

Extra exercises 4: Tree-Structured Indexing

Question 1: In a B+tree, every root-to-leaf path has the same number of edges.

- A) True
- B) False

Question 2: Assume that we constructed a B+ Tree index in which the data records are stored with the associated index keys (Alternative 1). Which of the options is correct according to the following statements:

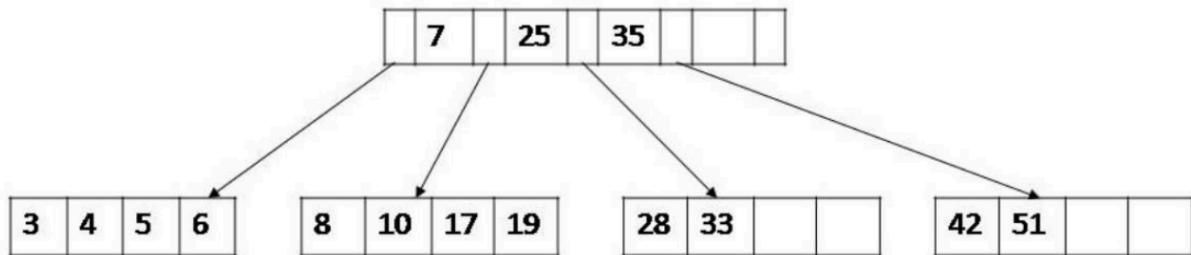
- A) The leaf nodes contain data records.
- B) The inner nodes (which are the non-leaf nodes) contain the records.

- 1) Only A is true.
- 2) Only B is true.
- 3) Both are true.
- 4) None are true.

Question 3: Which of the following statements accurately distinguishes between copy-up and push-up actions in the B+ Trees index?

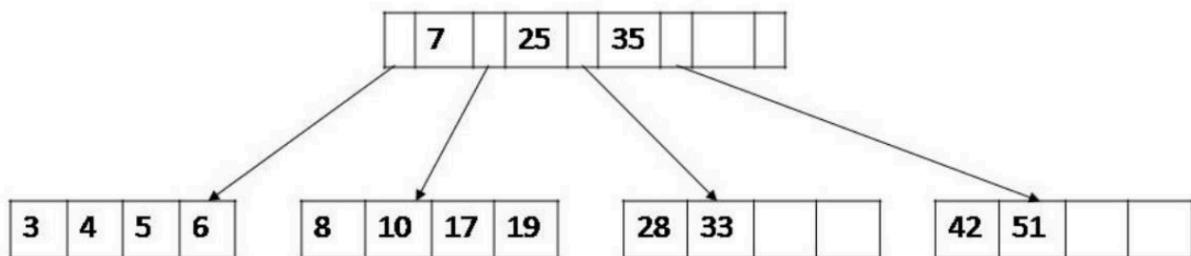
- A) In copy-up action, the median key from a split node is directly inserted into the parent node, while in push-up action, the median key is copied to the sibling node.
- B) Copy-up action involves redistributing keys between the split nodes to maintain balance, while push-up action involves directly copying the median key to the parent node without altering the split nodes.
- C) we want to copy-up leaf node data into the parent so we don't lose the data in the leaf node.
- D) Push-up action only happens when a leaf node splits.

Question 4: What is the maximum number of entries we can add to the following B+ tree without increasing its height? (we can only add integer numbers)



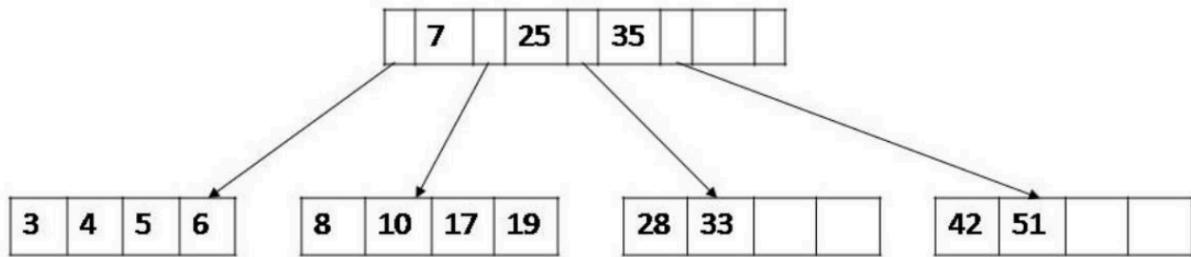
We can insert examples: 26, 27, 52, 53, 54, 55, 56, 57. Then after that the B+ tree will be full.

