Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: M.Tech
Sub_Code: 23PE1004

1st Semester Back Examination: 2024-25
SUBJECT: Cloud Computing
BRANCH(S): CSEDS
Time: 3 Hours
Max Marks: 100
Q.Code: R549

Answer Question No.1 (Part-I) 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) What are the primary components of cloud computing?
b) List any four differences between cloud providers and traditional IT service providers.
c) What does “security level of a third party” mean in cloud computing?
d) What are the architectural influences that have shaped cloud computing?
e) What is the role of service providers in cloud computing?
f) List the key features of the platform as a service model.
g) State the advantages of cloud computing.
h) Define the term “cloning” in the context of virtual machines.
i) List the limitations of the virtual machine.
j) Differentiate between hot and cold migrations.

Part-II

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

a) Explain the characteristics of "on-demand self-service" and "broad network access" with examples.
b) Compare the concept of resource pooling in cloud computing with traditional resource allocation methods.
c) Discuss how the characteristic "rapid elasticity" benefits businesses in scaling their services.
d) Discuss the limitations of cloud computing with respect to sensitive information and data security.
e) Explain the impact of high-performance computing and utility computing on cloud architecture development.
f) Compare and contrast the influence of utility computing and grid computing on cloud computing.
g) Explain the features and benefits of software as a service with suitable examples.

h) Compare and contrast public, private, and hybrid clouds with examples.

i) Explain the benefits of using infrastructure as a service in a business scenario and its impact on cost management.

j) Describe the steps involved in creating a virtual machine using VMware workstation.

k) What are the advantages of using GreenCloud for cloud simulation? Give a suitable simulation example.

l) Discuss the benefits of virtualizing a physical machine using VMware tools.

Part-III

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

Q3 Discuss the roots of cloud computing, including key milestones and technological advancements that have contributed to its evolution. **(16)**

Q4 Discuss how government policies and compliance requirements influence the adoption and functioning of cloud computing. Explain case studies or examples to illustrate your answer. **(16)**

Q5 Discuss the challenges and risks of cloud adoption and suggest strategies to overcome them. **(16)**

Q6 Discuss a comprehensive explanation of the CloudSim simulator, its architecture, and how it facilitates cloud computing research. **(16)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**
Sub_Code: 24PC1001

1st Semester Regular Examination: 2024-25
SUBJECT: Data Science
BRANCH(S): CSEAIML,CSEDS
Time: 3 Hours
Max Marks: 100
Q.Code: R427

Answer Question No.1 (Part-I) 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) What is the difference between supervised and unsupervised learning.
b) What is Cross Validation in Data Science?
c) Define LASSO.
d) What are ROC Curves?
e) Why is data cleaning important?
f) Define clustering.
g) What do you mean by BIC?
h) Define Boosting.
i) What is PCA?
j) Define Text Mining.

Part-II

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

a) Explain about confusion matrix.
b) How can we handle missing data?
c) Explain Bayesian Classification.
d) Describe Rule Based Classification in brief.
e) Can you explain the term overfitting? Describe.
f) Write the issues regarding Classification and Prediction.
g) Explain Bayesian Classification with example.
h) Describe in brief the Logistic Regression.
i) Write the Accuracy and Error Measures.
j) What is Association Mining? Explain.
k) What is Ridge Regression? Explain.
l) What do you mean by subset selection?

Part-III

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

Q3	Explain Random Forest algorithm with neat diagram.	**(16)**
Q4	What are Boot Strap Methods? Explain.	**(16)**
Q5	Explain Support Vector Machine in detail with neat diagram.	**(16)**
Q6	Describe in detail about K – Nearest Neighbour Classifiers.	**(16)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: M.Tech
Sub_Code: 24PC1002

1st Semester Regular Examination: 2024-25
SUBJECT: Advanced Data Structure and Algorithm
BRANCH(S): CSEDS, CSEAIML
Time: 3 Hours
Max Marks: 100
Q.Code: R504

Answer Question No.1 (Part-I) 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) Explain the role of a hash function in a hash table.
b) Explain the concept of online algorithms with an example.
c) Describe the key steps involved in parallel merge sort.
d) What is the Euclidean algorithm for finding the greatest common divisor (GCD)?
e) How NP-hard problems are different from NP-Complete?
f) What is amortized analysis, and why is it important?
g) Define Binomial Heap.
h) Explain the structure and use of an interval tree.
i) What is the load factor in a hash table, and why is it important?
j) What are the drawbacks of AVL trees?

