N. B: 1. Question ONE is compulsory.
2. Attempt any THREE out of remaining.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.

Qu-1  a) What are the characteristics of big Data?  
     b) Explain Hadoop Architectural Model.
     c) List the different issues and challenges in data stream query processing.
     d) Explain NoSQL data Architecture patterns.

Qu-2  a) Explain DGIM algorithm for counting ones in a stream with example.
     b) Explain Social Network graph clustering algorithm with example.

Qu-3  a) Explain Model for Recommendation System in detail
     b) Explain Matrix - Matrix Multiplication using TWO step MapReduce model.

Qu-4  a) Explain PageRank algorithm with suitable example.
     b) Explain Bloom’s filter for stream data mining with example.

Qu-5  a) Explain PCY algorithm with suitable example.
     b) i) Find Jaccard distance \( \{1, 2, 3, 4\} \sqcup \{2, 3, 5, 7\} \) and \( \{a, a, a, b\} \sqcup \{a, a, b, b, c\} \)
     ii) Find Hamming Distance between 11001 1 and 010101
     iii) Compute the cosines of the angles between \( (3, -1, 2) \) and \( (-2, 3, 1) \).

Qu-6  Write a note on
     a) Hadoop Ecosystem
     b) CURE Algorithm
     c) HITS
     d) MapReduce programming model

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N.B.: (1) Question No.1 is Compulsory.
    (2) Attempt any three questions from remaining questions.
    (3) Assume suitable data wherever required but justify the same.
    (3) Figures to the right indicate full marks.
    (4) Use of Statistical Table is allowed.

1. (a) Define model. Explain different models with suitable example.
    (b) Explain Naylor Finger approach for validation of simulation model.

2. (a) Consider a single server system. Let the arrival distribution be uniformly distributed between 1 and 10 minutes and the service time distribution is as follows:

    | Service Time (Min) | 1   | 2   | 3   | 4   | 5   | 6   |
    |-------------------|-----|-----|-----|-----|-----|-----|
    | Probability       | 0.04| 0.20| 0.10| 0.26| 0.35| 0.05|

    Develop the simulation table and analyze the system by simulating the arrival and service of 10 customers. Random digits for inter-arrival time and service times are as follows:

    Customer | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
    -------- |----|----|----|----|----|----|----|----|----|----|
    R.D. for Inter-arrival Time | -- | 853| 340| 205| 99 | 669| 742| 301| 888| 444 |
    R.D. for Service Time | 71 | 59 | 12 | 88 | 97 | 66 | 81 | 35 | 29 | 91 |

    (b) Explain the following terms: Event Scheduling, Process Interaction, Activity Scanning, Bootstrapping, and Terminating Event.

3. (a) Suppose that the life of an industrial lamp, in thousands of hours, is exponentially distributed with failure rate \( \lambda = 1/3 \) (one failure every 3000 hours, on average).
    i) Determine the probability that lamp will last longer than its mean life of 3000 hours.
    ii) Determine the probability that the lamp will last between 2000 and 3000 hours.
    iii) Find the probability that the lamp will last for another 1000 hours, given that it is operating after 2500 hours.

    (b) Explain Direct Transformation method for random variate generation using Normal and Lognormal distribution.

4. (a) Test the following random numbers for independence by Poker test.
    \[ \{0.594, 0.928, 0.515, 0.055, 0.507, 0.351, 0.262, 0.797, 0.788, 0.442, 0.097, 0.798, 0.227, 0.127, 0.474, 0.825, 0.007, 0.182, 0.929, 0.852 \} \]
    Use \( \alpha = 0.05 \) and \( \chi^2_{0.05,1} = 3.84 \)

    (b) Explain Inventory system. Discuss the cost involved in inventory systems.

5. (a) Give the equations for steady state parameters for M/G/1 queue and derive M/M/1 from M/G/1.

