CS 4750: Database Systems (Fall 2021)

POTD 7: Query cost estimation

Due Friday 5-Nov-2021, 10:00am EST — *(no late submission, no extension)*

Purpose:

- Understand the concepts of indexing
- Use B+ tree to find records, insert keys, and delete keys

You may make a copy of a worksheet and complete this activity, or simply type your answers in any text editor.

You may work alone or with at most two other students in this course (feel free to make use of any communication channels of your choice).

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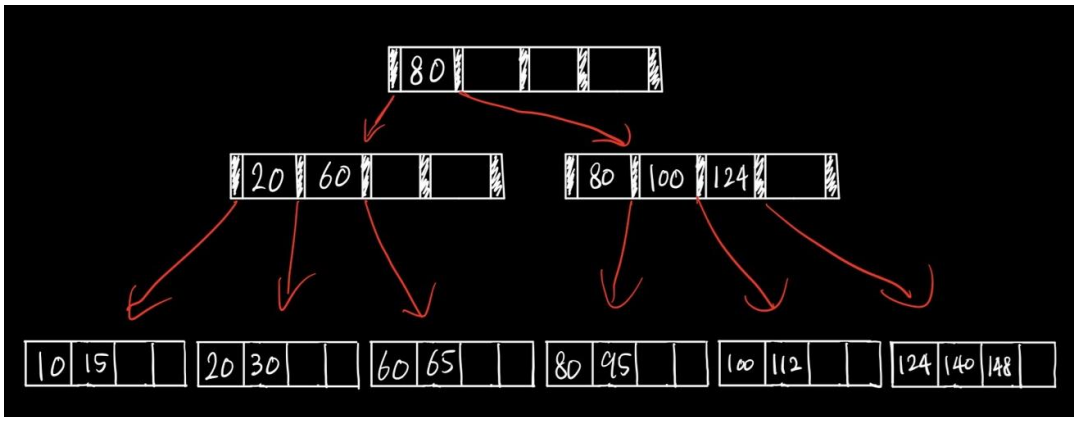
1. Construct a B+ tree for the following set of key values:
   `(10, 15, 20, 30, 60, 65, 80, 95, 100, 112, 124, 140, 148)`

   Assume that the tree is initially empty and values are added in ascending order. Construct B+ tree for the cases where the number of pointers (n) that will fit in one node is five.



2. Use the B+ tree constructed in question 1, what is the **minimum** number of pointers to be followed to satisfy the query: Get all records of data associated with key(s) between 40 and 85?

Three separate paths need to be taken:

1) Look for key(s) between 40 and 60
2) Look for key(s) between 60 and 80
3) Look for key(s) between 80 and 85

1) 1st pointer in the first level node => 2nd pointer in the second level node => two pointers

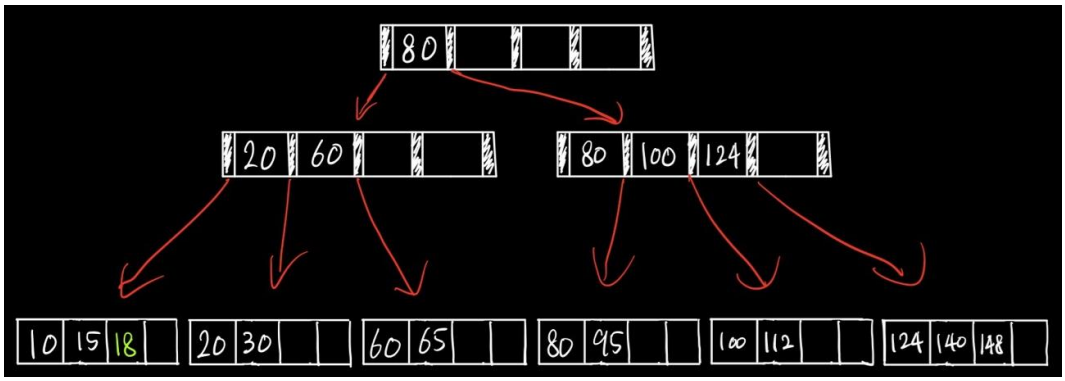
2) 1st pointer in the first level node => 3rd pointer in the second level node => two pointers

3) 2nd pointer in the first level node => 2nd pointer in the second level node => two pointers

