

Total No. of Pages: 2

Roll No... 2M1ITY

FIRST SEMESTER

Ph.D./M.Tech.

MID TERM EXAMINATION

September-2024

COURSE CODE: ITY 507 COURSE TITLE: FUNDAMENTAL OF MACHINE LEARNING

Time: 1:30 Hours

Max. Marks: 20

Note: All question is compulsory.

All questions carry equal marks.

Assume suitable missing data, if any.

1. Describe the different types of machine learning algorithms: supervised, unsupervised, semi-supervised, and reinforcement learning, highlighting their key characteristics and examples. Discuss the common challenges and issues faced in each type, such as overfitting, under-fitting, data scarcity, computational complexity, and interpretability. How can these challenges be addressed in real-world applications? [4] CO#1
2. A company records the monthly sales data of a product for 12 months (in thousands of units) as follows: 12, 15, 14, 13, 18, 17, 15, 20, 19, 18, 22, and 16. [4][CO#1]
 - a) Calculate the mean, median, and standard deviation of the sales data.
 - b) Assess the skewness of the data based on the mean and median. Is the data distribution skewed left, skewed right, or symmetric?
3. Consider the simple linear regression model given by the equation $y = wx + b$, where w is the weight, b is the bias, and x is the input feature. You are given the following dataset of points (x, y) :

x	1	2	3	4
y	2	3	5	4

Assume that the initial weights and bias are $w = 0$ and $b = 0$. Use gradient descent to update the weights and bias. Follow these steps:

- a) Calculate the mean squared error (MSE) loss for the initial parameters.
 b) Compute the gradients of the loss with respect to www and bbb .
 c) Update w and b using a learning rate of $\alpha=0.01$.
 d) Perform one iteration of gradient descent and provide the updated values for w and b . [4][CO#1]
4. A multiclass classifier predicts labels for a dataset containing 5 classes (A, B, C, D, E). The confusion matrix for the classifier's predictions is as follows: [4][CO#2]

	Predicted A	Predicted B	Predicted C	Predicted D	Predicted E
Actual A	30	2	1	0	1
Actual B	5	25	3	1	1
Actual C	2	3	20	4	1
Actual D	0	1	2	15	1
Actual E	1	1	0	2	20

- a) Calculate Precision, Recall, and F1 Score for each class.
 b) Calculate the Overall Accuracy of the classifier.
 c) Compute the Macro and Micro Averages of the F1 Score.
5. A binary classifier is tested on a dataset of 100 samples. The following confusion matrices are observed at different decision thresholds:

Threshold	True Positives (TP)	False Positives (FP)	True Negatives (TN)	False Negatives (FN)
0.9	10	1	89	0
0.7	15	5	85	5
0.5	20	10	80	10
0.3	25	15	75	15
0.1	30	25	65	20

- a) Calculate the True Positive Rate (TPR) and False Positive Rate (FPR) for each threshold.
 b) Plot the ROC curve using the calculated TPR and FPR values.
 c) Based on the ROC curve, explain how to evaluate the performance of the classifier. [4][CO#2]

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Roll No.

FIRST SEMESTER

M.Tech. (IT)

END SEMESTER EXAMINATION

November-2024

ITY-507: ADVANCED OPERATING SYSTEM

Time: 3:00 Hours

Max. Marks : 50

Note : All questions are compulsory.

Assume suitable missing data, if any.

1[a] Write the meaning of the following path expressions:-

[5][CO1][BTL4]

- [i] path read + {write} end
- [ii] path {read} + {write} end
- [iii] path {read} + write end
- [iv] path read + write end
- [v] path read; write end

[b] Consider the data as given in the below matrix. Using the Banker's algorithm, answer the following questions:-

- [i] How many resources of type A, B, C, D are there?
- [ii] What are the contents of need matrix?
- [iii] Find if the system is in safe state? If it is, find the safe sequence.

