algorithm and find the shortest distance from 'A' to all other vertices by tracing algorithm.



14. Tranform a string "L E V E N S H T E I N" into another string "M E I L E N S T E I N" by using minimum numbers of editing operations by applying dynamic programming approach.

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Third CIA Exam – April 2024
Course Code: CSE318
Course Name: Algorithm Design Strategies & Analysis
Duration: 90 minutes Max Marks: 50

PART A

Answer all the questions **10 x 2 = 20 Marks**

1. List out any six algorithm-design strategies.
2. Backtracking approach uses _____ search, whereas Branch & Bound approach uses _____ search.
3. What are the four different types of approximation algorithms available for solving Bin-Packing Problem?
4. Predict the algorithm design strategy used in the following algorithms. (a) Bin Packing Problem (b) Dijkstra's Shortest Path Problem (c) Job Sequencing Problem (d) Sum of Subsets Problem
5. Compare deterministic and non-deterministic algorithms.
6. Relate decision problems with optimization problems.
7. What is negative weight cycle in a graph? Which algorithm is used to check whether a graph containing negative weigh cycle or not?
8. State Boolean Satisfiability Problem. Give an example.
9. What is Clique in graph? Describe Clique Decision Problem.
10. Differentiate NP-Hard and NP-Complete problems.

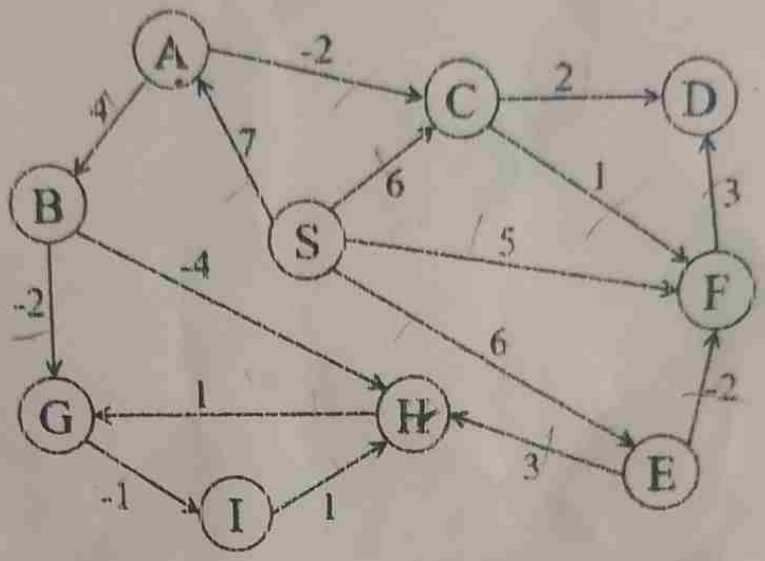
PART B

Answer any two questions **2 x 10 = 20 Marks**

11. How to prove a problem belongs to NP-Complete? Prove that Travelling Salesperson Problem is NP-Complete.
12. Given a set of (n=5) items with their profits and wieghts. Apply the branch and bound strategy to solve the 0/1 Knapsack Problem.

    Profit[1..5] = {10, 10, 12, 18, 5}
    Weight[1..5] = {2, 4, 6, 9, 3}
    Knapsack Capacity = 15

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



PART C

Answer all questions **1 x 10 = 10 Marks**

14. 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.

SASTRA

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School of Computing

First CIA Exam –Feb 2024

Course Code: ENG212

Course Name: Business Communication & Value Science III

Duration: 90 minutes Max Marks: 50

PART A 5x2=10 Marks

I. Answer the following questions

1. Expand VUCA and VUCA 2.0
2. Name two strategies to strengthen customer relationship in business ambience
3. Differentiate Global and Glocal value systems.
4. Give two examples for translocational impact in the business world
5. Define Culture Shock with examples.

PART –B 2x5=10 Marks

II. Answer the following questions

6. Differentiate Multiculturalism and Pluralism with adequate example
7. Give 5 tips to enhance Effective Cross Cultural Communication.

PART –C 3x10=30 Marks

I. Answer the following questions

8. Analyse a SWOT to achieve your goals. Identify your strengths and weaknesses, leverage opportunities and counteract the threats/Challenges in the Business Era.
9. Elevate the thoughts of VUCA to VUCA 2.0 in the perspective of Higher Studies.
10. Discuss on an application of artificial intelligence in everyday life -their advantages and limitations.

SASTRA

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THINK MERIT | THINK TRANSPARENCY | THINK SASTRA

School of Computing
Second CIA Exam – March 2024
Course Code: ENG212
Course Name: Business Communication & Value Science III
Duration: 90 minutes Max Marks: 50

PART A

Answer any 4 of the following questions in about 300 words:
(3x10=30 Marks)

1. 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.
2. Motivation causes you to act in a way that gets you closer to your goals - substantiate with adequate example and pictorial representation.
3. Draft a Feasibility Report to start a organic products manufacturing unit. Organic production is a system that integrates cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity.. .Your report should contain- terms of reference, work done, findings, recommendations and conclusion.
4. The influence of river in culture – Substantiate with adequate examples

Part B

Answer the following question in about 400 words (1x20=20 Marks)

5. Design your University in 2035 anticipating the future, embedded with modern digital technology.

SASTRA

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School of Computing
Third CIA Exam –April 2024
Course Code: ENG212
Course Name: Business Communication & Value Science III
Duration: 90 min Max Marks: 50

PART A

Answer any three of the following in about 200 words 3x10 =30

1. 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
2. Motivation causes you to act in a way that gets you closer to your goals - substantiate with adequate example and pictorial representation.
3. Draft a Feasibility Report to start a Organic Dairy Products manufacturing unit. Organic products are not harmful to the body, 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.
4. Human Machine communication encourages us to focus on how relationships between human and machine partners unfold through social processes, perceptual dynamics, and interaction- Justify with relevant evidences.

