

Registration No.:

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Total Number of Pages: 02

Course: M.Tech
Sub_Code: 23PC1001

1st Semester Regular Examination: 2023-24
SUBJECT: Data Science
BRANCH(S): COMPUTER SCIENCE & ENGG. (DATA SCIENCE)

Time: 3 Hour

Max Marks: 100

Q.Code: N484

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- Differentiate between structured and unstructured data.
- What is OLAP?
- Define Data Science and Big Data.
- Write the common errors in retrieving data.
- Define correlation coefficient.
- What is metadata?
- Differentiate between discrete and continuous variables.
- Write the difference between qualitative data and quantitative data.
- List the attributes of Numpy array.
- Define Spatial Data Mining.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain multidimensional data analysis with example.
- Write the different processes of data cleaning.
- What do you mean by data reduction? Explain.
- Describe constraint-based Association Mining.
- Explain Bayesian classification with example.
- What is rule based classification? Explain.
- What do you mean by the lazy learners? Explain with example.
- Explain how the accuracy of a Classifier or Predictor is done.
- Write the different ensemble methods in machine learning.
- What is clustering? Describes K - Means clustering algorithm with example.
- What is outlier analysis? Explain.
- What is text mining? Explain with example.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** What is a data warehouse? Outline the architecture of a data warehouse with neat diagram. **(16)**
- Q4** Describe the algorithm of Support Vector Machine with suitable diagrams. **(16)**
- Q5** For the following given Transaction Data set, generate rules using Apriori Algorithm, the association rule mining. **(16)**
Consider the values as Support = 50% and Confidence = 75%

| Transaction ID | Items Purchased |
|----------------|---------------------------|
| 1 | Bread, Cheese, Egg, Juice |
| 2 | Bread, Cheese, Juice |
| 3 | Bread, Milk, Yogurt |
| 4 | Bread, Juice, Milk |
| 5 | Cheese, Juice, Milk |

- Q6** Explain about various visualization charts like line plots, scatter plots and histograms using Matplotlib with examples. **(16)**

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Total Number of Pages: 02

Course: M.Tech
Sub_Code: 23PC1002

1st Semester Regular Examination: 2023-24
SUBJECT: Advanced Data Structure and Algorithm
BRANCH(S): COMPUTER SCIENCE & ENGG (DATA SCIENCE)

Time: 3 Hour

Max Marks: 100

Q.Code: N590

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define the single source shortest paths problem.
- What is the purpose of Dijkstra's Algorithm?
- Write the differences between spanning tree and minimum spanning tree.
- What is Binary heap?
- How NP-hard problems are different from NP-Complete?
- What is a circular queue? How do you check the queue full condition?
- Define Binomial Heap.
- Define Splay Tree.
- Define B-tree
- What are the drawbacks of AVL trees?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Solve the recurrence relation: $T(n) = 3T(n/4) + n$
- Determine an LCS of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$.
- Explain the methodology of Dynamic programming. List the applications of Dynamic programming.
- Write the algorithms for PUSH, POP, and change operations on stack. Using these algorithms, how do you check whether the given string is a palindrome?
- A file contains only colons, spaces, newlines, commas and digits in the following frequency. colon- 100, space - 605 newline- 100, comma- 705, 0- 431, 1- 242, 2- 176, 3- 59, 4- 185, 5- 250, 6- 174, 7- 199, 8- 205, 9- 217. Construct the Huffman code. Explain Huffman algorithm
- Write the algorithm to compute 0/1 Knapsack problem using dynamic programming and explain it.
- Explain topological sorting with example.
- The single source shortest path problem with an example.

- i) Write an algorithm for 2-3 Tree deletion and discuss its analysis.
- j) Find out the inorder, preorder, postorder traversal for the binary tree representing the expression $(a + b*c)/(d - e)$ with the help of procedures.
- k) Show step by step process for constructing binary heap using the following data 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13, and 2.
- l) Write and explain Floyd-Warshall's algorithm.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

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| Q3 | Describe in detail about merge sort with an example. | (16) |
| Q4 | Explain in detail about the Single-Source Shortest Paths in DAGs. | (16) |
| Q5 | Explain the relationship between class P, NP, NP- complete and NP hard problem with example of each class. | (16) |
| Q6 | Discuss in detail about Backtracking with N-Queens Problem. | (16) |

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Total Number of Pages: 02

Course: M.Tech
Sub_Code: 23PC1003

1st Semester Regular Examination: 2023-24
SUBJECT: Scientific Computing
BRANCH(S): COMPUTER SCIENCE & ENGG(DATA SCIENCE)

Time: 3 Hour
Max Marks: 100
Q.Code: N536

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

- Q1 Answer the following questions: (2 x 10)
- Define round of error. Explain with an example.
 - Write the condition that the system $AX=b$ is uniquely determined.
 - Find the LU factorization of $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$
 - Find the root of the interval for the equation $\cos x = xe^x$.
 - Write the formulas for 2 point and 3 point forward difference and centered difference.
 - Use Newton's method to solve $e^x = x^2$ using initial guess $x_0 = 1$. Do two iterations.
 - Determine the Eigen values of $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$.
 - Use Trapezoidal rule approximate $\int_1^2 e^{x^2} dx$. Use the step size $h = 0.2$.
 - Write the gauss quadrature formula for $\int_a^b f(x) dx$.
 - Which of the following method is better? Give reason.
(i) Runge-Kutta 4th Order (RK4) (ii) Forward Euler Method.

Part-II

- Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)
- Convert the base 10 number $d = 11.5625$ to base 2.
 - Convert 1101101.1011 to decimal format
 - Use Gaussian elimination to solve the following system of equations
$$y + 4z = 9, \quad 2x + 4y + 6z = 16, \quad 5x + 6y = 6$$
 - Approximate the derivative of $f(x) = \cos^2 x$ at $x = 1$, using forward, backward and centered difference approximation. Use $h = 1$ and $h = 0.1$
 - Use Secant method to approximate the root of the equation $e^x = x^2$, initial guess $x_0 = -1$. Do two iterations

- f) Use Bisection method and find the smallest positive root of the equation, $\sin x = \cos x$.
- g) Use the Eigen function power method to find the largest Eigen values of the matrix.

$$A = \begin{bmatrix} 2 & 3 & 2 \\ 1 & 0 & -2 \\ -1 & -3 & -1 \end{bmatrix}$$
- h) Find an interpolating polynomial using the points (0,1),(1,2),(2,3),(3,6),(4,9).
- i) Find a line of best fit for the set of points (1,1), (1.5, 1), (2.5, 1.5),(3,1.5), (4,2), (7,3.5).
- j) Apply Gauss quadrature two point formula to approximate $\int_1^2 \sin x \, dx$.
- k) Use composite midpoint rule with 10 sub intervals approximate $\int_2^3 \log x$.
- l) Convert the following scalar ODE to a first order vector ODE

$$y'''(t) - ty''(t)y'(t) + y'(t) - ty(t) + \sin t = 0, y(t_0) = y_0, y'(t_0) = z_0, y''(t_0) = w_0$$

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Find Taylor series approximations using quadratic polynomials for the function $f(x) = e^x$ at $x = 0.9$, using the expansion point $x_0 = 1$. Find an upper bound on the error using Taylor's theorem and compare it to the actual error. **(16)**
- Q4** Determine the Eigen values and Eigen vectors of the matrix **(16)**

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$
- Q5** Use composite Simpson rule with 10 sub intervals approximate $\int_1^2 e^{x^2} \, dx$. **(16)**
- Q6** Use gauss-Jordan Elimination solve the system of equations. **(16)**

$$3x + y = 1, \quad x - y + z = 1, \quad y + 2z = 1$$

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Course: M.Tech
Sub_Code: 23PC1004

1st Semester Regular Examination: 2023-24
SUBJECT: Optimization Techniques
BRANCH(S): COMPUTER SCIENCE & ENGG (DATA SCIENCE)
Time: 3 Hour
Max Marks: 100
Q.Code: N563

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- a) At origin, discuss the continuity of $f(x, y) = \begin{cases} \frac{xy}{x^2 + y^2}, & x^2 + y^2 \neq 0 \\ 0 & , x = y = 0 \end{cases}$.
- b) Explain convex combination with an example.
- c) Define sample space. Give an example of it.
- d) A fair die is tossed. Find the probability of getting a 4, 5, or 6 on the first toss and a 1, 2, 3, or 4 on the second toss.
- e) Prove or disprove that all feasible solutions are basic feasible solutions.
- f) If a dual has unbounded solution, then what can you say about the solution of corresponding primal problem.
- g) Differentiate constrained and unconstrained optimization problem with examples.
- h) Write 2 limitations of linear programming.
- i) When the quadratic form $x^T Q x$ negative-semi definite?
- j) What is a general nonlinear programming problem?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- a) Prove that the set of all convex combinations of a finite number of points of $s \subset \mathbb{R}^N$ is convex set.
- b) Do the vectors $\{(1,1,0), (1,1,1), (1,0,0), (1,2,3)\}$ form a basis for \mathbb{R}^3 . Justify your answer
- c) If $\{x_1, x_2, x_3, \dots, x_n\}$ is a basis for a vector space V , then show that any vector $x \in V$ can be represented uniquely as $x = \alpha_1 x_1 + \alpha_2 x_2 + \dots + \alpha_n x_n$, where $\alpha_i \in \mathbb{R}, i = 1, 2, 3, \dots n$.