[5][CO1][BTL3]

Process	Max	Allocation	Available
	A B C D	A B C D	A B C D
P ₀	6 0 1 2	4 0 0 1	3 2 1 1
P ₁	2 7 5 0	1 1 0 0	
P ₂	2 3 5 6	1 2 5 4	
P ₃	1 6 5 3	0 6 3 3	
P ₄	1 6 5 6	0 2 1 2	

2[a] Consider a group of distributed processors P1, P2, P3, and P4 that use the Ricart-Agrawala algorithm for ensuring mutual exclusion. Assume that P4 is currently in the critical section and there is no other node in the WAITING state.

[i] Show the STATE and REQUEST_QUEUE entries at each processor.

[ii] Now consider P1 requests critical section at logical timestamp 2 and P2 requests critical section at logical timestamp 3. Now show the updated STATE and REQUEST_QUEUE entries at each processor.

[5][CO2][BTL3]

[b] Consider the space time diagram given in the figure 1. Assume that the logical clocks store only integer values and the initial logical clock values are all initialized to zero. Also assume that after each event, the corresponding logical clock is incremented by 1. List the vector timestamps for each event shown in figure 1:

[5][CO2][BTL3]

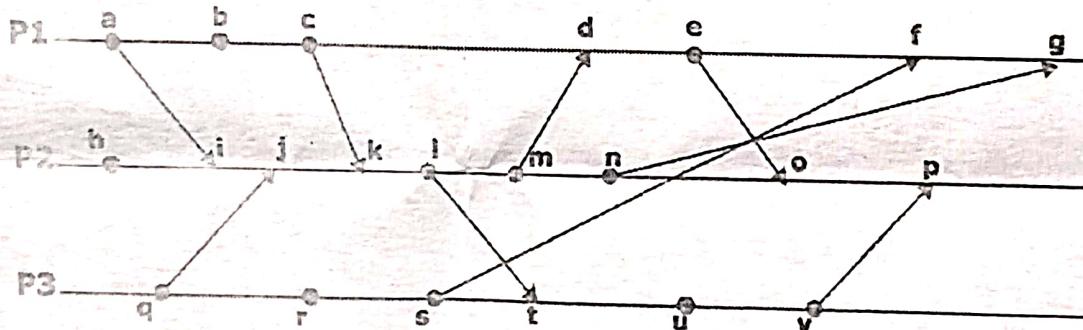


Figure 1

3[a] What are the various design issues in distributing file system?

[5][CO3][BTL2]

[b] Write the advantages and disadvantages of various Load distributing algorithms?

[5][CO3][BTL2]

Or

3[a] Explain the architecture of the DSM systems.

[5][CO3][BTL2]

[b] Write short note on mechanisms for building distributed file system.
[5][CO3][BTL2]

4[a] What do you mean by forward and backward error recovery? Define checkpointing.
[5][CO4][BTL1]

[b] What are the fault tolerant computer systems? What are the differences between commit and voting protocols?
[5][CO4][BTL2]

5[a] What are the different implementations of the access matrix model?
[5][CO5][BTL2]

[b] Consider two prime numbers 13 and 7 and encryption key $e = 5$, Encrypt the Plaintext 3, using RSA public key algorithm.
[5][CO5][BTL3]

MID SEMESTER EXAMINATION

SEPT-2024

ITY-505 ADVANCED DATA STRUCTURES

Time: 1:30 Hours

Max. Marks : 20

Note : Attempt all Questions.

Assume suitable missing data, if any.

- 1) Given the following sequence of integers to be inserted into an empty AVL tree: [6] [CO 1]

50, 20, 70, 10, 30, 60, 80, 25, 5

- i) Insert these values one by one into the AVL tree, and for each insertion, show the structure of the tree and any rotations that occur to maintain the balance factor.
- ii) After the insertions, delete the node with value 20 from the AVL tree. Perform the necessary rotations to maintain the AVL property after deletion and show the final tree structure.
- iii) After deletion, insert the value 15 into the AVL tree. Again, show the tree structure and any rotations required to maintain balance.

- 2) What is a B-tree? How is it different from a binary tree and an M-way tree? Demonstrate how to split a node when inserting into a full node in a B-tree.