Part-II

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

a) Solve the recurrence relation: $T(n) = 3\,T(n/4) + n$
b) Determine an LCS of <1, 0, 0, 1, 0, 1, 0, 1> and <0, 1, 0, 1, 1, 0, 1, 1, 0>.
c) Discuss the time complexity of order statistics operations in an augmented binary search tree. How does the augmentation affect the performance of other operations like insertion and deletion?
d) Describe the randomized version of the Quicksort algorithm. How does randomization help in improving the average-case performance of Quicksort? Provide a detailed explanation and example.
e) Describe the Chinese Remainder Theorem and its applications in number theory and cryptography. How does it help in solving systems of linear congruences? Provide a detailed example.
f) Compare red-black trees with AVL trees in terms of balancing and performance. In what scenarios is one preferred over the other?

g) Discuss the average-case and worst-case time complexities of the Quicksort algorithm. How does the choice of pivot affect the performance of Quicksort? Provide a detailed analysis.

h) Discuss the limitations of direct-address tables. In what scenarios are they not suitable, and how do hash tables address these limitations?

i) Explain the RSA public-key cryptosystem and its underlying mathematical principles. How does the RSA algorithm use number-theoretic concepts like modular arithmetic and GCD? Provide a detailed explanation of the key generation, encryption, and decryption processes.

j) Explain the structure and functionality of an interval tree. How is it used to manage intervals and perform interval queries efficiently? Provide examples to illustrate the insertion, deletion, and query operations in an interval tree.

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) Describe the problem of constructing an optimal binary search tree (OBST). How does dynamic programming help in finding the optimal solution? Provide a detailed explanation of the algorithm, including the construction of the cost and root matrices.

Part-III

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

Q3 Explain Strassen's algorithm for matrix multiplication. How does it improve the time complexity compared to the traditional matrix multiplication method? Provide a detailed example illustrating the steps of Strassen's algorithm. **(16)**

Q4 Describe the open addressing method for collision resolution in hash tables. Compare the different probing techniques such as linear probing, quadratic probing, and double hashing. Provide examples to illustrate each technique. **(16)**

Q5 Describe the process of proving that a problem is NP-complete. How do reductions from known NP-complete problems help in establishing NP-completeness? Provide a detailed example of an NP-completeness proof, including the steps involved in the reduction process. **(16)**

Q6 Explain the rod cutting problem and how dynamic programming can be used to solve it. Provide a detailed example, including the formulation of the recurrence relation and the construction of the solution table **(16)**

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Total Number of Pages: 02 **Course: M.Tech**
Sub_Code: 24PC1003

1st Semester Regular Examination: 2024-25
SUBJECT: SCIENTIFIC COMPUTING
BRANCH(S): CSEDS
Time: 3 Hours
Max Marks: 100
Q.Code: R479
Answer Question No.1 (Part-I) 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) Why one study numerical methods?
b) Differentiate between analytical solution and numerical solution.
c) What is the minimum and maximum distance between two adjacent floating-point numbers?
d) State Taylor's theorem.
e) Differentiate between 2-point forward difference and 2-point backward difference.
f) State the procedure for finding curves that best fit.
g) Differentiate between composite left endpoint and composite right endpoint.
h) Show the use of integral functions in MATLAB with suitable examples.
i) Compare forward Euler, backward Euler, Crank-Nicolson, and Runge-Kutta 4 using speed, stability and accuracy.
j) Define the backward Euler formula.

Part-II

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

a) Convert the base 10 number d = 11.5625 to a 64-bit double floating-point representation. Show that the decimal number 0.1 cannot be represented exactly as a finite binary number.
b) What is the next biggest computer-representable number after 1 (assuming 64 double floating-point numbers)? What about after 4096? What about after (1/8)?
c) Show the use of Gaussian elimination to solve the system of equations Ax = b.
A = (0 1 4; 2 4 6; 5 6 0)
x = (x1; x2; x3)
b = (9; 16; 6)
Note that elements are arranged row-wise, and ";" represents the separation between two rows.

