

**Jaypee University of Engineering & Technology, Guna****T-3 (Odd Semester 2023)**  
18B11CI311 – Data Structures

Maximum Duration: 2 Hours

Maximum Marks: 35

**Notes:**

1. This question paper has 07 questions.
2. Write relevant answers only.
3. Attempt the questions in a serial order.
4. Do not write anything on question paper (Except your Er. No.).

- |   | <b>Marks</b> | <b>CO No.</b> |
|---|--------------|---------------|
| <b>Q1.</b> Given a singly linked list of characters, write an efficient algorithm that prints "Yes" if the given linked list is a palindrome, otherwise it prints "No".   | <b>[05]</b>  | <b>CO3</b>    |
| <b>Examples:</b><br><b>Input:</b> R→A→D→A→R→NULL<br><b>Output:</b> Yes<br><b>Input:</b> C→O→D→E→NULL<br><b>Output:</b> No   |              |               |
| <b>Q2.</b> Design algorithms for enqueue and dequeue operations for a priority queue. Assume the priority queue is implemented as a singly linked list. Ensure that enqueue adds elements with consideration to priority, while dequeue removes the highest-priority element. Note that lower numeric values represent elements with higher priority. Analyze the worst-case time complexity for both operations. | <b>[05]</b>  | <b>CO4</b>    |
| <b>Q3.</b> Write an algorithm to delete a node that is either a leaf node or a node with exactly one child in a Binary Search Tree (BST).   | <b>[05]</b>  | <b>CO3</b>    |
| <b>Q4.</b> With the help of a priority queue, construct the Huffman tree for the sentence "I am gonna tattarrattat at the door" and find Huffman codes for each character. Suppose a networking company uses a compression technique to encode the message before transmitting over the network where each character is encoded with 8 bits.  | <b>[05]</b>  | <b>CO5</b>    |

Calculate the number of bits that can be saved by the company if Huffman encoding compression technique is used instead?

- Q5.** Write the Breadth-First Search (BFS) algorithm. Perform a Breadth-First Search on the graph given in Figure 1 by considering vertex '0' as the starting point. Show all the steps. [05] CO3

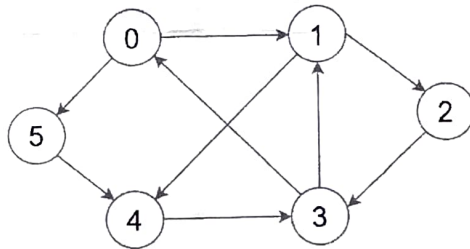


Figure 1

- Q6.** Write an algorithm to search for an edge in a given graph represented as an adjacency list. Also, provide the worst-case time complexity of your algorithm. [05] CO4

- Q7.** Define following terms with suitable examples for each: [05] CO1

- (a) Perfect binary tree
- (b) Height of a tree
- (c) Degree of a node in a tree
- (d) Complete graph
- (e) Path in a graph

**Jaypee University of Engineering & Technology, Guna****T-3 (Odd Semester 2023)****18B11CI312 – Database Systems**

Maximum Duration: 2 Hour

Maximum Marks: 35

**Notes:**

1. This question paper has 5 questions.
2. Answer the questions in serial order.
3. Write relevant answers only.
4. Do not write anything on question paper (Except your Er. No.).
5. Calculators are allowed according to university norms.

- Q1.** Compute and draw the site allocation diagram of the distributed database for the “The Redundant All Beneficial Sites Method” on the basis of System Parameters data and the User Transaction Data as provided below:

**Marks** [07] **CO No.** CO4

Table	Size	Avg. local query (update) time (milliseconds)	Avg. remote query (update) time (milliseconds)
R1	300 KB	100 (150)	500 (600)
R2	500 KB	150 (200)	650 (700)
R3	1.0 MB	200 (250)	1000 (1100)

**System Parameters**

Transaction	Site(s)	Frequency	Table accesses (reads, writes)
T1	S1, S4, S5	1	Four to R1 (3 reads, 1 write), two to R2 (2 reads)
T2	S2, S4	2	Two to R1 (2 reads), four to R3 (3 reads, 1 write)
T3	S3, S5	3	Four to R2 (3 reads, 1 write), two to R3 (2 reads)

**User Transaction Data**

- Q2.** Explain ACID properties with examples for each. What is a serial schedule? How do we test for serializability? Differentiate between shared lock and exclusive lock. For the schedule S1 given below test whether it is serializable or not. Mention all the steps while you test.