[5][CO 1]

- 3) Explain the structure of a skip list. How does it differ from a linked list? Describe the role of probability in a skip list and how it influences the height of the list. Why is this probability important? [3][CO 1]

- 4) Given the following sequence of numbers:

[6][CO 2]

12, 7, 25, 15, 28, 33, 41, 18, 29, 21

- a) Construct a binomial heap from this sequence by inserting the numbers one by one. Show the structure of the binomial heap after each insertion.
- b) After constructing the heap, delete the minimum element from the binomial heap. Explain the steps involved and show the resulting binomial heap.
- c) Explain the time complexity of inserting an element and deleting the minimum element in a binomial heap.

1st SEMESTER

M.Tech / Ph.D.

MIDTERM EXAMINATION

September-2024

COURSE CODE ITY501COURSE TITLE Linear Algebra andProbability

Time: 1:30 Hours

Max. Marks: 25

Note: All questions are compulsory.

All questions carry equal marks.

Assume suitable missing data, if any.

Q.1 What is the need for SVD? Find the SVD of A, $U\Sigma V^T$,

$$\text{Where } A = \begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix} \quad [5][\text{CO}\#1]$$

Q.2 What do you mean by linear transformation? Prove that rotation and in \mathbb{R}^2 is a linear transformation. Determine whether $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ given $T(x_1, x_2) = (-x_2, x_1, 0)$ is a linear transformation. [5][\text{CO}\#1]Q.3 What is Gram-Schmidt orthogonalization? Given $B = \{u_1, u_2, u_3\}$, where B be a subspace in \mathbb{R}^3 spanned by $\{u_1, u_2, u_3\}$, where $u_1 = (1, 2, 1)$, $u_2 = (1, 1, 3)$ and $u_3 = (2, 1, 1)$. Find the orthonormal basis for B. [5][\text{CO}\#2]Q.4 Prove that $V = \mathbb{R}^2$ is a vector space over the field of real numbers. Also prove that $v_1 = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$, $v_2 = \left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right)$ are orthonormal vectors. [5][\text{CO}\#2]Q.5 What is the relevance of linear algebra in AI/ ML? Test the linear dependencies and find the relationship if it exists for $X_1 = (1, 2, 3)$, $X_2 = (3, -2, 1)$ and $X_3 = (1, -6, 5)$ [5][\text{CO}\#1, \text{CO}\#2]

SEMESTER

M.Tech.

Roll No.

END TERM EXAMINATION

NOV-2024

ITY531: MALWARE ANALYSIS

Time: 3 Hours

Max. Marks: 40

Note : All questions are compulsory.

All questions carry equal marks.

Assume suitable missing data, if any.

Q.1 Explain the following in brief: [2x4][CO1,CO2,CO4,CO5][L1]

- What is Metamorphic code?
- What is Dalvik VM sandbox.
- What are sensitive contents in Android System?
- Explain microkernel based operating system.

Q.2 [4x4][CO1,CO2][L2,L3]

- Discuss "Good" viruses/worms.
- How homogeneity of software affect the prevalence of malware?

Q.3 [4x4][CO2,CO3][L6,L5]

- Design a procedure to install Ubuntu OS in an Oracle virtual box.
- Develop a procedure to analyse Cyber Attacks in the year 2024.

Q.4 [4x4][CO3, CO4][L5,L4]

- Design a procedure to patch copy.exe executable file.
- Explain in detail Parcel's role in Android apps communicate with each other.

Q.5 [4x4][CO4, CO5][L5,L3]

- Develop a procedure for packing obfuscates strings.
- Explain statically, runtime, and dynamically linking in binary executable files.

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Roll No. 29/ITY/19

FIRST SEMESTER

M.Tech. (IT)

MID SEMESTER EXAMINATION

September-2024

ITY-505 ADVANCED OPERATING SYSTEM

Time: 1:30 Hours

Max. Marks : 25

Note : All questions are compulsory.
Assume suitable missing data, if any.

1. Explain the following in brief:-

- [a] Dining philosoper's problem [1 Mark]
- [b] AND Request model of deadlock [1 Mark]
- [c] Path Expressions [1.5 Marks]
- [d] Serializer [1.5 Marks]

2[a] A counting semaphore S is initialized to 7. Then 20 P operations and 15 V operations are performed on S. What is the final value of S?

