University at Buffalo

CSE 4/560
Fall 2024
Databases and Query Languages Homework -3
Total Marks 100

Instructions:

1. Write the answers to each problem in a separate MS Word file, and save it as a single PDF file. Upload the PFD file in BrightSpace
2. Write your name and your UBIT number top of the HomeWork
3. No handwritten or drawn Homework will be accepted.
6. **Submission Deadline: Nov 26th 2024**

Problem 1 [2X15=30]

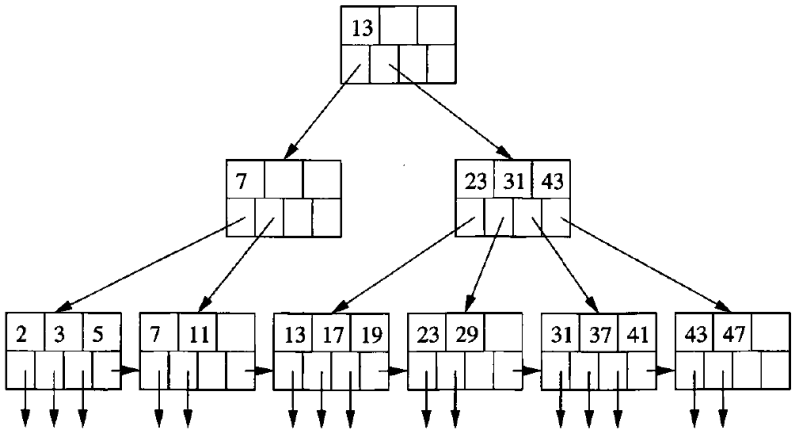

Figure 14.13: A B-tree

Execute the following operations on Fig. 14.13. Describe the changes for operations that modify the tree.

a) Lookup the record with key 41.

Ans:

b) Delete the record with key 23.

Ans:

Problem 2 [10]

Construct a B+-tree for the following set of key values:

(2, 3, 5, 7, 11, 17, 19, 23, 29, 31)

Assume that the tree is initially empty and values are added in ascending order. Construct B+-trees for the cases where the number of pointers that will fit in one node is Four
Ans:

Problem 3 [2X10=20]

What are the minimum numbers of keys and pointers in B-tree *(i)* interior/interim nodes and *(ii)* leaves, when:
a) $n = 10$; i.e., a block holds 10 keys and 11 pointers.
b) n = 11; i.e., a block holds 11 keys and 12 pointers.
Ans:

Problem 4[2X15=30]

Consider the Extendible Hashing index shown in Figure 11.1. Assume The Hash function is *Mod 8*. Answer the following questions about this index:

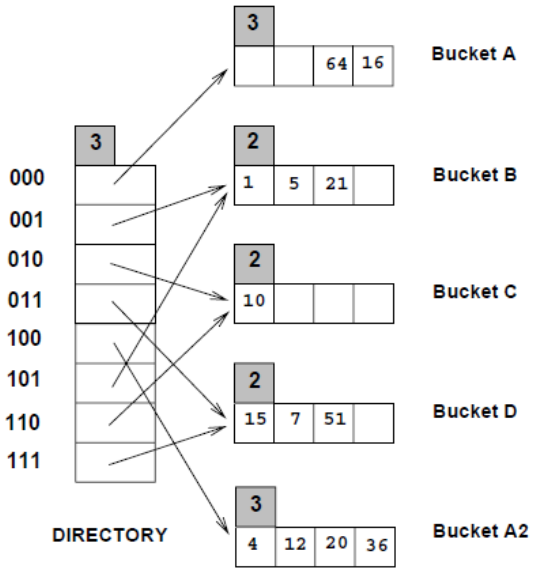

Figure 11.1 Figure for Exercise 11.1

a. Show the index after inserting entries with key values 17 and 69

b.Show the index after inserting an entry with key 68.

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Problem 5[10]

Differentiate between Linear and Extensible Hashing

Ans:

Bonus Work

*Bonus work will be converted to 5%and will be added to your final grade

a) **Problem 1 [10]**
Consider the following two transactions"

T_{13}: read(A);
read(B);
if $A = 0$ **then** $B := B + 1$;
write(B).

T_{14}: read(B);
read(A);
if $B = 0$ **then** $A := A + 1$;
write(A).

Let the consistency requirement be $A = 0 \vee B = 0$, with $A = B = 0$ as the initial values. Show that every serial execution involving these two transactions preserves the consistency of the database.

Ans:

Problem 2[2X5=10]

For each of the following schedules draw a precedence graph for the schedules. Is the schedule conflict serializable? If so, what are all the equivalent serial schedules:

a) r1(A); r2(A), r3(B),w1(A);r2(C),r2(B),w2(B),w1(C)

b) w3(A),r1(A),w1(B),r2(B),w2(C),r3(C)

Ans: