USN | | | | | | | | | | **20SCN/SCE/SSE/SCS/SIT/SIS/SFC/LNI/SAM/SCR11**

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Mathematical Foundations of Computer Science

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Define linearly independent and linearly dependent vectors.
        Show that the vectors $v_1 = (1, 1, 2, 4)$, $v_2 = (2, -1, -5, 2)$, $v_3 = (1, -1, -4, 0)$ and $v_4 = (2, 1, 1, 6)$ are linearly dependent in $R^4(R)$.   **(06 Marks)**

    b. Define the terms basis and dimension. Find the basis for the subspace W spanned by $\{v_1, v_2, v_3, v_4\}$.
$$v_1 = \begin{bmatrix} 1 \\ -3 \\ 4 \end{bmatrix}, \ v_2 = \begin{bmatrix} 6 \\ 2 \\ -1 \end{bmatrix}, \ v_3 = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}, \ v_4 = \begin{bmatrix} -4 \\ -8 \\ 9 \end{bmatrix}$$
        Also find dimension of W.   **(07 Marks)**

    c. Define linear transformation. Linear transformation defined by $T:R^2 \rightarrow R^3$ by $T(x) = Ax$,
$$\text{Let } A = \begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 7 \end{bmatrix}, \ u = \begin{bmatrix} 2 \\ -1 \end{bmatrix}, \ b = \begin{bmatrix} 3 \\ 2 \\ -5 \end{bmatrix}$$
        Find $T(u)$, the image of u under the transformation T. Also find an x in $\mathbb{R}^2$ whose image under T is b.   **(07 Marks)**

OR

2   a. Define vector space and subspace.   **(06 Marks)**

    b. Define the term coordinate system. Find the coordinate vector $[x]_B$ of x relative to the given basis
$$b_1 = \begin{bmatrix} 1 \\ -1 \\ -3 \end{bmatrix}, \ b_2 = \begin{bmatrix} -3 \\ 4 \\ 9 \end{bmatrix}, \ b_3 = \begin{bmatrix} 2 \\ -2 \\ 4 \end{bmatrix}, \ x = \begin{bmatrix} 8 \\ -9 \\ 6 \end{bmatrix}$$
        (07 Marks)

    c. The set $B = \{1 + t^2, t + t^2, 1 + 2t + t^2\}$ is a basis for P_2. Find the coordinate vector of $P(t) = 1 + 4t + 7t^2$ relative to B. Also test the linear independence of the set of polynomials.   **(07 Marks)**

Module-2

3   a. Verify that $\{u_1, u_2\}$ is an orthogonal set, and then find the orthogonal projection of y onto span $\{u_1, u_2\}$.
$$u_1 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \ u_2 = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}, \ y = \begin{bmatrix} -1 \\ 4 \\ 3 \end{bmatrix}$$
        (06 Marks)

    b. Let $u_1 = \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}, u_2 = \begin{bmatrix} -2 \\ 1 \\ 1 \end{bmatrix}$ and $y = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ $\{u_1, u_2\}$ is an orthogonal basis for
        $W = \text{span} \{u_1, u_2\}$. Write y as the sum of a vector in W and a vector orthogonal to W.   **(07 Marks)**

c. If $A = \begin{bmatrix} 3 & 1 \\ 6 & 2 \\ 0 & 2 \end{bmatrix}$. Find the QR factorization of A. **(07 Marks)**

OR

4 a. Define orthogonal basis. Show that $\{u_1, u_2, u_3\}$ is an orthogonal basis for $\mathbb{R}^3$. Then express x as a linear combination of the vector u_1, u_2, u_3.

$u_1 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, $u_2 = \begin{bmatrix} -1 \\ 4 \\ 1 \end{bmatrix}$, $u_3 = \begin{bmatrix} 2 \\ 1 \\ -2 \end{bmatrix}$, $x = \begin{bmatrix} 8 \\ -4 \\ -3 \end{bmatrix}$ **(06 Marks)**

b. Find an orthogonal basis for the column space of the matrix

$\begin{bmatrix} 3 & -5 & 1 \\ 1 & 1 & 1 \\ -1 & 5 & -2 \\ 3 & -7 & 8 \end{bmatrix}$ using Gram-Schmidt process. **(07 Marks)**

c. Find a least square solution of $Ax = b$ for $A = \begin{bmatrix} 1 & -2 \\ -1 & 2 \\ 0 & 3 \\ 2 & 5 \end{bmatrix}$, $b = \begin{bmatrix} 3 \\ 1 \\ -4 \\ 2 \end{bmatrix}$ **(07 Marks)**