PART B

Answer the following in about 300 words 1x20=20

5. Technology plays a fundamental role in wealth creation, improvement of the quality of life, real economic growth and transformation in any society- Elucidate with reference to Nation Building

SASTRA

School of Mechanical Engg
First CIA Test – Feb 2024
Course Code: MCT309
Course Name: Industrial Manipulators
Duration: 90 minutes Max Marks: 50

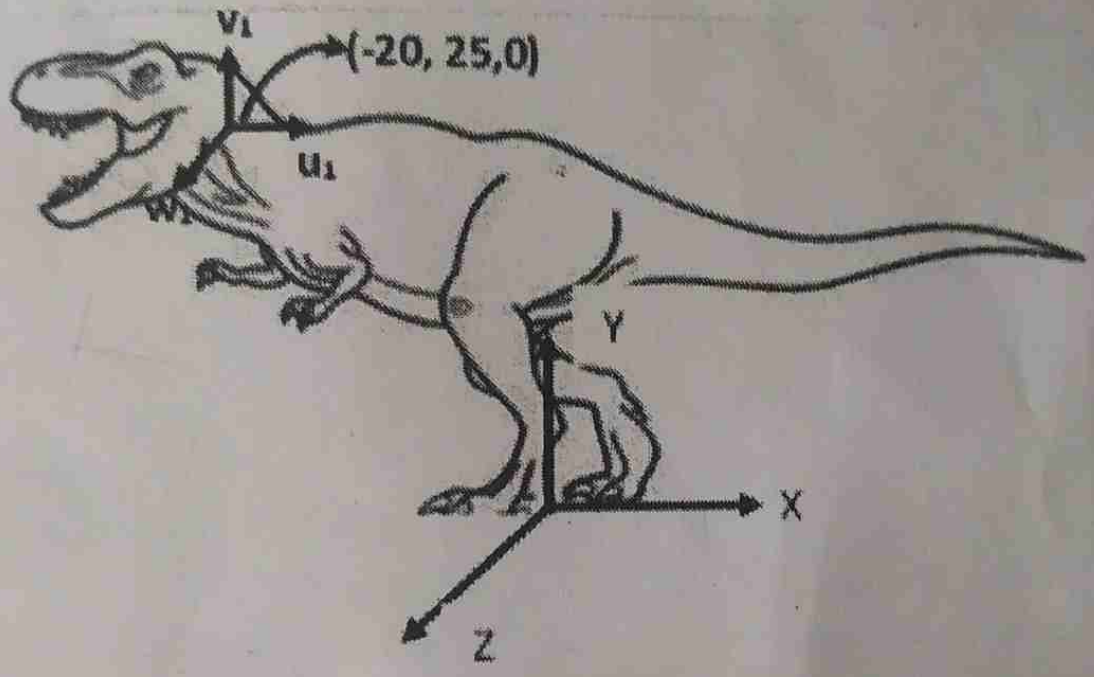
Part A **20 marks**

Answer all the followings:

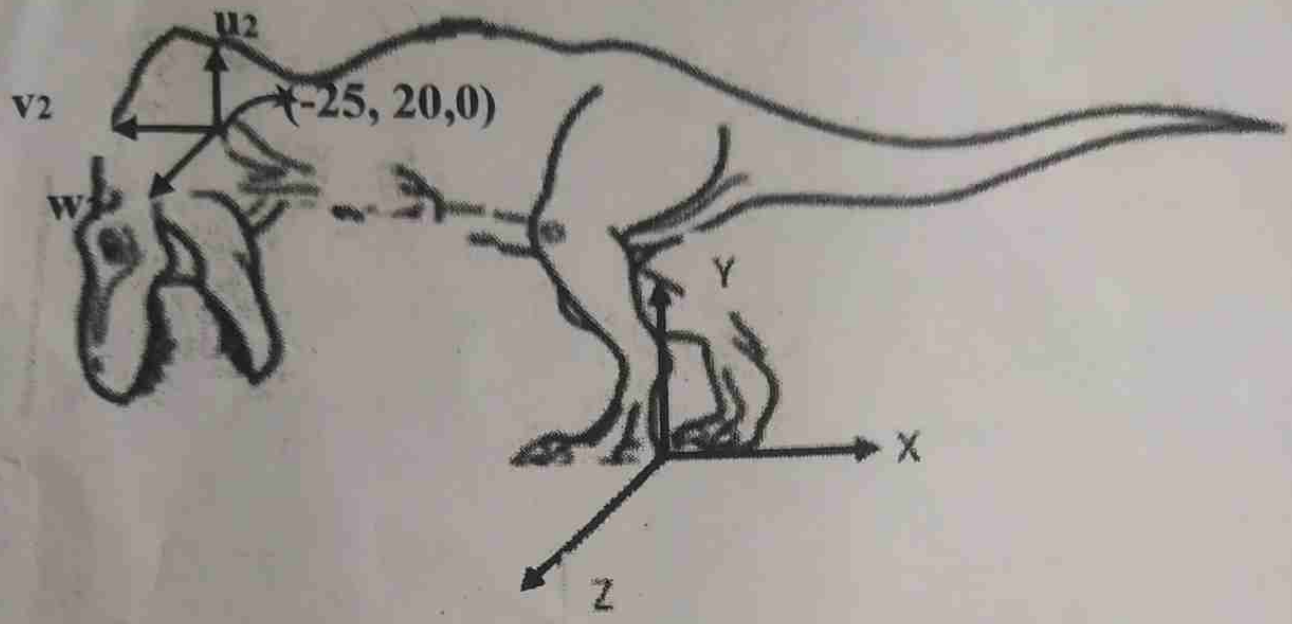
1. Draw 3 instances of an XYZ-frame wherein Y -axis points outward, X and Z axes only change their relative orientation.
2. If
$$T = \begin{bmatrix} {}^1R_2 & {}^1D_2 \\ 0\ 0\ 0 & 1 \end{bmatrix},$$
determine the expression for T^{-1}.
3. A frame undergoes 90° rotation about its Z-axis. Write the corresponding rotation matrix.
4. Two frames-XYZ and uvw are having the same origin. Now, uvw frame rotates about Z axis of XYZ frame. In another case, frame uvw is not having same origin with that of XYZ frame. Frame uvw rotates about Z-axis of XYZ frame. What would be the difference in both cases. Explain with an example. 4 marks
5. In a robotics surgery, transformation matrix of surgical tool with respect to robot base is given. Transformation matrix of patient head w.r.t robot base is also given. Determine the expression of transformation matrix of patient head with respect to surgical tool. 4 marks
6. If physical coordinates of a point are [2 3 4], express it in the homogenous coordinates with 3 scaling factors. 2 marks
7. Prove that the transformation matrix obtained after a series of rotations following fixed angle representation is the same following Euler angle representation when the order of rotations is reversed. 4 marks

PART – B Answer the followings **30 marks**

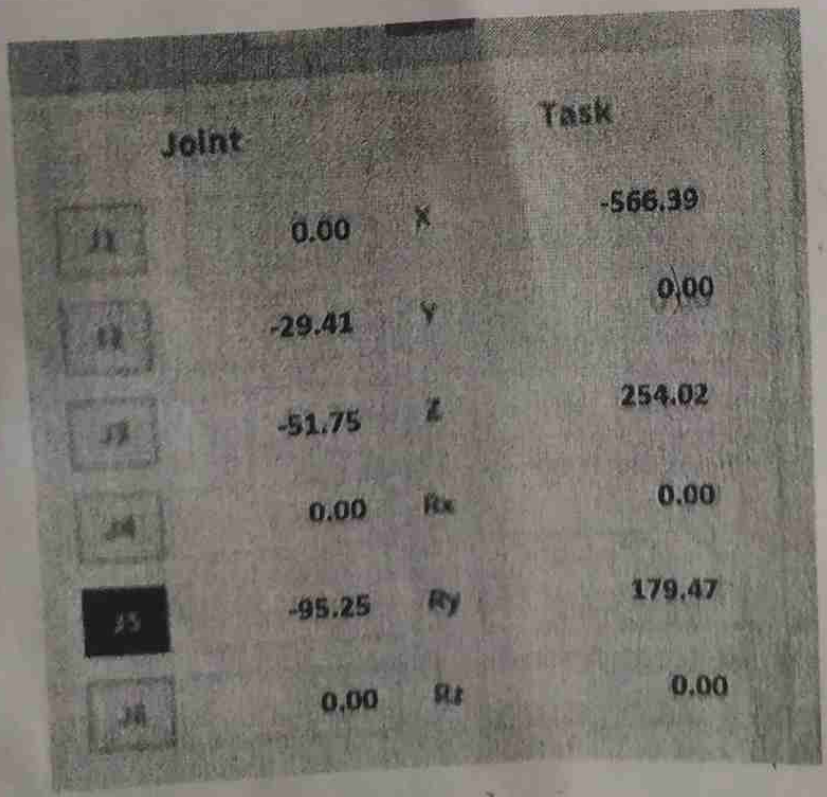
1)



Above figures are two stages of animation of a dinosaur. In bottom fig, the dinosaur's head has undergone a transformation compared to that of above fig. The co-ordinates of the origins of the two frames are also mentioned in the two figures. Determine the transformation matrix of frame $u_2v_2w_2$ w.r.t. frame XYZ and also write the transformation matrix that the frame $u_1v_1w_1$ undergoes to reach $u_2v_2w_2$.



2. In the bottom figure, X, Y and Z are the end-effecter position and the orientation is given by Rx, Ry and Rz (angles following ZYZ Euler angle rotation of the Doosan cobot). Determine the transformation matrix of the end-effector with respect to base frame.