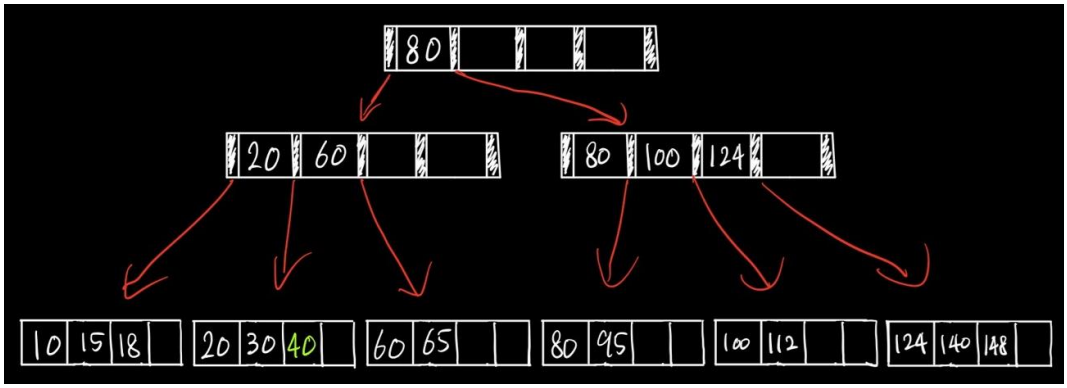
Because the key(s) between 40 and 85 can exist in three different ranges and each path taken costs 2 pointers, a total of 6 pointers are required at minimum to satisfy the query.

3. Use the B+ tree from question 1, apply each of the following operations in order, and show the tree after each operation.
    1. Insert 18
    2. Insert 40
    3. Insert 85
    4. Delete 124
    5. Insert 138
    6. Insert 135
    7. Insert 120

