

(2 ½ Hours)

[Total Marks: 60]

- N.B:**
- (1) **All questions are compulsory.**
 - (2) Figures to the **right** indicate full marks.
 - (3) **Assume additional data if necessary** but state the same clearly.
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 - (5) Use of **calculators** and statistical tables are **allowed**. / If required keep it.

Q.1 Attempt **any two** of the following (12)

- a) Illustrate the operations of BUBBLE SORT for {40, 23, 45, 21, 45, 22, 10, 30}. 6
- b) How would you modify QUICKSORT to sort into non-increasing order? 6
- c) Explain Asymptotic Notation in brief. 6
- d) Explain the use of growth of functions for analyzing algorithms. 6

Q.2 Attempt **any two** of the following (12)

- a) Explain longest common subsequence problem. 6
- b) Discuss running time complexity of Kruskal algorithm. 6
- c) Explain Huffman coding in short. 6
- d) Explain recursive top down implementation of ROD Cutting algorithm. 6

Q.3 Attempt **any two** of the following (12)

- a) Write a short note on Running time of Euclid algorithm. 6
- b) What do you mean by NP Complete problem? 6
- c) Prove that if $a \mid b$ and $b \mid c$ then $a \mid c$ 6
- d) Explain Traveling salesman problem. 6

Q.4 Attempt **any two** of the following (12)

- a) What are the 6P's of the research? 6
- b) What is the Evidence based research? 6
- c) Write a short note on research ethics. 6
- d) What are the sources of research idea? 6

Q.5 Attempt **any two** of the following (12)

- a) Write a short note on Indicator random variable. 6
- b) Write a short note on Dijkstra's algorithm. 6
- c) Explain Vertex Cover problem. 6
- d) What is internet research? 6

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- Q.1 Attempt **any two** of the following (12)
- How multiplexing and demultiplexing is implemented in transport layer with the help of diagram and discuss any one application which makes use of it. 6
 - Name the application layer protocol and the underlying transport protocol for the following applications: 6
 - Remote terminal access
 - Routing protocol
 - Electronic mail
 - File transfer
 - Explain Distance Vector Routing Algorithm and its application. 6
 - Explain the relevance of virtual circuit and datagram network. 6
- Q.2 Attempt **any two** of the following (12)
- What is network virtualisation and elaborate the need for external and internal network virtualization. 6
 - Explain with the help of diagram path of the packet traversed in network virtualization through the tunnel and without use of tunnel. 6
 - Explain any 3 desirable properties of network virtualization. 6
 - Explain the routing protocols in network virtualization. 6
- Q.3 Attempt **any two** of the following (12)
- Explain Active and Passive Attack in adhoc network 6
 - Write a short note on MAC protocol issues. 6
 - Explain SCO and ACL Bluetooth links in detail. 6
 - Write a note on Scalable Broadcast algorithm. 6
- Q.4 Attempt **any two** of the following (12)
- Discuss the sensor networks design considerations. 6
 - Discuss the application of clustering of SNs 6
 - Write a note on RFID as passive sensors. 6
 - Write a short note on Localization scheme in sensor networks. 6
- Q.5 Attempt **any two** of the following (12)
- Differentiate between network architecture and application architecture. 6
 - Explain control plane virtualization? 6
 - Explain any one Proactive routing approach. 6
 - What is relevance of Regularly placed Sensors? 6

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Q.1 Attempt **any two** of the following (12)

- a) Explain allocation model of distributed DBMS which attempts to (i) minimize the total cost of processing and storage, (ii) meet certain response time restrictions. 6
- b) Fragment the following relations using vertical and horizontal fragmentation on two nodes. 6

College (cNum, cName, Location)

Faculty (fNum, fName, Salary, cnum, sNum)

Students (sNum, Attendance, Marks)

- c) State and explain query optimization issues in distributed database System. 6
- d) Explain fully and partially replication of a relation. Is there any thumb rule by which a specific relation is replicated? Illustrated with example. 6

Q.2 Attempt **any two** of the following (12)

- a) State various types of strategies used for designing DDBMS. Compare the characteristics of stated strategies. 6
- b) Why *ack* messages are required in 2PC? What are the differences between traditional 2PC and 2PC with Presumed Abort? 6
- c) Assume that the data are distributed across 8 sites A to H. Item a is stored at site A, item b is stored at site B and so on. $R_i(a)$ and $W_i(a)$ denote read and write lock request by transaction i on data item a . Consider the following sequence of operations: 6

$W_1(c), R_7(b), R_4(a), W_3(d), R_8(g), R_2(f), W_3(g), W_6(e),$
 $R_5(f), W_7(f), R_6(c), W_6(h), W_8(a), W_2(b), R_4(d), W_1(e)$

Draw the wait-for graph (WFG) for the above operations. Identify deadlocks if there is any.