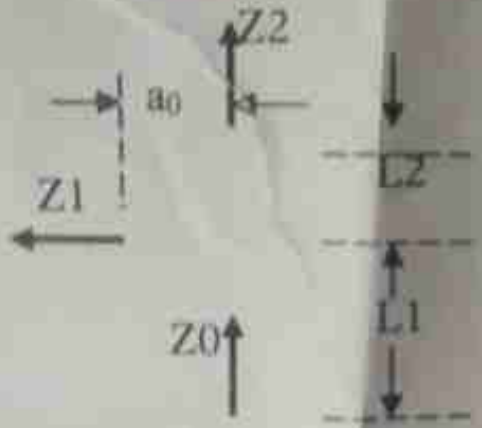
SASTRA

School of Mechanical Engg
2nd CIA Test – Apr 2024
Course Code: MCT309
Course Name: Industrial Manipulators
Duration: 90 minutes Max Marks: 50

Part A **20 marks**

Answer all the followings:

1. What purpose DH parameters solve in relation to industrial manipulators?
2. In the following fig, locate the origin of frame 1 and draw X1.



3. In the above fig (of que no 2), locate the origin of frame 2 and draw X2.
4. Determine the DH parameters of link 1 and link 2 in the fig of que no 2. 4 marks
5. Draw the workspace of 3-DOF cartesian manipulator.
6. While doing inverse kinematics, why should we give preference to $\tan^{-1}$ than $\sin^{-1}$ or $\cos^{-1}$? Explain with an example.
7. Draw an approximate manipulator befitting to frames given in que no 2. Assume frame 2 as the last but 2nd frame. 4 marks.
8. With the help of ai, αi, di and θi what do we do? How is it helpful for forward kinematics of a manipulator?

PART – B Answer the following **30 marks**

1. Fix the frames and determine the DH parameters for the following 6-DOF manipulator.

Draw the manipulator in home config
then draw the frames

12.6C1.8C08

SASTRA

School of Mechanical Engg
Third CIA Test – Apr 2024
Course Code: MCT309
Course Name: Industrial Manipulators
Duration: 90 minutes Max Marks: 50

Part A Answer the following: **10 marks**

1. What will be the size of the Jacobian matrix for the Cobot in TDC? What does the last column of the Jacobian matrix imply?
2. What is Robot centered layout?
3. What happens when a Cobot hits a human being? What is the safety feature given in the Cobot in this connection?
4. Give applications of Joint space and cartesian space trajectory planning.
5. What do the top three rows and bottom three rows of Jacobian matrix imply?

Part B Answer any two of the followings **2x15=30 marks**

6. The forward kinematics model of the SCARA, 4-DOF (RRPR) manipulator is given below. Determine the top three rows of the Jacobian matrix.

$$ {}^{0}T_{4} = \begin{bmatrix} C_{124} & S_{124} & 0 & L_2C_{12} + L_{11}C_1 \\ S_{124} & -C_{124} & 0 & L_2S_{12} + L_{11}S_1 \\ 0 & 0 & -1 & L_{12} + d_3 - L_4 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

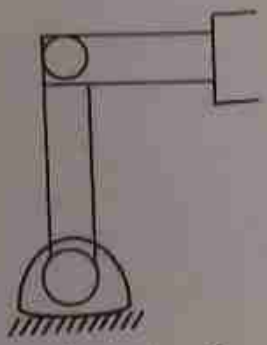
7. The first joint of a 3-DOF manipulator rotates from 45° to -25° in 5 sec. Design a cubic spline trajectory for the joint for a pick and place task.
8. Write short notes on the following
   (i) Lead through and textual programming
   (ii) Digital twin

Part C **10 marks**

9. For the Home configuration I, derive the Jacobian matrix.

If the home configuration changes to 'Home configuration-2' as shown below, will there be any change in the Jacobian matrix?

Home configuration-1



Home configuration-2

SASTRA

School of Computing
First CIA Exam – Feb 2024
Course Code: MGT 207
Course Name: Introduction to Innovation, Entrepreneurship and IP Management.
Duration: 90 minutes Max Marks: 50

PART A

Answer all the questions 10 x 2 = 20 marks

1. Explain the concept of innovation space with a diagram
2. Discuss the tangible and intangible outcomes as the impact of innovation on the organization.
3. Explain the structured process of creativity.
4. Differentiate divergent and convergent thinking styles.
5. Discuss the characteristics of innovation.
6. How can data be converted to information?
7. How can organizations foster creativity.
8. Mention the types of innovation under marketing and distribution strategies
9. Define knowledge markets.
10. Compare and contrast radical and incremental innovation with suitable examples.

PART B

Answer all the questions 10 x 3 = 30 marks

11. How do you recognize innovation in products and services.

12. Explain the concept of knowledge management, starting from data to knowledge, knowledge generation and knowledge acquisition.

13. Enumerate the components of the innovative organization

SASTRA

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Second CIA Exam –March 2024

Course Code: MGT 207

Course Name: Introduction to Innovation, Entrepreneurship and IP Management

Duration: 90 minutes Max Marks: 50

PART A 5 X 2 = 10 MARKS

Answer all the questions

1. Mention the innovation at three levels.

2. Explain Ishikawa fishbone diagram with an illustrative example.

3.Discuss the concept of technology watch.

4. List down the various terms involved in effectuation process.

5.Sketch out the Lean management technique, as a scientific approach to creating and managing startups.

PART B 2 X 15 = 30 MARKS

Answer ANY 2 questions

6.As an entrepreneur, explain the various forms of business. Also describe the strategies for going global.

7. "It is a solution-based approach to solving problems, with an iterative process, categorizing alternative strategies and solutions." Identify the process and summarize the iterative process in detail.