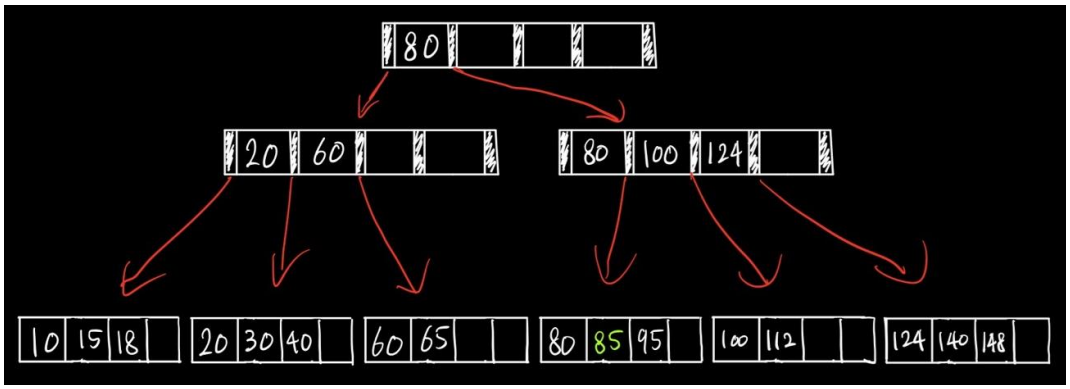
Insert 18



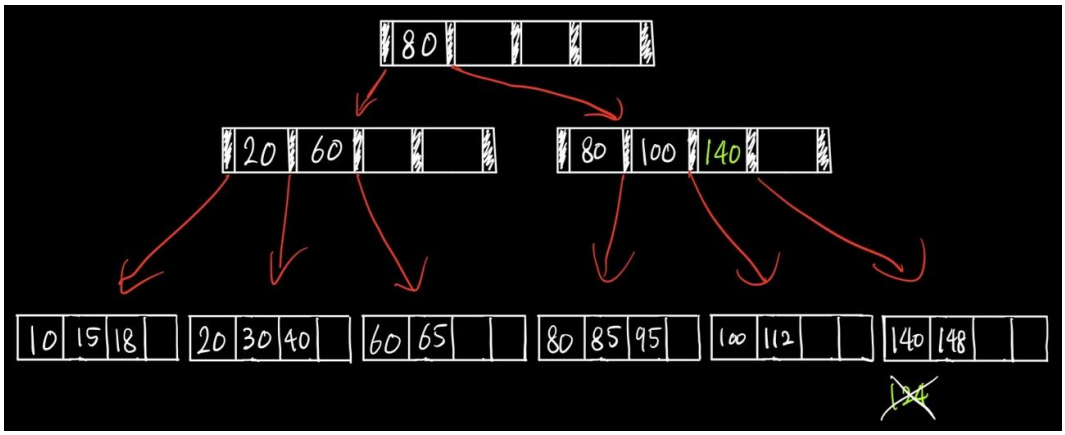
Insert 40



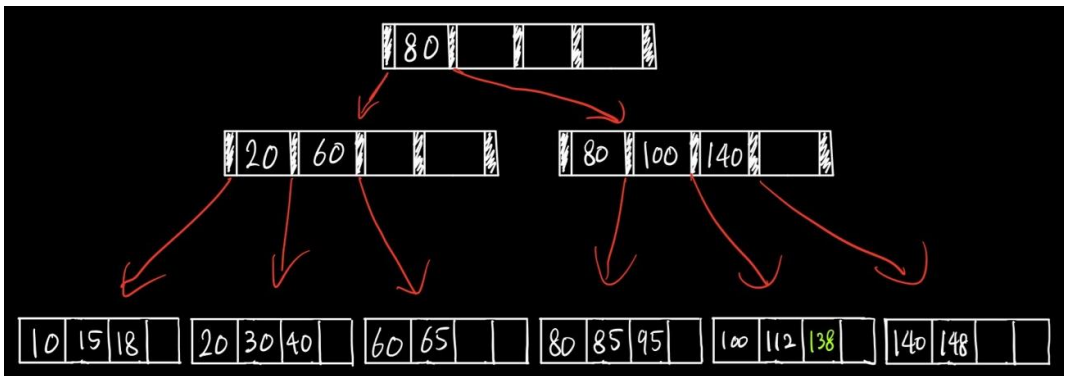
Insert 85



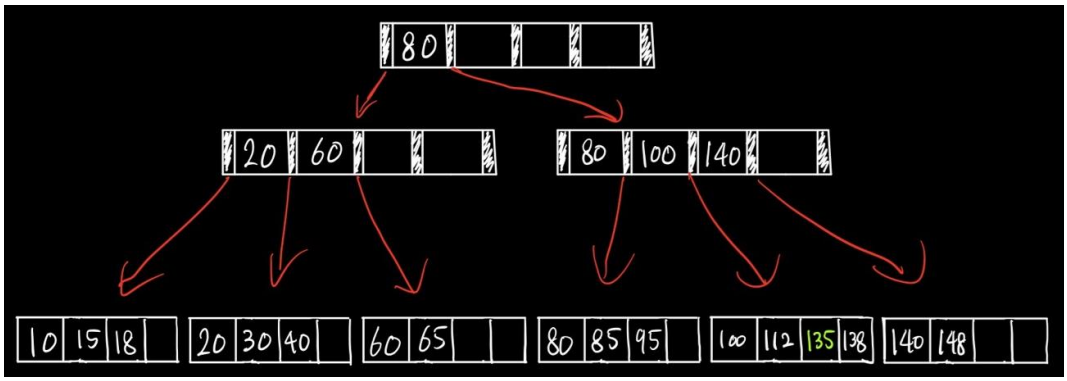
Delete 124



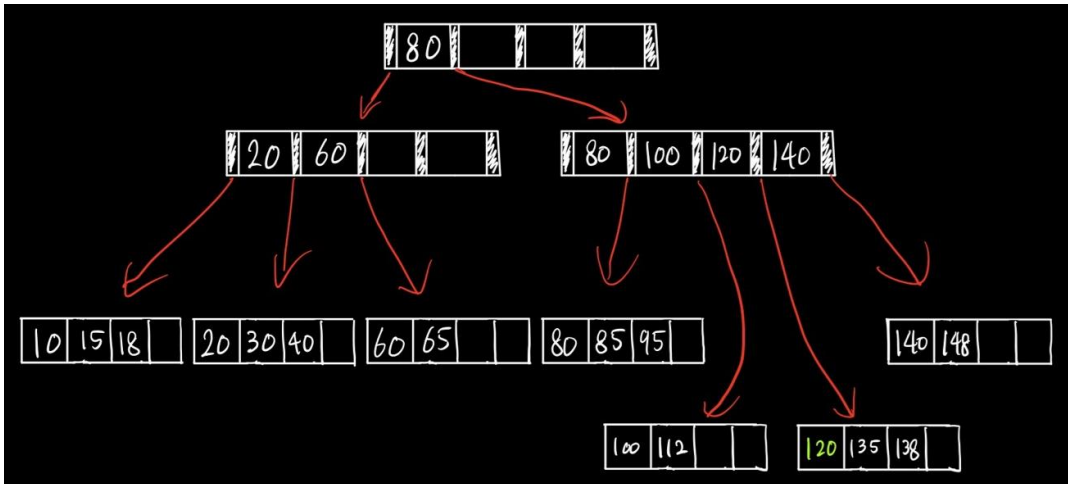
Insert 138



Insert 135



Insert 120



Grading rubric

[Total: 10 points]: Done (or provide evidence of your attempt, full or reasonable effort)

- (5 points) — Providing evidence of your attempt, minimal effort

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Submission

- [optional] Take a selfie (or picture) of your team and submit it with your POTD
- You may do one of the following:
  - Draw and write neatly and then take screenshot(s) of your POTD, or
  - Type and save your POTD as a .pdf file — *No Word document.*
- Submit your POTD to Collab (under Assignments/POTD8). If you have multiple files, no need to zip them.
- Each team submits only ***one*** copy

- When submitting your POTD to Collab, make a note in a submission textarea (or text box), ***clearly specifying all team members' computingIDs and names.*** This will help us record your team's grades efficiently.
- Please verify that your POTD is accessible. Making your submission available to instructors and course staff is your responsibility; if we cannot access your file(s) then we cannot give your credit. Be sure to test access to your file(s) before the due date.