Module-3

5 a. Make a change of variable $x = py$, that transforms the quadratic form $x_1^2 - 8x, x_2 - 5x_2^2$ into a quadratic form with no cross product term. **(10 Marks)**

b. Find a singular value decomposition of $A = \begin{bmatrix} 4 & 11 & +14 \\ 8 & 7 & -2 \end{bmatrix}$ with eigen values of A^TA are 360, 90 and 0. **(10 Marks)**

OR

6 a. Find:
   i)   Maximum value of Q(x) subject to the constraint $x^Tx = 1$
   ii) A unit vector u where this maximum is attained
   iii) The maximum of Q(x) subject to the constraints $x^Tx = 1$ and $x^Tu = 0$. Given
        $Q(x) = x_1^2 + x_2^2 - 10x_1 x_2$ **(10 Marks)**

b. Three measurements are made on each of four individuals in a random sample from a

population. The observation vectors are $X_1 = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$, $X_2 = \begin{bmatrix} 4 \\ 2 \\ 13 \end{bmatrix}$, $X_3 = \begin{bmatrix} 7 \\ 8 \\ 1 \end{bmatrix}$, $X_4 = \begin{bmatrix} 8 \\ 4 \\ 5 \end{bmatrix}$.

Compute the sample mean and the covariance matrix. **(10 Marks)**

Module-4

7 a. Compute the coefficient of correlation between X and Y using the following data:

X: 1   3   5   7   8   10
Y: 8   12 15 17 18 20

(06 Marks)

b. A study of prices of rice at Chennai and Mumbai gave the following data:

	Chennai	Mumbai
Mean	19.5	17.75
SD	1.75	2.5

Also the coefficient of correlation between the two is 0.8. Estimate the most likely price of rice (i) at Chennai corresponding to the price of 18 at Mumbai (ii) at Mumbai corresponding to the price of 17 at Chennai. **(07 Marks)**

c. Fit a curve of the form $y = ax^b$ to the following data and estimate y at x = 12.

x : 20 16 10 11 14
y : 22 41 120 89 56

(07 Marks)

OR

8 a. Find the angle between the two lines of regression. **(06 Marks)**

b. Fit an equation of the form $y = a_0 + a_1x_1 + a_2x_2$ to the given data:

x_1	1	2	3	4
x_2	10	1	2	3
y	12	18	24	30

(07 Marks)

c. X_1, X_2, X_3 are three variates measured from their means with N = 10, $\sum X_1^2 = 90$, $\sum X_2^2 = 160$, $\sum X_3^2 = 40$, $\sum X_1X_2 = 60$, $\sum X_2X_3 = 60$, $\sum X_1X_3 = 40$. Calculate the multiple correlation coefficient $R_{1.23}$ **(07 Marks)**

Module-5

9 a. If the random variable X takes the values 1, 2, 3 and 4 such that $2P(X = 1) = 3P(X = 2) = P(X = 3) = 5P(X = 4)$. Find the probability distribution and $P(1 \leq X < 3)$ and $P(X \geq 3)$ **(06 Marks)**

b. A continuous random variable X has a p.d.f $f(x) = Kx^2e^{-x}$, $x \geq 0$. Find K, mean and variance. **(07 Marks)**

c. Fit a binomial distribution for the following data and also test the goodness of fit.

x : 0 1 2 3 4 5 6 Total
f : 5 18 28 12 7 6 4 80

To find the binomial distribution $N(p + q)^n$, which fits the given data, $\left(\chi_{0.02}^2 (v = 2) = 5.99\right)$. **(07 Marks)**

OR

10 a. The following data represents the biological values of protein from cow's milk and buffalo's milk at a certain level.

Cow's milk   1.82 2.02 1.88 1.61 1.81 1.54
Buffalo's milk   2.00 1.83 1.86 2.03 2.19 1.88

Examine if the average values of protein in the two samples significantly differ $(t_{0.05} (v = 10) = 2.23)$ **(06 Marks)**

b. The following data give the number of air craft accidents that occurred during the various days of a week:

Days:	Mon	Tues	Wed	Thu	Fri	Sat
No. of accidents:	15	19	13	12	16	15

Test whether the accidents are uniformly distributed over the week $\left(\chi_{0.05}^2 (v = 5) = 11.07\right)$. **(07 Marks)**

c. The probability density function of a variable X is

X :   0   1   2   3   4   5   6
P(X) : k   3k   5k   7k   9k   11k   13k

Find k and $P(X < 4)$, $P(X \geq 5)$, $P(3 < X \leq 6)$ **(07 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐ 20SCS/SAM12