d) Use Taylor's theorem with n = 2 to approximate sin(x) at x = 1.1, using the expansion point x_0 = 1. Find a bound on the error using Taylor's theorem and compare the bound to the actual error.

e) Write the forward Euler time stepping algorithm.

f) The following data represents (time (s), distance travelled (ft)) for a car: (0, 0), (2, 224), (4, 384), (6, 625), (8, 746), (10, 994). Use second-order formulas to approximate the speed in miles per hour at t = 0, t = 8, and t = 10.

g) Use the bisection method to find the root of $f(x) = \cos(x) - e^x$ on [–2, –0.5].

h) Let a = 1e – 8, b = 100, and c = 1e – 2. Find the roots of the quadratic $f(x) = ax^2 + bx + c$. Find the eigenvalues of the companion matrix. Assume suitable values, if required.

i) Write the MATLAB code to find a polynomial that interpolates the five points. (0, 1), (1, 2), (2, 2), (3, 6), (4, 9).

j) Verify that the trapezoid rule is exact on all linears by showing it is exact for f(x) = 1 and f(x) = x.

k) Verify that Simpson's method is exact on cubics by checking that the rule is exact for f(x) = 1, x, x^2, x^3.

l) Prove that backward Euler is unconditionally stable.

Part-III

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

Q3 Create an LU decomposition of A = (1 2; 3 4). Note that elements are arranged row-wise, and ";" represents the separation between two rows. Solve Ly = b for y using forward-substitution and solve Ux = y for x using back-substitution. Note that Ax = b. Determine the time complexity in each case. **(16)**

Q4 Find Taylor series approximations using quadratic polynomials (n = 2) 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. Compare bisection, Newton, and secant methods. **(16)**

Q5 Show that for any symmetric matrix, all eigenvalues are real numbers and eigenvectors corresponding to distinct eigenvalues are mutually orthogonal. Discuss real-world applications of curve fitting in the machine learning field. **(16)**

Q6 Write a program to compute a composite 2-point Gauss quadrature. The input should be a function f, a, b, and the number of subintervals to use n. Compare the accuracy of the 2-point Gauss quadrature on $f(x) = \sin^2(x)$ to composite Simpson's method, using the interval [0, 2], with different subintervals of your choice. **(16)**

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Total Number of Pages: 02 **Course: M.Tech**

Sub_Code: 24PC1004

1st Semester Regular Examination: 2024-25

SUBJECT: Optimization Techniques

BRANCH(S): CSEDS

Time: 3 Hours

Max Marks: 100

Q.Code: R523

Answer Question No.1 (Part-I) 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) Do the vectors $\{(1,1,0),(1,1,1),(1,0,0),(1,2,3)\}$ form a basis for $\mathbb{R}^3$.

b) Show that the function $f(x) = 7x^2 + 1$ is convex in $\mathbb{R}$.

c) Define convex combination.

d) Write two limitations of linear programming problems (LPP).

e) Give an example of an LPP, which has unbounded solutions.

f) Write 2 importance of duality in mathematical programming problems.

g) What is the difference between constraint and unconstraint optimization.

h) Write two applications of one-dimensional search methods.

i) What is a general nonlinear programming problem?

j) State Lagrange's theorem.

Part-II

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

a) Define Hessian matrix. Explain it with a suitable example.

b) Show that the rank of a matrix A is invariant under the operation multiplication of the columns of A by nonzero scalars.

c) Show that all eigenvalues of a symmetric matrix are real.

d) Use simplex method solve the following LPP: Maximize $z = 4x_1 + 10x_2$ subject to the constraints: $2x_1 + x_2 \leq 50, 2x_1 + 5x_2 \leq 100, 2x_1 + 3x_2 \leq 90;\ x_1, x_2 \geq 0$.

e) A firm manufactures two types of products A and B and sells them at a profit of Rs. 2 on type A and Rs. 3 on type B. Each product is processed on two machines G and H. Type A requires one minute of processing time on G and two minutes on H; type B requires one minute of processing time on G and one minutes on H. The Machine G is available for not more than 6 hours 40 minutes while machine H is available for 10 hours during any working days. Formulate the problem as a linear programming problem and solve it.

f) Convert the optimization problem $Max\ x_2 - x_1$ subject to $3x_1 = x_2 - 5, |x_2| \leq 2, x_1 \leq 0$, into a standard form.

