Department of Computer Science and Engineering
Faculty of Engineering
University of North Texas

Mid Term Examination II | CSCE5350 | Fall 2023

Time Allowed: 1hour 30 minutes | Answer All questions

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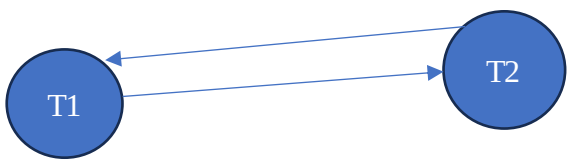
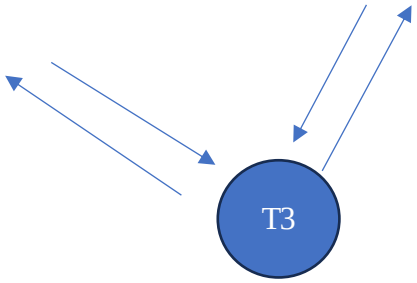
1. A **transaction** is a *unit* of program execution that accesses and possibly updates various data items. Answer the following questions based on the transaction processing concept.
   a. Explain how a concurrent execution of transactions improves the performance of the application.

   b. What is the importance of preserving ACID properties of a transaction? Explain each property and its purpose.

   c. Check that if the following schedule is conflict serializable by using a Precedence Graph. Write down the serial schedule that the following schedule is conflict equivalent with if it is conflict-serializable.

T1	T2	T3
		Read(B)
Read(A)		
Write(A)		
	Read(A)	
	Write(A)	
Read(C)		
Write(C)		
	Read(B)	
	Write(B)	
Read(B)		
Write(b)		
		Write(B)





This precedence graph has a loop. Therefore, this schedule is not conflict serializable.

d. Explain why the following schedule is not recoverable.

T1	T2	T3
Read(A)		
Read(B)		
Write(A)		
	Read(A)	
	Write(A)	
	Commit	Read(A)

2. This question is based on query processing and optimization.

a. What is the purpose of query evaluation in the query processing steps?

b. How do we optimize a given query?

c. Explain the difference in record searching in a linear file scan and index scan.

d. Compute the cost of the query if you want to select a key that is not a candidate key in the relation. But there is a secondary index defined on the search key.

Assume the index height is 10, and time it takes to transfer one block is 10ms, and time taken for one seek is 15ms. Assume there will be 10 matches for your query.

e. Assuming you have two relations Instructor and department, you need to compute the cost of join using nested loop for the following configuration and condition.

   Configuration:

   Instructor relation has 20,000 rows and stored in 100 blocks.
   Department table has 20 rows and stored in one block.

   Condition:

   Only one block from each relation can accommodate in the memory.

3. Database indexing is a vital aspect in application development.
   a. Compare and contrast B+-tree file organization and B+-tree indexing.

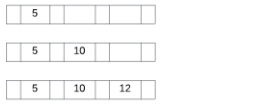
   b. What is the difference between dense and dense-clustering index?

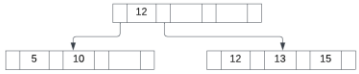
   c. Insert the following set of integers to a B+ tree. The tree node has a fanout of 4 (which is n=4). Show each insertion in a separate tree.

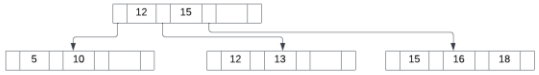
      5,10,12,13,15,16,18, 20, 21, 23

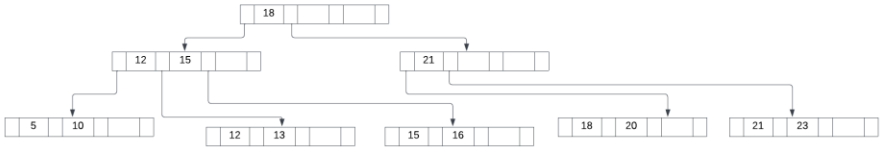
   d. Delete the item 20 from the final B+ tree generated in the above question. Show each step clearly.

5,10,12,13,15,16,18, 20, 21, 23

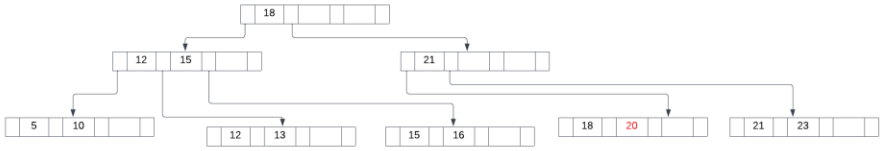


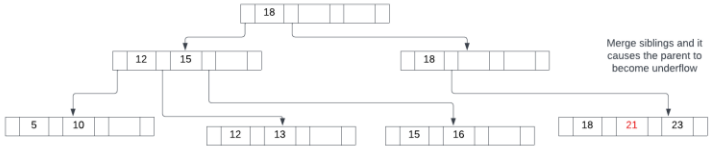




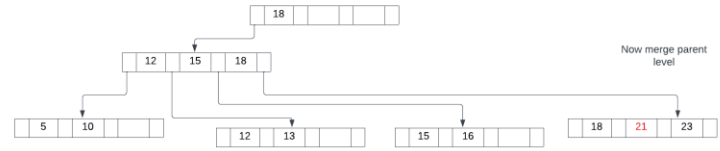


Delete 20





Merge siblings and it causes the parent to become underflow



Now merge parent level

Root is underflow and hence get rid of the root.