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Artificial Intelligence and Machine Learning

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Artificial Intelligence. List and explain the four categories of Intelligence Systems. **(10 Marks)**
   b. Define Production System. Describe the usage of production rules considering the Water Jug problem as an example. **(10 Marks)**

OR

2 a. Describe approach1 and approach2 for implementing the Tic-Tac-Toe game along with advantages and disadvantages of each approach. **(10 Marks)**
   b. With an example and algorithm, describe the A* algorithm for implementing Best First Search. **(10 Marks)**

Module-2

3 a. Define Terminal Node. Non-Terminal AND Node and Non-Terminal OR Node. Describe AO* algorithm with an example. **(10 Marks)**
   b. Along with the steps in MIN MAX strategy and functions used, describe the MIN MAX algorithm. **(10 Marks)**

OR

4 a. Define Well-Formed Formula (WFF). List and explain any four equivalence laws with name of relation and equivalence relations. **(10 Marks)**
   b. List the steps taken to transform the formula into a equivalent Conjunctive Normal Form (CNF). Convert the formula $(\sim A \rightarrow B) \wedge (C \wedge \sim A)$ into its equivalent CNF. **(10 Marks)**

Module-3

5 a. Describe the searching the World Space and searching the Plan space as part of planning as a search strategy. **(10 Marks)**
   b. Explain the Mean End Analysis (MEA) algorithm considering the Robot moving a large table with two objects as an example. **(10 Marks)**

OR

6 a. With suitable example and diagram, describe the knowledge representation using semantic networks. **(10 Marks)**
   b. With suitable example, structures and list of facets, explain the knowledge representation using frames. **(10 Marks)**

Module-4

7 a. Describe Joint Probability and Conditional Probability with suitable equations and examples. **(10 Marks)**
   b. List the advantages and disadvantages of Bayesian Belief Networks. **(10 Marks)**

OR

8 a. With a neat diagram, explain the components of Learning system. **(10 Marks)**
   b. Define Clustering. Explain the classification of clustering algorithms. **(10 Marks)**

Module-5

9 a. Describe the Case Representation Models along with the major challenges in Case Based Reasoning methods. **(10 Marks)**
   b. List and explain the tools for Case Based Reasoning methods. **(10 Marks)**

OR

10 a. Describe the Neuron Model with a neat diagram and activation functions along with the definition of Artificial Neural Networks (ANN). **(10 Marks)**
    b. List and explain the Design Issues of Artificial Neural Networks (ANN). **(10 Marks)**

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20SCS13

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Advances in Database Management System

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Describe the following schema-based constraints:
    i)   Domain constraints
    ii)   Key constraints
    iii) Entity integrity constraints
    iv)   Referential Integrity Constraints.   **(10 Marks)**
   b. Briefly explain the mapping of EER schema to an ODB schema.   **(10 Marks)**

OR

2 a. Discuss the different types of update operations on a relation. Show an example of the violation of integrity constraints in each of the three types of update operations.   **(10 Marks)**
   b. What is the difference between persistent and transient objects? How is persistence handled in a typical OODBS? Explain with example.   **(10 Marks)**

Module-2

3 a. What are the main goals of the RAID technology? How does it achieve them?   **(10 Marks)**
   b. What is Buffering? Discuss the responsibilities of the buffer managers buffer replacement strategies.   **(10 Marks)**

OR

4 a. Discuss data fragmentation and replication method of storing data in a distributed database.
                                                                             (10 Marks)
   b. Briefly explain concurrency control and recovery in distributed databases.   **(10 Marks)**

Module-3

5 a. Discuss the characteristics of many NOSQL and explain how these systems are different from traditional SQL systems.   **(10 Marks)**
   b. What are the data modeling concepts used in MongoDB? What are the main CRUD operations of MongoDB?   **(10 Marks)**

OR

6 a. Explain the Map and Reduce functions of the MapReduce programming model.   **(10 Marks)**
   b. Explain YARN Architecture with a neat diagram.   **(10 Marks)**

Module-4

7 a. Explain the generalized model for active databases and oracle triggers.   **(10 Marks)**
   b. Write short notes on:
    i)   Spatial Databases
    ii)   Deductive database.   **(10 Marks)**

OR

8 a. Briefly explain all the four information retrieval models. (10 Marks)

b. Write short notes on:
   i) Inverted Indexing
   ii) Text preprocessing. (10 Marks)

Module-5

9 a. Define support and confidence. Explain Apriori algorithm for finding frequent Itemsets. (10 Marks)

b. What is classification? Write the algorithm for Decision Tree Induction and also explain with an example. (10 Marks)