[1.5 Marks]

[b] Consider a system having m resources of same type. These resources are shared by three processes A, B and C. These have a peak demand of 3, 4 and 6 units of the resource respectively. For what value of m, deadlock will not occur?

[1.5 Marks]

[c] Suppose there are three processes P1, P2 and P3 and three resources R1, R2 and R3. There are 2 units of R1 and 1 unit of R2. R3 is a consumable resource and P3 is the producer of R3. P1 holds one unit of R2 and P2 holds one unit of R1. P1 has requested 1 unit of R1 and 1 unit of R3. Draw a general resource graph for this.

[2 Marks]

3[a] What are the various design issues in distributed OS?

[2 Marks]

[b] Write Chandy lamport's Global state recording algorithm.

[3 Marks]

4. Consider the space time diagram given in the figure 1. Assume that the logical clocks store only integer values and the initial logical clock values are all initialized to zero. Also assume that after each event, the corresponding logical clock is incremented by 1.

- [a] List the lamport timestamps for each event shown in figure 1. [2 Marks]

- [b] List the vector timestamps for each event shown in figure 1 [3 Marks]

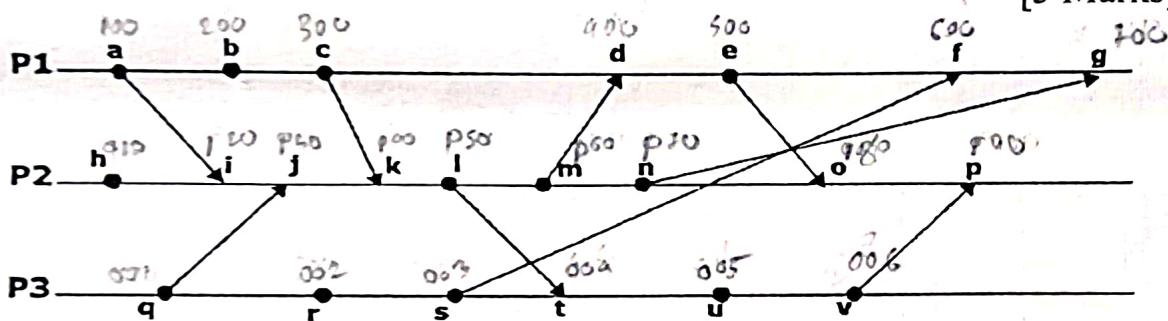


Figure 1

5. Consider the space-time diagram given in figure 2. Use SES (Schiper-Eggli-Sandoz Algorithm) to decide whether a message is to be buffered or delivered. Write the logical clock values and the vector V_P values, for each message send and receive events. (Assume that the logical clocks store only integer values and the initial logical clock values are all initialized to zero. Also assume that after each event, the corresponding logical clock is incremented by 1.)

[5 Marks]