- d) Explain how in place update and out of place update works in reliability theory of distributed database. 6

Q.3 Attempt **any two** of the following (12)

- a) Why there is a need to define a new abstract data type (ADT) in ORDBMS? Is it different from primary key? Illustrate by giving suitable example. 6
- b) What is a need to create temporal database? Is the first normal form satisfied by a relation of temporal database? Explain with example. 6
- c) Consider the relational schema
 Garden (Gard_No, Gard_Name)
 Suppose user wants to know the dimensions of a garden, then which additional attribute is required in the above schema? Which type of data base you get after adding new attribute? How is it different from traditional database? 6
- d) Describe graphically, data shown below in Minimum Bounding Rectangle (MBR): 6
 Let $S = \{s_1, s_2, \dots, s_{13}\}$ be a set of 13 points. Include 13 points in 5 MBR's as follows:
 $r_1 = \{s_1, s_2, s_3\}$, $r_2 = \{s_4, s_5, s_6\}$, $r_3 = \{s_7, s_8, s_9\}$, $r_4 = \{s_{10}, s_{11}\}$, $r_5 = \{s_{12}, s_{13}\}$
 Include these MBR's in $r_6 = \{r_1, r_2\}$, $r_7 = \{r_3, r_4, r_5\}$. Draw R-tree.

Q.4 Attempt **any two** of the following (12)

- a) Define the term fixed point. What can you say about least fixed points for Datalog programs? 6
- b) Consider the following IDB predicate: 6
 $p(A, B) :- q(A, C) \ \& \ r(C, B) \ \& \ B < 12$
 Evaluate the above datalog program if possible by taking
 $Q = \{(3, 4), (5, 6)\}$ and $R = \{(4, 7), (6, 11), (6, 12), (8, 9)\}$.
- c) Explain Event Condition Action model of active databases with example. 6
- d) Describe how XML data can be stored in relational DBMS. How do we map XML data to relations? Give an example. 6

Q.5 Attempt **any two** of the following (12)

- a) Explain with example (i) Intra-query Parallelism, (ii) Intra Operation Parallelism, (iii) Inter Operation Parallelism. 6
- b) What is Geographical Information system? Explain different format used to represent Geographic data. 6
- c) What is spatial database? Explain how to model spatial data in traditional DBMS. Illustrate an example to support your answer. What are the differences between spatial range queries, nearest neighbor queries, and spatial join queries? 6
- d) Write note on multimedia databases. 6

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Q.1 Attempt **any two** of the following (12)

- a) Explain with examples the three main categories of robot? 6
- b) Compare and contrast the autonomy and controllers in robots? 6
- c) Explain with neat diagram the components of the robot? 6
- d) Explain the different types of Motors used in Robots? 6

Q.2 Attempt **any two** of the following (12)

- a) Explain the importance of COG and polygons of support with respect to a two –legged humanoid and six legged robot on flat ground? 6
- b) Explain sonar sensing with ultrasonic mechanism? 6
- c) Briefly describe how *stereo cameras* can be used to extract depth Information from images. 6
- d) How would you write a controller for a wall following robot using feedback control 6

Q.3 Attempt **any two** of the following (12)

- a) Explain in detail the drawbacks of the deliberative robot control architectures? 6
- b) Explain planning and re- planning with respect to hybrid control? 6
- c) What can the robot store and remember to help it navigate a maze? 6
- d) Explain the concept of optimizing search in a maze? 6

Q.4 Attempt **any two** of the following (12)

- a) Explain how search operation works in Branch and Bound Algorithm 6
- b) Explain the Iterative deepening algorithm to help a robot navigate through a network 6
- c) Explain Space complexity and time complexity of hill climbing algorithm? 6
- d) Compute the time and space complexity of DFS algorithm? 6

Q.5 Attempt **any two** of the following

- a) Explain in brief the advantages of robot technology? **6**
- b) Explain in details position control and torque control in robotics? **6**
- c) Explain how Toto the robot represented the map of its environment? **6**
- d) Differentiate between breath first search and depth first search? **6**