    (b) A federal agency studied the records pertaining to the number of job-related injuries at an underground coal mine. The values for the past 10 months were as follows:

    | Injuries per Month | 0  | 1  | 2  | 3  | 4  | 5  | 6  |
    |--------------------|----|----|----|----|----|----|----|
    | Frequency of Occurrence | 35 | 40 | 13 | 6  | 4  | 1  | 1  |

    i. Apply the Chi-Square test to these data to test the hypothesis that the underlying distribution is Poisson.
    ii. Apply the Chi-Square test to these data to test the hypothesis that the underlying distribution is Poisson with mean 1.0.

    Use level of significance \( \alpha = 0.05 \) and \( \chi^2_{0.05,5} = 5.99 \), \( \chi^2_{0.05,3} = 7.81 \)

6. Write short notes on (any two):

   (a) Poisson Process and its properties.
   (b) Manufacturing and Material Handling Systems.
   (c) Initialization bias in steady state simulation.
   (d) Steps in simulation study.
N.B.
1. Question No. 1 is compulsory
2. Solve any three questions from the remaining questions
3. Assume suitable data if required

Q1. a) Why is ERP implement to a company? (5)
    b) What are the common ERP myths? Explain in brief. (5)
    c) Describe business modeling process. (5)
    d) Explain the concept of SCM state its benefits. (5)

Q2: a) What are the other factors that should be considered in addition to the tangible benefits while justifying ERP investments? (10)
    b) Why is the availability of timely, relevant and accurate information necessary for business success? Discuss with Examples. (10)

Q3: a) Discuss the roadmap for successful ERP implementation. (10)
    b) What is an enterprise? What is the role of enterprise? Discuss with example. (10)

Q4. a) List the main variants of E- procurement, also discuss the advantages of adopting E- Procurement. (10)
    b) Distinguish between EFT and EDI. (10)

Q5. a) Explain CRM in detail. (10)
    b) Explain Business Process Reengineering BPR. How BPR connected with ERP? (10)

Q6. Write Short notes on
   i) Importance of Security for ERP System
   ii) Impact of internet on ERP products.
   iii) E- Business supply chain
   iv) KDD Process (20)
Q.1 (a) Define Robotics and Explain its Classification.
(b) How do you characterize robot specifications?
(c) Describe robot workspace.
(d) Explain various robot applications.

Q.2 (a) Explain Robotic Components? What is forward and inverse Kinematics.
(b) A frame F has been moved 15 units along the Y axis and 15 units along the z axis of the reference frame.

Find the new location of the frame.

\[ \begin{bmatrix} 0.527 & -0.574 & 0.628 & 5 \\ 0.369 & 0.819 & 0.439 & 3 \\ -0.766 & 0 & 0.643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix} \]

Q.3 (a) A point P (8, 4, 1)^T is attached to a frame and is subjected to the following transformations. Find the coordinates of the point relative to the reference frame at the conclusion of transformations.

1. Rotation of 90 degree about the Z axis.
2. Followed by a rotation of 90 degree about the Y axis.
3. Followed by a translation of [2, -1, 2].

(b) The Jacobin of a robot at a particular time is given. Calculate the linear and angular differential motions of the robot's hand frame for the given joint differential motions.

\[ J = \begin{bmatrix} 2 & 0 & 0 & 0 & 1 & 0 \\ -1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \]

\[ D \theta = \begin{bmatrix} 0 \\ 0.1 \\ -0.1 \\ 0 \\ 0 \\ 0.2 \end{bmatrix} \]

Q.4 (a) An object, attached to a frame B, is subjected to the forces and moments given relative to the reference frame. Find the equivalent forces and moments in frame B.

\[ F = [0, 10(lb), 0, 0, 20(lb-in)] \text{ and } B = \begin{bmatrix} 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 1 & 0 & 0 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix} \]

Turn over
Q5 (a) Explain Concept of motion planning in robotics in brief?

(b) Explain bug1, bug2 and tangent bug algorithms and compare in brief.

Q6 Write short notes on any two:
   a) Generalized Voronoi Diagrams.
   b) DH Algorithm.
   c) Silhouette methods.
N. B: 1. Question ONE is compulsory.
2. Attempt any THREE out of remaining.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary.