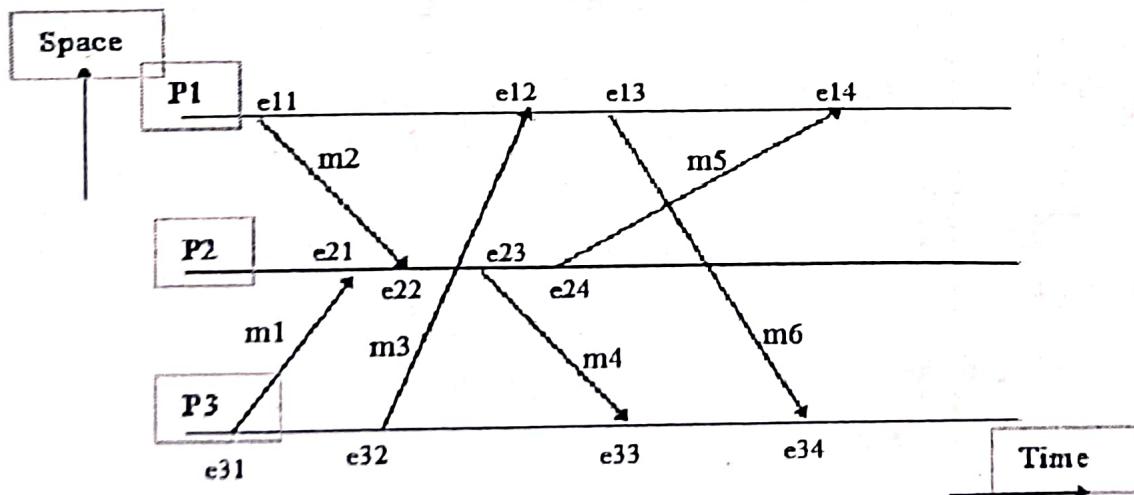


Figure 2

Total No. of Pages: 2

Roll No. 24/ITY/19

V/VII SEMESTER

B.Tech

MID TERM EXAMINATION

September-2024

COURSE CODE: ITY 507 COURSE TITLE: FUNDAMENTAL OF MACHINE LEARNING

Time: 1:30 Hours

Max. Marks: 20

Note: All question is compulsory.

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Assume suitable missing data, if any.

1. Describe the different types of machine learning algorithms: supervised, unsupervised, semi-supervised, and reinforcement learning, highlighting their key characteristics and examples. Discuss the common challenges and issues faced in each type, such as overfitting, under-fitting, data scarcity, computational complexity, and interpretability. How can these challenges be addressed in real-world applications? [4] CO#1
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 - a) Calculate the mean, median, and standard deviation of the sales data.
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3. Consider the simple linear regression model given by the equation $y = wx + b$, where w is the weight, b is the bias, and x is the input feature. You are given the following dataset of points (x, y) :

x	1	2	3	4
y	2	3	5	4

Assume that the initial weights and bias are $w = 0$ and $b = 0$. Use gradient descent to update the weights and bias. Follow these steps:



$$y = (x - \bar{x})^2$$

↑
y = mean

- a) Calculate the mean squared error (MSE) loss for the initial parameters.
 b) Compute the gradients of the loss with respect to w_{www} and b_{bbb} .
 c) Update w and b using a learning rate of $\alpha=0.01$.
 d) Perform one iteration of gradient descent and provide the updated values for w and b . [4][CO#1]

4. A multiclass classifier predicts labels for a dataset containing 5 classes (A, B, C, D, E). The confusion matrix for the classifier's predictions is as follows: [4][CO#2]

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Actual D	0	1	2	15	1
Actual E	1	1	0	2	20

- a) Calculate Precision, Recall, and F1 Score for each class.
 b) Calculate the Overall Accuracy of the classifier. ✓
 c) Compute the Macro and Micro Averages of the F1 Score.
5. A binary classifier is tested on a dataset of 100 samples. The following confusion matrices are observed at different decision thresholds:

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0.9	10	1	89	0
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0.5	20	10	80	10
0.3	25	15	75	15
0.1	30	25	65	20

- a) Calculate the True Positive Rate (TPR) and False Positive Rate (FPR) for each threshold. ✓
 b) Plot the ROC curve using the calculated TPR and FPR values. ✓
 c) Based on the ROC curve, explain how to evaluate the performance of the classifier. [4][CO#2]

Total no. of Pages: 2

1st SEMESTER

Roll no.....

Ph.D/ M.Tech.

END TERM EXAMINATION

Nov-2024

SM901/RUCC503 : Research Methodology & IPR

Time: 03:00 Hours

Max. Marks: 50

Note : All questions carry equal marks.

Assume suitable missing data, if any.

Q.1 What do you understand by research methodology, state the types of research, and apprehend the steps that need to be accomplished in order to complete a research study? [10][CO1][BTL1]

Q.2 How do you formulate a research problem? What considerations should a researcher keep in mind while formulating a research question and discuss the importance of literature review in approaching a research problem? [10][CO2][BTL2]

Q.3 "A sample may be large yet worthless because it is not random; or it may be random but unreliable because it is small." Comment upon the above statement and explain the importance of sampling in daily life.

[10][CO3][BTL2]

OR

You need to assess the effectiveness of a new teaching scheme by comparing the test scores of the same group of students before and after the implementation of the scheme. The following data is given:

Before scores: 76, 88, 65, 56, 76

After scores: 85, 95, 75, 60, 81

Determine if there is a significant difference in the average test scores before and after the implementation of the scheme. (critical t-value is 2.776) [10][CO3][BTL4]