

(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.
  - (4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.
  - (5) Use of **calculators** and statistical tables are **allowed**.

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

- a) What are indicator random variables? Give analysis of the hiring problem using indicator random variables. 6
- b) Explain various asymptotic notations and functions with examples. 6
- c) Describe the running time of the recursive FIND-MAXIMUM-SUBARRAY procedure. 6
- d) Consider array [43, 2, 5, 65, 23, 12, 41, 29]. Sort this array using Merge sort. Explain sorting procedure with figures. Comment on running time of Merge sort. 6

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

- a) Give the best approach to solve overlapping sub-problems. Give example. 6
- b) Define longest-common-subsequence problem. Give algorithm to solve this problem. 6
- c) Give two representations of a directed graph. Give breadth-first search algorithm with suitable example. 6
- d) Explain the execution of Prim's algorithm on any suitable graph. Why Prim's algorithm is a special case of the generic minimum-spanning- tree method? 6

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

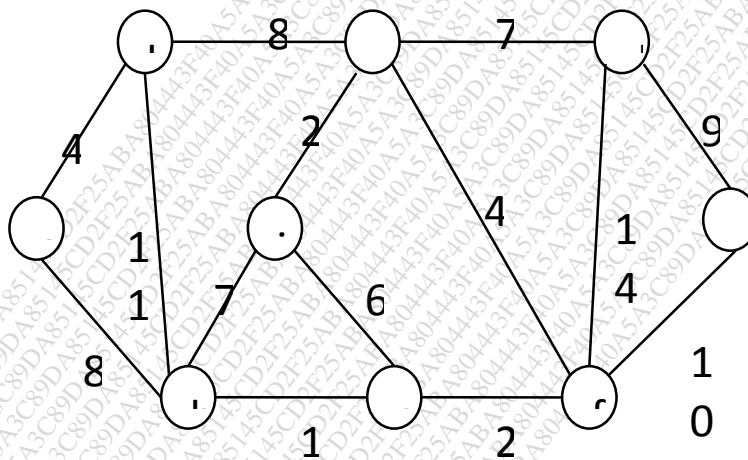
- a) Describe the traveling-salesman problem with the triangle inequality. 6
- b) Give overview of showing problems to be NP-complete. 6
- c) Solve the congruence  $42x \equiv 12 \pmod{90}$ . 6
- d) Give a greedy approximation algorithm to solve the set-covering problem. 6

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

- a) What is data in research? Why data need to be analyzed? 6
- b) What is empirical and experimental research? 6
- c) What is research methodology? Explain importance of research methodology in research study. 6
- d) Give layout of a research paper. Write sample abstract of a research paper on any topic. What abstract must contain? 6

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

- a) What is purpose of Chinese remainder theorem? State any two major applications of it. 6
- b) What is a minimum spanning tree? Consider following connected graph. Determine minimum spanning tree in it. 6



- c) Prove that the fractional knapsack problem has the greedy-choice property. 6
- d) Why should a researcher report his/her Findings? Give characteristics of a good report. 6

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- Q.1 Attempt **any two** of the following (12)
- a) Define Internet. Explain Internet Standards. 6
  - b) What is TCP? Explain TCP/IP model in detail 6
  - c) Explain Multiplexing and Demultiplexing in detail 6
  - d) Explain the need and relevance of UDP in contrast to TCP 6
- Q.2 Attempt **any two** of the following (12)
- a) What is network virtualisation and elaborate the need for external and internal network virtualization. 6
  - b) Explain with the help of diagram path of the packet traversed in network virtualization through the tunnel and without use of tunnel. 6
  - c) What is the need of control plane virtualization and forwarding plane virtualization? 6
  - d) Explain with the help of diagram data center network design before virtual machine came into existence. 6
- Q.3 Attempt **any two** of the following (12)
- a) Explain Active and Passive Attack in adhoc network. 6
  - b) Discuss Hidden & Exposed terminal problem. 6
  - c) State and discuss the application of Adhoc network. 6
  - d) Write short note on Multicasting and Geocasting in adhoc network. 6
- Q.4 Attempt **any two** of the following (12)
- a) Explain any 3 applications of WSN 6
  - b) What are the design issues of WSN? 6
  - c) Explain Threshold- sensitive energy efficient (TEEN) routing of WSN. 6
  - d) Elaborate Grand Duck Island Monitoring Network with neat diagram 6
- Q.5 Attempt **any two** of the following (12)
- a) Which services are provided by TCP to application layer? Explain any one. 6
  - b) Explain the virtualization components and their functionality with the help of diagram 6
  - c) Write short note on Bluetooth Technology. 6
  - d) Explain the sensing and communication range of WSN. 6

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(2 1/2 Hours)

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

- a) Explain multi client / single server and multi client / multi servers distributed DBMS architecture. 6
- b) What is meant by replication of database? Explain various ways to implement it. 6
- c) Consider the relations 6  
 $Faculty(fno, fname, dept)$  and  $Student(sno, fno, course)$ .

Let  $Faculty$  have the primary horizontal fragmentation:  $F_1 = Faculty$  with  $fno < 100$ ;  $F_2 = Faculty$  with  $fno \geq 100$ ; and  $Student$  have the primary horizontal fragmentation:  $S_1 = Student$  with  $Sno < 100$ ;  $S_2 = Student$  with  $100 \leq Sno < 200$ ;  $S_3 = Student$  with  $sno \geq 200$ .