OR

10 a. What is Data Warehouse? Explain the architecture of Data warehouse with a neat diagram. (10 Marks)

b. What is multidimensional model? Explain the star schema and snowflake schema. (10 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐   **20SCS15**

First Semester M.Tech. Degree Examination, Jan./Feb.2021
Internet of Things and Applications

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Define Internet of Things. Justify internet of things is "Just a concept" and "An infrastructure".   (10 Marks)
    b. Explain any four applications of automotives.   (10 Marks)

OR

2   a. Explain IOT framework with respect to high Level M2M System Architecture (HLSA).
                                                                               (10 Marks)
    b. Explain the role of IPV6 in IOT.   (10 Marks)

Module-2

3   a. Compare contactless smart card and RFID tags.   (10 Marks)
    b. Discuss structural aspects of IOT.   (10 Marks)

OR

4   a. Explain the RPL ROLL routing protocols.   (10 Marks)
    b. With a neat sketch, explain 3GPP service model and architecture.   (10 Marks)

Module-3

5   a. List and explain IEEE 802.15.4 frames.   (10 Marks)
    b. Describe the architecture of Bluetooth system with HDP and applications. (10 Marks)

OR

6   a. Explain the interaction between NFC interrogator and NFC device communicates. (10 Marks)
    b. With neat diagram, explain the overall network architecture of the Evolved Packet System (EPS) network elements.   (10 Marks)

Module-4

7   a. With neat diagram, explain home automation IOT system-mode service and state service.
                                                                               (10 Marks)
    b. Show how the communication occurs between various components of the web socket implementation of the weather monitoring system.   (10 Marks)

OR

8   a. With neat diagram, explain smart parking IOT system.   (10 Marks)
    b. Explain smart irrigation system with python code for controller native service. (10 Marks)

Module-5

9   a. Explain the procedure to you setup Hadoop cluster.   (10 Marks)
    b. Write note on : (i) Hadoop map reduce   (ii) Hadoop yarn.   (10 Marks)

OR

10 a. Explain Oozie workflow for computing machine status error codes with min count.
                                                                               (10 Marks)
    b. Explain Apache storm for real time data analysis.   (10 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐   **20SCS14**

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Advanced Algorithms

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the various Asymptotic notations with related graphs and suitable examples.
   (08 Marks)
   b. Use a recursion tree to determine a good asymptotic upper bound on the recurrence relation $T(n) = 3T(n/4) + Cn^2$. **(08 Marks)**
   c. State the Master theorem and solve the following recurrence relations using Master theorem.
 $T(n) = 2T(n/2) + n$. **(04 Marks)**

OR

2 a. Define Amortized Analysis. Explain the Accounting method of Amortized analysis.
   (08 Marks)
   b. Explain the aggregate analysis techniques used in amortized analysis using multipop stack and binary counter problems. **(08 Marks)**
   c. Using substitution method, solve the following recurrence relation $T(n) = 2T(n/2) + \theta(n)$.
   (04 Marks)

Module-2

3 a. Write the Complete Bellman – Ford Algorithm with initialize and Relax functions for solving single source Shortest path problem. Trace it for the graph, Shown in Fig. Q3(a).
   **(10 Marks)**

Fig. Q3(a)
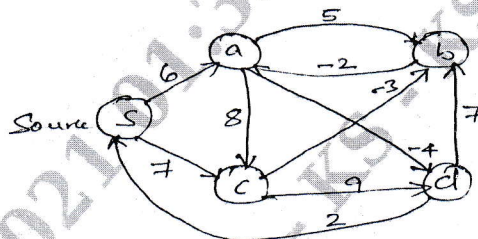
   b. Describe how to find maximum bipartite matching for a given graph, considering suitable example. **(05 Marks)**
   c. Write and explain Interative FFT. **(05 Marks)**

OR

4 a. Write Johnson's Algorithm to solve. All – pairs shortest path problem. **(05 Marks)**
   b. Explain the point value representation of a polynomial with examples. **(05 Marks)**
   c. Give Ford – Fulkerson Algorithm for solving the maximum flow problem. Apply the same algorithm to find the maximum flow for the graph. Shown in Fig. Q4(c). **(10 Marks)**