g) Write a short note on The method of steepest descent.

h) Consider the quadratic function $f(x_1, x_2, x_3) = \frac{3}{2}x_1^2 + 2x_2^2 + \frac{3}{2}x_3^2 + x_1x_3 + 2x_2x_3 - 3x_1 - x_3$. Find the minimizer using the conjugate gradient algorithm, using the starting point $x^{(0)} = [0,0,0]^T$.

i) Let $f(x_1, x_2) = x_1^2 + \frac{1}{2}x_2^2 + 3$. Apply the rank one correction algorithm to minimize f.

j) Find local extremizers for the optimization problem $Max\ 4x_1 + x_2^2$ subject to $x_1^2 + x_2^2 = 9$.

k) Solve the optimization problem $Min\ x_1^2 + x_2^2$ subject to $x_1 - x_2^2 - 4 \geq 0, x_1 - 10 \leq 0$ using the second-order sufficient conditions.

l) Explain projection method with an example.

Part-III

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

Q3 **a)** Let $f(x) = \frac{x_1x_2}{2}$, $g(s,t) = (4s + 3t, 2s + t)^T$. Evaluate $\frac{\partial}{\partial s}f\big(g(s,t)\big)$ and $\frac{\partial}{\partial t}f(g(s,t))$ using the chain rule. **(8x2)**

b) The system of equations $Ax = b$ has a solution *iff* $rank\ A = rank[A\ b]$.

Q4 **a)** Explain Karmakar's algorithm. **(8x2)**

b) Solve the LPP Maximize $z = 6x_1 + 4$ subject to $2x_1 + 3x_2 \leq 30, 3x_1 + 2x_2 \leq 24,\ x_1 + x_2 \geq 3\ ;\ \ x_1,\ x_2 \geq 0$ By Big M method. Is the solution unique?

Q5 Use the Golden Section search method and Fibonacci search method to find the value of x that minimizes $f(x) = x^4 - 14x^3 + 60x^2 - 70x$ in the range $[0,2]$. **(16)**

Q6 **a)** Solve the nonlinear programming problem: $Min\ z = x_1^2 + x_2^2 + x_3^2$, subject to constraints $2x_1 + x_2 \leq 5\ , x_1 + x_2 \leq 2, x_1 \geq 1, x_2 \geq 2;\ x_3 \geq 0$. **(8x2)**

b) Discuss the importance of Kuhn-Tucker conditions in nonlinear programming.

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Total Number of Pages: 02

Course: M.Tech
Sub_Code: 24PE1004

1st Semester Regular Examination: 2024-25
SUBJECT: Cloud Computing
BRANCH(S): CSEDS
Time: 3 Hours
Max Marks: 100
Q.Code: R550

Answer Question No.1 (Part-I) 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) What are the primary components of cloud computing?
b) List any four differences between cloud providers and traditional IT service providers.
c) What does “security level of a third party” mean in cloud computing?
d) What are the architectural influences that have shaped cloud computing?
e) What is the role of service providers in cloud computing?
f) List the key features of the platform as a service model.
g) State the advantages of cloud computing.
h) Define the term “cloning” in the context of virtual machines.
i) List the limitations of the virtual machine.
j) Differentiate between hot and cold migrations.

Part-II

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

a) Explain the characteristics of "on-demand self-service" and "broad network access" with examples.
b) Compare the concept of resource pooling in cloud computing with traditional resource allocation methods.
c) Discuss how the characteristic "rapid elasticity" benefits businesses in scaling their services.
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f) Compare and contrast the influence of utility computing and grid computing on cloud computing.
g) Explain the features and benefits of software as a service with suitable examples.

h) Compare and contrast public, private, and hybrid clouds with examples.

i) Explain the benefits of using infrastructure as a service in a business scenario and its impact on cost management.

j) Describe the steps involved in creating a virtual machine using VMware workstation.

k) What are the advantages of using GreenCloud for cloud simulation? Give a suitable simulation example.

l) Discuss the benefits of virtualizing a physical machine using VMware tools.

Part-III

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

Q3 Discuss the roots of cloud computing, including key milestones and technological advancements that have contributed to its evolution. **(16)**

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Q6 Discuss a comprehensive explanation of the CloudSim simulator, its architecture, and how it facilitates cloud computing research. **(16)**