Question 5: What is the minimum number of entries we can add to the B+ tree above that will cause the height to increase by one? (we can only add integer numbers)



By inserting 2 and 9 for example.

Question 6, 7, 8, 9, 10: Consider the following B+tree with $d = 2$. At each step apply the insert/deletion and calculate the number of edges. For example, the initial tree has 4 edges. The output tree of each part is the input tree of the next one.



- A) The number of edges after inserting 34 into the tree:
- B) The number of edges after inserting 2 into the tree:
- C) The number of edges after inserting 15 into the tree:
- D) The number of edges after deleting 28 from the tree:
- E) The number of edges after deleting 8 from the tree:

Extra exercises 4: Tree-Structured Indexing Solutions

Answer 1: A

Answer 2: 1

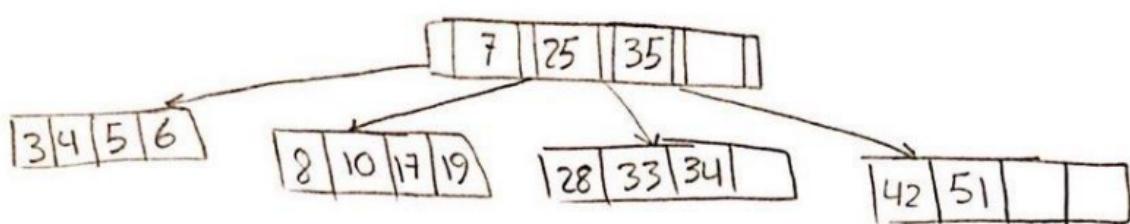
Answer 3: C

Answer 4: 8

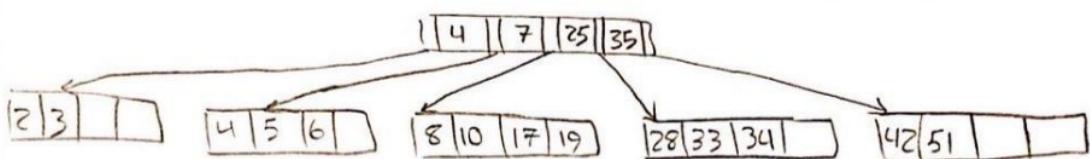
Answer 5: 2

Answers 6, 7, 8, 9, 10:

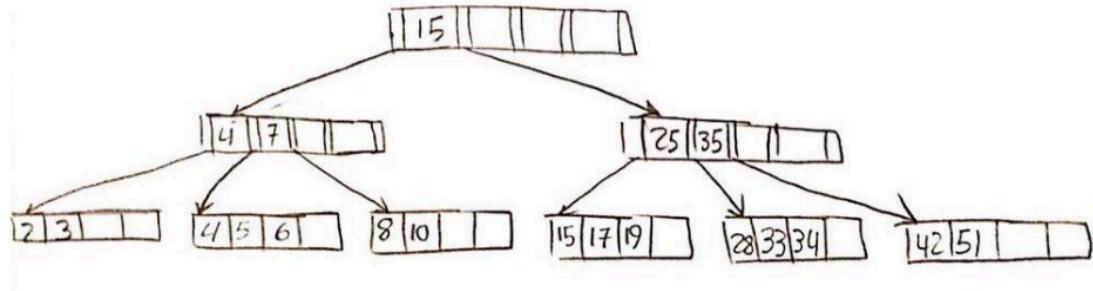
A) 4



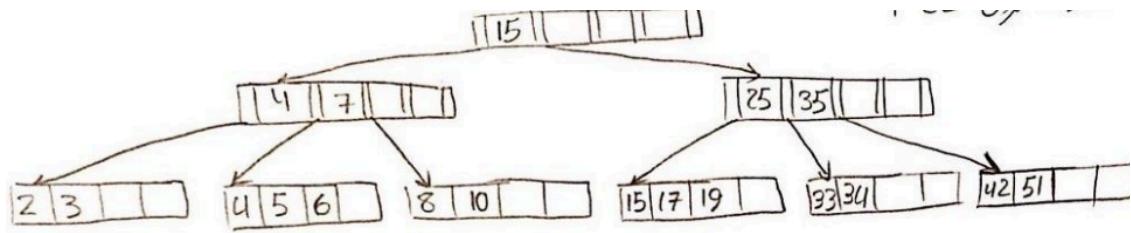
B) 5



C) 8



D) 8



E) 5