8. Rani is a project manager with lot of projects to choose from. Give a guideline for Rani to evaluate the best project with both discounting and non-discounting criteria. Moreover, Rani would like to appraise her company with proper interpretation through ratio analysis. Explain the various ratios involved in it.

PART C 1 X 10 = 10 MARKS

Answer the question

9. Elucidate the stages of innovation with a clear mention of the various idea creation methodologies or techniques available.

SASTRA

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School of Computing

Third CIA Exam – March 2024

Course Code: MGT 207

Course Name: Introduction to Innovation, Entrepreneurship and IP Management

Duration: 90 minutes Max Marks: 50

PART A 5 X 2 = 10 MARKS

Answer all the questions

1. Describe the innovation space with an apt diagram.
2. Explain the concept of thinking hats to enhance creativity.
3. Why do we need intellectual property rights?
4. List down the various empathizing tools involved in design thinking process.
5. Mention concept of copyright in intellectual property rights.

PART B 2 X 15 = 30 MARKS

Answer ANY 2 questions

6. Explain the effectuation process with clear mention of all the steps.
7. "Patents are the key to technology and technology is the key to innovation." Elucidate the patent filing procedure in detail.
8. Describe the nuances of copyright and trademark infringement and the remedies available for it.

PART C 1 X 10 = 10 MARKS

Answer the question

9. Ram has a great idea to start a business in the field of fintech. Propose a business plan, provided he needs to pitch it before a "Start-up India" panel. Ensure the business plan covers all functional aspects of your proposed business.

SASTRA
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THANJAVUR KUMBAKONAM CHENNAI

School of Arts, Science, Humanities and Education (SASHE)
FIRST CIA Test – February 2024
Course Code:MAT330R01
Course Name: OPERATIONS RESEARCH
Duration: 90 minutes Max Marks: 50

PART A [5×2 = 10 Marks]

Answer all the questions:

1. Write the procedure for forming an LPP.
2. Define the following
   (i) Basic feasible solution (ii) Optimum basic feasible solution
3. Define Pseudo-optimal solution.
4. Write a few important steps for the BIG M method.
5. How to form an initial LPP in Phase II from the Two-phase simpl method.

PART B [4×10 = 40 Mark

Answer all the questions:

6. Use graphical method to solve the following LPP:
   $Minimize\ Z = -x_1 + 2x_2$
   subject to the constraints:
   $$-x_1 + 3x_2 \leq 10,$$
   $$x_1 + x_2 \leq 6,$$
   $$x_1 - x_2 \leq 2,$$
   $$x_1, x_2 \geq 0.$$
7. Solve the following LPP by using Simplex method:
   $Maximize\ Z = 10x_1 + 15x_2$
   subject to
   $$2x_1 + x_2 \leq 26;$$
   $$2x_1 + 4x_2 \leq 56;$$
   $$-x_1 + x_2 \leq 5; \text{ and } x_1, x_2 \geq 0.$$

8. Use the Big-M (Penalty) method to solve the following LPP:

Minimize $Z = 5x_1 + 3x_2$ subject to the constraints

$$2x_1 + 4x_2 \leq 12;$$
$$2x_1 + 2x_2 \leq 10;$$
$$5x_1 + 2x_2 \geq 5;$$
and $x_1, x_2 \geq 0.$

9. (a) Explain the special case of Multiple optimal solution and an unbounded solution.

(b) Use graphical method to solve the following LPP:

Maximize $Z = 10x_1 + 6x_2$ subject to the constraints:

$$5x_1 + 3x_2 \leq 30,$$
$$x_1 + 2x_2 \leq 18, \text{ and } x_1, x_2 \geq 0.$$

Further investigate the special case of LPP.

End of Question Paper

SASTRA
DEEMED TO BE UNIVERSITY

School of Arts, Science, Humanities and Education (SASHE)
SECOND CIA Test – MARCH 2024
Course Code:MAT330R01
Course Name: OPERATIONS RESEARCH
Duration: 90 minutes Max Marks: 50

PART-A [5×2 = 40 Marks]

Answer all the questions:

1. Define Basic Feasible Solution (BFS) to the transportation problem.
2. Define degenerate and non-degenerate in transportation problems.
3. What do you mean by balanced and unbalanced transportation problems?
4. Give any two differences of the Transportation problem and the Assignment Problem.
5. Write the mathematical formulation of an assignment problem..

PART B [4×10 = 40 Marks]

Answer ANY FOUR questions:

6. Obtain an initial basic feasible solution to the following transportation problem using the NORTH-WEST Corner rule:

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

12200

7. Obtain an optimum basic feasible solution to the following transportation problem.

	B_1	B_2	B_3	B_4	B_5	Supply
A_1	5	8	6	6	3	8
A_2	4	7	7	6	5	5
A_3	8	4	6	6	4	9
Demand	4	4	5	4	8	

B1

8. Obtain an optimal basic feasible solution to the transportation problem given in the following table:

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	

735

9. Write an algorithm for the Hungarian method.

10. A company is faced with the problem of assigning four different salesmen to four territories for promoting its sales. Territories are not equally rich in their sales potential and the salesmen also differ in their ability to promote sales. The following table gives the expected annual sales (in thousand of rupees) for each salesman if assigned to various territories. Find the assignment of salesmen so as to maximize the annual sales.