**[07]** **CO5**

	T1	T2	T3
Time ↓	Read(A)	Read(B)	
	A := f <sub>1</sub> (A)	B := f <sub>2</sub> (B) Write(B)	Read(C)
	Write(A)		C := f <sub>3</sub> (C) Write(C)
	Read(C)	Read(A) A := f <sub>4</sub> (A)	Read(B)
	C := f <sub>5</sub> (C) Write(C)	Write(A)	
			B := f <sub>6</sub> (B) Write(B)

Schedule S1

Q3. For the following schema write the relational algebra statements [07] CO5

*account* (account-number, branch-name, balance)

*Suppliers* (sid: integer, sname: string, address: string)

*Parts* (pid: integer, pname: string, color: string)

*Catalog* (sid: integer, pid: integer, cost: real)

- Find the smallest account balance. Explain all steps. Do not use aggregate function.
- Find the names of suppliers who supply some red part.
- Find the *sids* of suppliers who supply some red or green part.
- Find the *sids* of suppliers who supply some red part or are at 221 Packer Ave.
- Find the *sids* of suppliers who supply some red part and some green part.
- Find the *sids* of suppliers who supply every part.
- Find the *sids* of suppliers who supply every red part.

Q4. Consider a company database schema as given below and write MySQL queries for following:

Company Database schema-

EMPLOYEE (Fname, Minit, Lname, SSN, Bdate, Address, Sex, Salary, Super\_ssn, Dno),

DEPARTMENT (Dname, Dnumber, Mgr\_ssn, Mgr\_Startdate),

DEPT\_LOCATIONS (Dnumber, Dlocation),

PROJECT (Pname, Pnumber, Plocation, Dnum),

WORKS\_ON (Essn, Pno, Hours),

DEPENDENT (Essn, Dependent\_name, Sex, Bdate, Relationship)



- (a) (i) Display Fname of employee with its department number [05] CO5  
and department name.
- (ii) To display department number, department name,  
department manager's ssn, fname of manager, and salary.
- (iii) Display Employee SSN, Fname, his/her manager SSN,  
Manager's Name, and Manager's gender.
- (iv) Display Employee's Fname, Project Name and number of  
hours working on each project.
- (v) Display fname and number of projects for each employee.
- (b) Consider a company database schema given above in Question [03] CO5  
4(a) and write MySQL queries for following:
- (i) To add a column "phone\_no" with data type integer in  
dependent table at a first position.
- (ii) To modify value of salary to 60000 for an employee  
having ssn 123456789.
- (iii) Display gender and gender wise average salary.
- Q5. (a) Consider following MySQL queries in sequence derive output of [03] CO4  
the last query:
- (i) Create table CasDel (P int primary key, F int);
- (ii) Insert into CasDel values (2,4), (3,4), (4,3), (5,2), (7,2),  
(9,5), (6,4);
- (iii) Alter table CasDel add constraint foreign key(F)  
references CasDel(P) on delete cascade;
- (iv) Delete from CasDel where P=2;
- (v) Select \* from CasDel;
- (b) Consider table R1 on right side and table R2 is on left side of [03] CO4  
join clause. There are m records in R1 and n records in table R2  
with k matching records on join clause.
- (i) How many records will be there if we perform Right outer  
join on R1 and R2?
- (ii) How many records will be there if we perform Left outer  
join on R1 and R2?
- (iii) How many records will be there if we perform Full outer  
join on R1 and R2?