- (i) Write relational algebra query to find  $fname$  and  $course$  from  $Faculty$  and  $Student$  where  $course = 'R'$ .
- (ii) Draw reduced query tree.

- d) Briefly describe and compare synchronous and asynchronous distributed database. 6

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

- a) Define a complete schedule. Write a complete schedule for the following transactions 6  
 $T1 = \{r_1(x), w_1(x), c\}$  and  $T2 = \{r_2(x), w_2(x), c\}$ ,  
 where  $c$  denote the commit of transaction.

- b) Consider the following schedules: 6

$S1 = W2(x), W1(x), R3(x), R1(x), W2(y), R3(y), R3(z), R2(x)$   
 $S2 = R3(z), R3(y), W2(y), R2(z), W1(x), R3(x), W2(x), R1(x)$   
 $S3 = R3(z), W2(x), W2(y), R1(x), R3(x), R2(z), R3(y), W1(x)$   
 $S4 = R2(z), W2(x), R3(z), W1(x), W2(y), R1(x), R3(x), R3(y)$

- (i) Which of the above schedules are conflict equivalent?
- (ii) Which of the above schedules are serializable?

- c) Compare the characteristics of two-phase commit protocol and three-phase protocol. 6
- d) Explain Wait-Die and Wound-Wait algorithms in distributed deadlock management. 6

- Q.3 Attempt **any two** of the following (12)
- Differentiate between object identity and primary key. 6
  - Consider the relational schema 6

Building( building\_No, building\_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?

- Consider the relational schema 6

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?

- Describe graphically, data shown below in Minimum Bounding Rectangle (MBR) and hence draw R-tree. 6

Toy Name	A	B	C	D	E	F	G	H	I	J	K	L
Toy Number	9	4	6	1	6	5	7	3	10	2	8	4
Toy Price	100	10	35	10	40	45	85	20	70	30	50	50

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

- What is a stratified program? How does stratification address the problem of identifying a desired fixed point? Show that every relational algebra query can be written as stratified Datalog program. 6
- What do you mean by liner datalog program? Is the following program linear and of first order? 6

father(X, Y) :- parent(X, Y), man(Y)  
 ancestor(X, Y) :- parent(X, Y),  
 ancestor(X, Y) :- parent(X, Z), ancestor(Z, Y)

- What are the differences between structured, semi-structured and un-structured data in XML database? 6
- What are the differences among immediate, deferred, and detached execution of active rule actions? 6

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

- What are speed-up and scale-up curves? Compare different parallel database architectures. 6
- Explain types of transparencies used in distributed database system. 6
- What is a datalog program? Consider the Flights relation : 6

Flights(flno: integer, from:string, to:string,  
 distance:integer, depart:time, arrives:time)

Write the following queries using Datalog:

- Find the *flno* of all flights that depart from Delhi.
- Find all cities reachable from Delhi through a chain of one or more connecting flights.

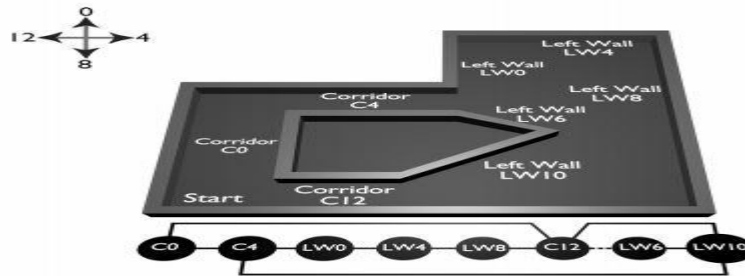
- What is the difference between XML schema and XML DTD? 6

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- Q.1 Attempt **any two** of the following (12)
- a) Explain the difference between the AI inspired robotics and vision based navigation robotics? 6
  - b) What advantages robot technology offers? 6
  - c) Explain the importance of robot sensors and its state space 6
  - d) Explain the concept of backlash and ganged gears 6
- Q.2 Attempt **any two** of the following (12)
- a) Explain the various types of errors in feedback system of the robot. 6
  - b) Explain the importance of programming languages for robot system. 6
  - c) Explain the Polarized light. 6
  - d) Explain the following 6
    1. Camera's
    2. Edge Detection
    3. Texture
    4. Shading
- Q.3 Attempt **any two** of the following (12)
- a) State the working principle of the reflective optosensors? 6
  - b) What is behaviour based control? Explain example? 6
  - c) Explain Hybrid architecture deals with changes in the world/map/task? 6
  - d) Define emergent behavior? Explain in detail what happens if no behavior in the given map matches the landmark Toto is detecting? 6



- Q.4 Attempt **any two** of the following (12)
- a) State and explain Depth first search algorithm. 6
  - b) Explain Brute Force solution on Local Maxima 6
  - c) Explain in detail the problems faced in hill climbing search? 6
  - d) Explain the working of Branch and Bound algorithm 6

- Q.5 Attempt **any two** of the following (12)
- a) Discuss in detail the degree of freedom for the car 6
  - b) Define Gait. What properties a desirable Gait need to have? Explain 6
  - c) Explain briefly the architectures for multi-robot control? 6
  - d) Explain the Depth bounded DFS algorithm in detail? 6

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