Territories

Salesmen

	T_1	T_2	T_3	T_4
S_1	60	50	40	30
S_2	40	30	20	15
S_3	40	20	35	10
S_4	30	30	25	20

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End of Question Paper

SASTRA

School of Arts, Science, Humanities and Education (SASHE)
THIRD CIA Test – APRIL 2024
Course Code : MAT330R01
Course Name : OPERATIONS RESEARCH
Duration : 90 minutes Max Marks: 50

PART-A [5×2 = 10 Marks]

Answer all the questions:

1. Define Pseudo-optimal solution.
2. Define (i) Activity and Dummy activity, (ii) Network of a project.
3. Write the formula for Economic Order Quantity (EOQ).
4. What is the minimum average cost of purchasing a model with no shortage?
5. For a deterministic queueing model, arrival rate should ___ the service rate.

PART B [2×15 = 30 Marks]

Answer the following questions:

6. A pineapple firm produces two products: canned pineapple and canned juice. The specific amounts of material, labour and equipment required to produce each product and the availability of each of these resources are shown in the table given below

	Canned Juice	Canned Pineapple	Available resources
Labour (Man hours)	3	2.0	12.0
Equipment (M/c hours)	1	2.3	6.9
Material (Unit)	1	1.4	4.9

Assuming one unit of canned juice and canned Pineapple has profit margins Rs. 2 and Rs. 1 respectively.

(a) Formulate this as a L.P.P. (8)

(b) Solve it graphically (7)

[OR]

7. (a) Write an Algorithm for the Big-M (Penality) method. (8)

(b) Use the Big M method to solve the following LPP:

Minimize $Z = 5x_1 + 3x_2$ subject to the constraints

$2x_1 + 4x_2 \leq 12$; $2x_1 + 2x_2 \leq 10$; $5x_1 + 2x_2 \geq 5$;

and $x_1, x_2 \geq 0$. (7)

8. A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 a metre and there is a demand for 8,000 metres a week. Each replenishment costs Rs. 1250 for administration and Rs. 1,750 for delivery, while holding costs are estimated at 25 percent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company? (8)

How would this analysis differ if the company wanted to maximize profit rather than minimize cost? What is the gross profit if the company sell cable for Rs. 360 a metre. (7)

[OR]

9. (a) Explain types of Inventory cost. (8)

(b) A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part cost Rs. 20. The ordering cost per order is Rs. 15 and the carrying charges are 15% of the average inventory per year. You have been 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? (7)

PART - C

Answer the following question: **[1×10 = 10 Marks]**

10. Calculate the earliest start, earliest finish, latest start, and latest finish of each activity of the project given below and determine the critical path of the project.

Activity	1 – 2	1 – 3	1 – 5	2 – 3	2 – 4	3 – 1	3 – 5	3 – 6	4 – 6	5 – 6
Duration (in weeks)	8	7	12	4	10	3	5	10	7	4

End of Question Paper

SASTRA

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School of Computing
First CIA Exam –Feb 2024
Course Code: CSE308
Course Name: OPERATING SYSTEMS
Duration: 90 minutes Max Marks: 50

PART A

Answer all the questions **10 X 2 =20**

1. State the advantage of accessing system calls through API
2. List the information contained in a PCB and its role in context switching
3. Justify the role of long term scheduler in maintaining the CPU's performance
4. What happens when a parent process issue a wait() system call and what happens if the parent fails to issue a wait() system call ?
5. Between shared memory and message queue, which one is better to reduce number of mode switches involved and why?
6. Mention the characteristics of an ordinary pipe with its syntax and parameters
7. How many processes get created if the following code is executed?

```
If(fork() || fork())
        fork();
```

8. Write the formula used for predicting the burst time using exponential average and mention the three possible ways its prediction can be controlled.
9. Calculate the number of context switches involved in scheduling of the following processes under preemptive SJF

	P1	P2	P3	P4	P5	P6
AT	0	2	4	6	7	9
BT	5	2	3	4	6	3

10. Prove with an example that preemptive algorithms may lead to race conditions

PART B

Answer all the questions **3 X 10 =30**

11. Calculate the turn-around times and waiting times of the following processes using the SJF algorithm. Note that you should consider the BT1 of processes which are yet to commence the first turn of execution and should consider BT2 of processes which have completed IO, for the selection of shortest processes.

	P1	P2	P3	P4	P5
AT	2	3	5	6	8
BT1	4	6	9	4	6
IO	4	3	5	4	3
BT2	2	4	5	2	3

12. Discuss the concept of system calls with the role API, parameter passing methods and types of system calls (7). Identify the system calls invoked during the execution of the program for the creation of parent-child processes and communication between them(3)

13. Find the waiting time of processes using Multi-level feedback queue scheduling with three queues having the time quantum of 2,4 and 6 respectively

	P1	P2	P3	P4	P5
AT	0	2	6	7	9
BT	3	8	6	11	9

PART A (2 * 10 = 20) Answer all the questions

1. Consider the following program execution involving 2 threads accessing the shared variable 'i' = 0.

Thread1	Thread2
i++;	i++;
while(i<2);	while(i<2);

Which of the following statement(s) is/are correct? justify .