- d) Solve the LPP Maximize $z = 2x_1 + x_2$ subject to the constraints:
 $x_1 + 5x_2 \leq 15, 6x_1 + 2x_2 \leq 24; x_1, x_2 \geq 0$ by simplex method.
- e) A firm manufactures headache pills in two sizes A and B . Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine. It is found by users that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as a standard LPP. Also solve the formulated LPP.
- f) Write a short note on Karmakar's method for duality.
- g) Using Newton's method, find the minimizer of $f(x) = \frac{1}{2}x^2 - \sin x$.
- h) Write short notes on One-dimensional Search method.
- i) Write short notes on Conjugate direction method.
- j) Consider the nonlinear programming problem: $Min z = x_1^2 + 0.5x_2^2 + 3x_2 + 4.5$, subject to $x_1, x_2 \geq 0$. Is the FONC for a local minimizer satisfied at $x = [0,3]^T$?
- k) Consider the function $f: \mathbb{R}^2 \rightarrow \mathbb{R}$ defined by $f(x) = x^T \begin{bmatrix} 1 & 4 \\ 2 & 7 \end{bmatrix} x + x^T \begin{bmatrix} 3 \\ 5 \end{bmatrix} + 6$. Find the gradient and Hessian of f at the point $[1,1]^T$.
- l) Find local extremizers for the following optimization problems:
 $Min z = x_1^2 + 2x_1x_2 + 3x_2^2 + 4x_1 + 5x_2 + 6x_3$, subject to
 $x_1 + 2x_2 = 3, 4x_1 + 5x_3 = 6$.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Write the general form of linear programming problems. When alternative solutions of an LPP exist? Solve the LPP Maximize $z = 4x_1 + 10x_2$ subject to the constraints:
 $2x_1 + x_2 \leq 50, 2x_1 + 5x_2 \leq 100, 2x_1 + 3x_2 \leq 90; x_1, x_2 \geq 0$ by simplex method. Determine the alternative optimal solution if any. (16)
- Q4** Consider the function $f(x) = x^4 - 14x^3 + 60x^2 - 70x$. Use the Fibonacci search method to find the value of x that minimizes f over the range $[0, 2]$. Locate this value of x to within a range 0.3. (16)
- Q5** Define Kuhn-Tucker conditions. Discuss the importance of Kuhn-Tucker conditions in nonlinear programming. (16)
- Q6** State Lagrange's theorem. Apply Lagrange's theorem directly to the problem $Min z = x_1x_2 - 2x_1$, subject to $x_1^2 - x_2^2 = 0, x_1, x_2 \in \mathbb{R}$ to show that if a solution exists, it must be either $[1,1]^T$ or $[-1,1]^T$. (16)

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Total Number of Pages: 02

Course: M.Tech
Sub_Code: 23PE1004

1st Semester Regular Examination: 2023-24
SUBJECT: CLOUD COMPUTING
BRANCH(S): COMPUTER SCIENCE AND ENGG. (DATA SCIENCE)
Time: 3 Hour
Max Marks: 100
Q. Code: N620

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- How do datacenters support cloud computing infrastructure?
- What security aspect is associated with broad network access?
- Why is rapid elasticity necessary for handling variable workloads?
- What architectural challenges arise in handling sensitive information in the cloud?
- How does utility computing architecture dynamically allocate resources based on demand?
- List two features that distinguish PaaS from other cloud service models.
- What are the benefits organizations gain from utilizing IaaS for computing resource requirements?
- How does cloud computing contribute to organizational efficiency and agility?
- Define VMware and its role in virtualization.
- How does GreenCloud contribute to environmentally friendly computing practices?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Discuss the essential characteristics of cloud computing. How do these characteristics contribute to the overall benefits of cloud computing?
- Give a comprehensive comparison between cloud providers and traditional IT service providers. Highlight the key differences in terms of service delivery, scalability, cost structure, and overall performance.
- What are the implications of location-independent resource pooling for ensuring high availability and disaster recovery in cloud services? Explain.
- Explain the architectural aspects that enable coordination and collaboration in enterprise grid computing.
- Explain the architectural strategies for managing different security levels of third-party services in the cloud.
- What architectural challenges are associated with ensuring regulatory compliance in cloud computing?

- g) Explain SaaS's significance in cloud computing. How does it differ from traditional software delivery models, and what are the key characteristics that distinguish it?
- h) Compare and contrast two major cloud service providers, focusing on their service offerings and global presence.
- i) Briefly explain the four cloud deployment models. Provide an example scenario for each deployment model.
- j) Differentiate between CloudSim and GridSim.
- k) Briefly explain the process of cloning virtual machines in VMware Workstation.
- l) How can a virtual machine be properly stopped in VMware Workstation? Discuss in detail.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Explain the historical evolution of cloud computing. How did the concept of cloud computing originate, and what were the key driving factors behind its development? Explain. **(16)**
- Q4** Discuss the architectural considerations for application development in the cloud. How does cloud architecture support the unique requirements of cloud-native application development? Explain. **(16)**
- Q5** List the layers in cloud architecture and elaborate on each layer's role in delivering cloud services. How do these layers interact to provide a seamless computing environment? Explain. **(16)**
- Q6** Describe the working platform for CloudSim and how it facilitates the simulation of cloud environments. Write any two simple programs in CloudSim and explain their working in detail. **(16)**