Qu-1 a) Distinguish between Soft computing and Hard computing. 5
   b) For a fuzzy set, \( A = \{0.5 + 0.4 + 0.7 + 0.8 + 1\} \) perform Fuzzy complement operation on \( A \). 5
   c) List different operators in Genetic Algorithm. Explain any one in detail. 5
   d) What is artificial neural network? Define characteristics and applications of artificial neural network. 5

Qu-2 a) Explain Character Recognition Application with suitable example. Assume necessary parameters such as input-output pairs, learning rate, error threshold etc. Clearly state the impact of learning rate and error threshold on Character Recognition Application. 10
   b) Explain perceptron learning with the help of an example. 10

Qu-3 a) State the Classification of GA and explain in detail the concept “Problem solving using GA”. 10
   b) Explain in detail Adaptive Neuro-Fuzzy Inference Systems with suitable architecture. 10

Qu-4 a) Explain architecture of BAM. How storage and retrieval is performed in BAM. 10
   b) Give weight matrix of McCulloch-Pitts neuron model for binary AND function. 10

Qu-5 a) With suitable example explain max-min composition and max-product composition. 10
   b) Explain Backpropagation algorithm in detail with the help of flowchart. 10

Qu-6 Attempt the following 20
   a) Radial Basis Function Networks
   b) Fuzzy Composition Rules
   c) Delta Learning Rule.
   d) Defuzzification
Note: 1. Question number 1 is compulsory. Solve any three out of remaining.
       2. Draw figure wherever necessary.
       3. Assume suitable data wherever necessary.

Q1.
   a. Design and implement ILM for Storage Management system. 5 Marks
   
   b. Consider a disk I/O system in which an I/O request arrives at a rate of 200 IOPS. The service time, R=8ms. Calculate the following measures of disk performance:
      a) Utilization of I/O controller (U)
      b) Total response time (R)
      c) Average queue size
      d) Total time spent by request in the queue. 5 Marks
   
   c. Explain Boolean queries with an example. 5 Marks
   
   d. Explain different types of backup with real time examples. 5 Marks

Q2. a. Consider an application that generates 3600 IOP with 60% reads and 40% writes. Calculate the disk load for different RAID levels. Also explain the steps for write penalty calculation and list the read and write penalty for different RAID levels. 10 Marks
   
   b. Explain FC Protocol Stack and FC SAN topologies. 10 Marks

Q3. a. Explain in detail the different components required to design Intelligent Storage System. 10 Marks

   b. Explain BC planning lifecycle with an example. 10 Marks

Q4. a. Explain IP Storage standards. 10 Marks
   
   b. Explain Multilingual retrieval systems. 10 Marks

Q5. a. Explain different components of information system and its types. 10 Marks
   
   b. Explain Network Data Management Protocol (NDMP) 10 Marks

Q6. Write a short note on
   
   a) IP Storage
   
   b) NAS
   
   c) Stemming
   
   d) Symmetric and Asymmetric virtualization 20 Marks
Total Marks 80

Question 1 is compulsory
Attempt any 3 questions from the remaining.

Q1  

a. What is measuring effectiveness of prioritized test suites? Consider a program with 5 faults and a test suite of 5 test cases, as shown in table below:

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td></td>
<td>x</td>
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<td>x</td>
</tr>
<tr>
<td>F4</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>F5</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Calculate APFD for this program.

b. Explain STLC in detail

Q2  

a. What is bug? Explain Life Cycle of Bug and different states of bug

b. Explain different regression testing types

Q3  

a. Explain test design preparedness metrics

b. Consider a project with the following distribution of data and calculate its defect spoilage:

<table>
<thead>
<tr>
<th>SDLC phase</th>
<th>No. of Defects</th>
<th>Defect age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement specification</td>
<td>34</td>
<td>2</td>
</tr>
<tr>
<td>HLD</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>LLD</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Coding</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

Q4  

a. Differentiate between
i. White box and Black box testing
ii. Verification and Validation

Turn Over
A program reads an integer number within the range [0,200] and determines whether it is an even number or not. Design test cases for this program using BVC, robust and worst case testing methods.

Q5
a. Explain with example class testing
b. Explain security testing in web based application

Q6
a. What is Test Point Analysis
b. Explain ISO 9126 quality characteristics