A. Both threads will never finish execution
B. Both threads will always finish execution
C. At least one of the threads will always finish execution
D. Either both threads will finish, or none of them of will finish execution

2. Mention the syntax of pthread_create and pthread_join
3. Define target thread and mention the two scenarios how it can be cancelled
4. Specify any two programming examples to claim multithreading provides better performance than a single-threaded solution.
5. Relate strong semaphore and the need for spinlock.
6. Define monitor and mention its use.
7. Is mutual exclusion guaranteed in counting semaphore state yes or no then justify.
8. Consider a non negative semaphore S. 20P(S) and 14 V(S)operations are performed on S in some order, where P(S) decrements S and V(S) increments. Estimate the largest initial value of S that will keep at least one process blocked.
9. Consider a system having m resources of the same type. These resources are shared by 3 processes A, B and C which have peak demands of 3, 4 and 6 respectively. For what value of m, deadlock will not occur?

10. Consider the following threads, T1, T2 and T3 executing on a single processor, synchronized using three binary semaphore variables, S1, S2 and S3, operated upon using standard wait( ) and signal( ). The threads can be context switched in any order and at any time.

T1	T2	T3
while(true) { wait(S3) print("C") signal(S2) }	while(true) { wait(S1) print("B") signal(S3) }	while(true) { wait(S2) print("A") signal(S1) }

Find the initial value of S1,S2,S3 that would print the sequence BCABCABCA..... ?

PART B (3 * 10 = 30) Answer any three questions

11. Develop the structure of the reader and writer process to achieve synchronization between multiple readers and writers. Mention the challenge posed on writers by allowing concurrent readers and how it can be resolved.
12. Elaborate multithreading models and highlight the benefits of multithreaded programming.
13. Consider a system of 6 process P0 to P5 using 4 types of resources A,B,C and D as 15,6, 9,10 instances of each type respectively. For the given allocation and maximum matrix determine safe allocation is possible. If so mention the safe sequence.

	Current Allocation				Maximum Need			
	A	B	C	D	A	B	C	D
P0	2	0	2	1	9	5	5	5
P1	0	1	1	1	2	2	3	3
P2	4	1	0	2	7	5	4	4
P3	1	0	0	1	3	3	3	2
P4	1	1	0	0	5	2	2	1
P5	1	0	1	1	4	4	4	4

14. With reference to the above question no. 13, determine whether a new request from P5 with (3,2,3,3) instances from each type can be accepted. If it is possible, generate the safe sequence otherwise estimate the minimum no of additional instances required from each type to handle a deadlock free execution.

School of Computing
ThirdCIA Exam – April 2024
Course Code: CSE308
Course Name: Operating Systems
Duration: 90 minutes
Max Marks: 50

PART - A

Answer all the questions **5 X 2 = 10**

1. How does an interrupt differ from a trap?
2. A process executes the following code.
   for (i = 0; i< n; i++) fork ();
   How many child processes are created?
3. Name two hardware instructions and their definitions that can be used for implementingmutual exclusion.
4. How the problem of external fragmentation can be solved?
5. Calculate the number of pages for the process of size 72,766 bytes and thepage size is 2,048 bytes. Does internal fragment occur? If yes, how? If no, why?

PART- B

Answer Any Three Questions **3 X 10 = 30**

6. Consider the following set of processes, whose arrival and execution time, is given below.

Process	Arrival Time	Exec. Time
P1	0.0	7
P2	2.0	4
P3	4.0	1
P4	5.0	4

(a) With pre-emptive SJF algorithm find average waiting time and average turnaround time. (4)
(b) With Round Robin algorithm [Time Quantum=2] find average waiting time and average turnaround time. (4)
(c) Compare two algorithms and conclude which one is best and why? (2)

7. Given page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 with four frames. Compare the number of page faults for LRU and Optimal page replacement algorithm.
8. Discuss : Segmentation.
9. With neat diagram, explain three major methods of allocating disk space.

PART – C

Answer the following Question **1 X 10 = 10**

10. a) Assume a disk with 200 tracks numbered 0 to 199. Initially the read/write head is on 100. The queue of the pending request is kept in the order 55, 58, 39, 18, 90, 160, 150, 38 and 184. With diagram showing the head movement calculate the average seek length for the following disk scheduling algorithm.
    i) FIFO ii) SSTF iii) C-SCAN

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School of Computing
First CIA Examination – Feb '24
Course Code: CSE215
Course Name: Software Engineering
Duration: 90 minutes Max Marks: 50

PART A

Answer all the questions **5 x 2 marks = 10 marks**

1. Build the layered technology components of software.
2. Derive any four umbrella activities of software engineering.
3. Enlist all prescriptive process models, specialized process models
4. How does the Capability Maturity Model Integration level(CMMI) determines the company reputation?
5. Developer A wants to develop similar existing Online shopping app as flipkart,
   Developers B Team wants to develop a new satellite to Jupiter.
   Justify your answer for the given software system with suitable decomposition strategies, process models.

PART B

Answer to all Questions **3 x 10 marks = 30 marks**

6. Identify the process flow, process model, life cycles steps, effort nature of given software.(5 marks)
   Draw its process model with its advantages and disadvantages.

Software Name	Process flow Name	Process model Name	Life cycle phases	Organic/ Semi attached/ embedded
Jinux OS				
National Rose				
Smart watch ver3.0				
Open OfficeXP Package				

7. Calculate FP count, **Value Adjustment Factor** and **Total FP count** of given ABC company's MIS
using Cost constructive model- COCOMO.