Fig. Q4(c)
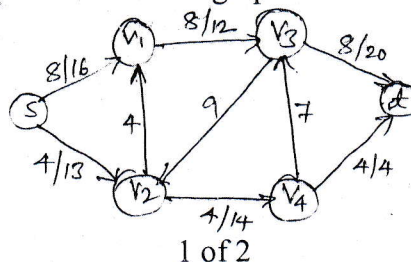
Module-3

5 a. Write extended Euclid's algorithm for computing GCD of two numbers. Find gcd(99, 78), using extended Ecludian algorithm and show the computation steps at each level of recursion. **(06 Marks)**

b. Discuss the Chainese remainder theorem. Find solution to the equation $a \equiv 2 \pmod 5$ and $a \equiv 3 \pmod{13}$. **(10 Marks)**

c. Define a group and list its properties. **(04 Marks)**

OR

6 a. Write the procedural steps of the RSA public key cryptosystem. Also, consider an RSA key set with P = 61, q = 53 and e = 17. What value of d should be used in the secret key? What is the encryption of the message M = 65? **(10 Marks)**

b. Write and explain an algorithm to solve modular linear equation. **(05 Marks)**

c. Write an algorithm to find factors of small numbers using 'Pollard – Rho'. **(05 Marks)**

Module-4

7 a. Explain string matching with Finite Automation. Also write the same transition diagram and the transition function of the string matching automation that accepts all the strings containing the pattern P = ababaca. **(10 Marks)**

b. Write Compute – prefix function of Knuth – Morris – Pratt algorithm. Apply it on the pattern a b a b a b a b c a. Indicate the running time of KMP algorithm. **(10 Marks)**

OR

8 a. Write and explain the Rabin – Karp string matching algorithm. Working modulo q = 13, demonstrate this algorithm for the test 2 3 5 9 0 2 3 1 4 1 5 2 6 7 3 9 9 2 1 and pattern 3 1 4 1 5. **(10 Marks)**

b. Write Bayer – Moore string matching algorithm. Illustrate it on the input.
Text : BESS_KNEW_ABOUT_BAOBABS
Pattern : BAOBAB. **(10 Marks)**

Module-5

9 a. Describe how to randomize the deterministic algorithm considering the following problems :
i) Linear Search Algorithm   ii) Quick Sort Algorithm. **(10 Marks)**

b. Write and explain Manto Carlo Algorithm for testing polynomial equality, with the help of suitable example. **(10 Marks)**

OR

10 a. Write and explain probabilistic and Randomizing deterministic algorithms with an example. **(10 Marks)**

b. Describe Las Vegas algorithm for the problem of searching a list with repeated elements. **(10 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐   **20RMI17**

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Research Methodology and IPR

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Discuss in brief on:
   (i) Objectives of research
   (ii) Types of research with a reference to:
       (1) Descriptive versus analytical
       (2) Quantitative versus qualitative   **(10 Marks)**
   b. Explain with short note on the criteria of good research.   **(10 Marks)**

OR

2 a. Explain with a brief note on any four conditions to be met while defining Research Problem.
                                                                             (10 Marks)
   b. Discuss the necessary observations which help in development of hypothesis.   **(10 Marks)**

Module-2

3 a. What is research problem? Define the main issues, which should receive the attention of the researcher in formulating the research problem.   **(10 Marks)**
   b. Describe fully the techniques of defining research problem with example.   **(10 Marks)**

OR

4 a. Summarize the literature review functions in research work and state the way in which it can help research.   **(08 Marks)**
   b. What are the steps involved to conduct literature review for research and explain each one briefly.   **(12 Marks)**

Module-3

5 a. List and explain various involved in sample design.   **(10 Marks)**
   b. With neat diagrams, explain different types of sample designs.   **(10 Marks)**

OR

6 a. Define measurement. List different types of errors in measurement.   **(06 Marks)**
   b. Write short notes on:
      (i) Test of validity
      (ii) Test of Reliability   **(10 Marks)**
   c. Define data collection. Explain the interview method in detail.   **(04 Marks)**

Module-4

7 a. What is hypothesis? Explain characteristics of hypothesis in brief.   **(10 Marks)**
   b. Explain hypothesis testing for difference between proportions.   **(10 Marks)**

OR

8 a. What are the limitations of the tests of hypothesis?   **(08 Marks)**
   b. What is Chi-square testing? Briefly explain Chi-Square as a test for comparing variance.
                                                                                                 (12 Marks)

Module-5

9 a. Explain layout of the research report.   **(10 Marks)**
   b. Mention emphasis topics of technical report. Write a general outline of a technical report.
                                                                                                 (10 Marks)

OR

10 a. Write short notes on intellectual property system in India.   **(06 Marks)**
    b. Summarize the salient provisional points in patents.   **(10 Marks)**
    c. What is TRIPS agreement? Outline the issues and features of the TRIPS agreement.
                                                                                                 (04 Marks)

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