Marketing MIS:

Function	Raw FP
Monthly sales	4 reports
Sales summary1	5 documents
Sales summary2	5 documents
Sales summary3	5 documents
Sales summary4	5 documents
Sales summary5	5 documents
Sales Enquiry	4
Sales files	10
Product files	7
Location file	7

General Specification Characteristics are: (GSC)

Performance = 3 , reusability = 4,
Online updates =3, Installation easiness = 4
Online data entry = 3, Operational easiness = 4
End-user efficiency = 4, change facilitation = 5

8. Find Software size of given CAD software: A range of LOC estimates is developed for each function. For example, the range of LOC estimate for the 3D geometric analysis function is optimistic, 4600 LOC; most likely, 6900 LOC and pessimistic, 8600 LOC, And calculate Effort of the same using $E = 3.2 * (KLOC)^{1.05}$ Boehm simple KLOC method.

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Duration: 90 minutes Max Marks: 50

PART A

Answer to all Questions **10 x 2 marks = 20 marks**

1. Design a use case diagram of "withdrawing Money from ATM" Scenario and get a concurrent message from the bank with 3 types of actors.
2. Develop sequence diagram for "Rhyme App" to school children that narrates chosen English rhymes then translates its meaning automatically towards NLP using google translator and finally stored in a google drive.
3. Identify Domain classes, Analysis classes, Potential classes, Design classes of "online Food ordering system"
4. Build the design pattern template.
5. Find the online, offline collaborators of the following to the Online Hospital Management System: HomePage, DBAdmin, Patients, Doctors, Receptionist, TokenNo, Visitors, Camera, medicines, prescription_report, Scan_report, XRay_machine and draw collaboration diagram
6. Find architectural style of the following:
   a. Mobile phone recharge system by multiple **clients**, ISP
   b. Online exam system through **centralized Question repository** for JEE exam.
   c. Binary **pipeline** search of Not-available element
   d. Component, Package, Modules, program, instruction and data design
7. Why does a good software design must exhibits firmness, commodity, delight? Justify.
8. What are the design issues of UI design and design models of it?

9. Find correct terms and Match the following architectural genre:

Artificial Intelligence - Netflix

Commercial – Alexa

Communication - cricInfo

Sports - telegram

10. What is the need for refactoring?

PART-B

Answer any three Questions: **3 x 10 marks = 30 marks**

11. a. Explain all Design principles, b. Elaborate all types of coupling and cohesion of component level design. (5+5 marks)
12. Explain all OO concepts and Fundamental design concepts with example (5+5 marks)
13. Explain all UI principles.
14. Explain the components (5marks) of Conversion process of "analysis to design model" with suitable pyramid picture. (5marks)

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THINK MERIT | THINK TRANSPARENCY | THINK SASTRA

School of Computing

Third CIA Examination – Apr '24

Course Code: CSE215

Course Name: Software Engineering

Duration: 90 minutes Max Marks: 50

PART A

Answer all the questions **10 x 2 marks = 20 marks**

1. Expand the following quality factors of the software: FURPS.
2. Define all concurrent modeling phases.
3. Derive the steps of requirement engineering process.
4. How many levels are maintained in the CMMI of the software?
5. Identify any two metrics of the software estimation from 4Ps.
6. State Beizer's four Behavior modeling testing methods
7. Design any four domain classes of "University Management system"
8. What are the two phases of documentation testing?
9. Enlist all approaches of Integration testing.
10. Give the guidelines of defining equivalence partitioning classes.

PART B

Answer any two Questions **2 x 10 marks = 20 marks**

11. Differentiate V-Model and Water fall model by its process flow diagram, advantages and disadvantages.
12. Assume there is an another version of Open Office package which consist of additional package as "insert a new object with AR modeling on camera captured images". Identify major, inter tasks and attributes of given OO software for an OOTesting.
13. Construct L9 Orthogonal array for the given software problem:

A microprocessor's functionality has to be tested to the given factor.
Temperature: 100C, 150C and 200C.
Pressure : 2 psi,5psi and 8psi
Doping Amount :4%,6% and 8%
Deposition Rate : 0.1mg/s , 0.2 mg/s and 0.3mg/s at these three levels

PART C

Answer to all Questions **1 x 10 marks = 10 marks**

14.a Draw flow graph, graph matrix of the following instruction set and find cyclomatic complexity. (2 marks)

```
Start → (1)
Declare a,b,c → (2)
Get(a,b,c);
d=sqrt(b*b-4a*c); → 3
r1=d/2*a; → 4
r2=-d/2*a; → 5
if (d==0) → 6
 print("roots are equal"); → 7
else if (d>0) → 8
 print(" roots are real"); → 9
else if (d<0) → 10
 print("roots are complex"); → 11
else print ("invalid inputs"); → 13
endif
print(r1,r2); → 14
end
→ (15)
```

14.b. Perform selective path testing, control structure and loop testing of matrix operations such as 1. Matrix addition 2. Matrix subtraction 3. Matrix multiplication with necessary constraints and verification points. (3 marks)

14.c. How to conduct Model based testing (MBT) for the "online food ordering and delivery system" with atleast 3 UML models?
Write the steps and guidelines of MBT.(3 marks)

14.d. Differentiate real time system testing with stand alone conventional module based software testing. (2 marks)

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