

## CS 353 Spring 2024

### Homework 6

**Due:** May 2, Thursday till midnight

**You will use the Moodle course page for submission of this assignment**

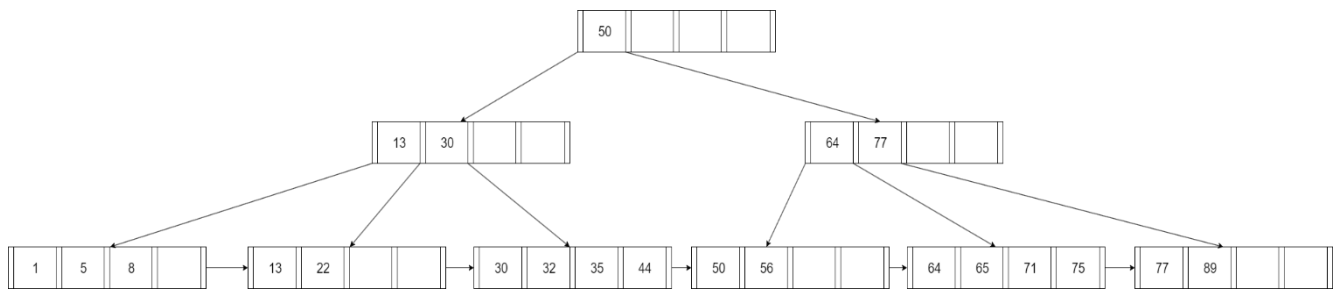
**Q.1 [15 pts]** Construct a B+ tree by inserting the following key values in the given order, using the **insertion algorithm discussed in the class**:

75, 9, 20, 41, 61, 87, 2, 50, 33, 6, 15, 69.

The order of the tree is given as  $n = 3$  (i.e., each node can hold 2 search key values).

**Q.2 [15 pts]** Construct a B+ tree of order  $n = 5$  for the sequence of key values given in **Q.1**.

**Q.3 [10 pts]** Given the following B+ tree of order  $n = 5$ . Draw the resulting tree after deleting the entry with key value 22.



**Q.4 [10 pts]** Given the original B+ tree in **Q.3**. Draw the resulting tree after inserting an entry with key value 11, and then deleting the entry with key value 22.

**Q.5 [10 pts]** Given the original B+ tree in **Q.3**. Draw the resulting tree after inserting an entry with key value 70, and then deleting the entry with key value 77.

**Q.6 [10 pts]** Given the original B+ tree in **Q.3**. Draw the resulting tree after inserting an entry with key value 66, and then deleting the entry with key value 13.

**Q.7 [30 pts]** Consider an extendable hash structure where buckets can hold 3 search key values. The hash function given is  $h(x) = x \bmod 16$ . The hash value of a search key is a 4-bit binary value. The entries with the key values listed below are inserted in the following order:

22, 36, 9, 24, 91, 66, 12, 48, 81, 23, 16, 3

Use the most significant bit of the hash value during insertion.

(a) [5 pts] Find the 4-bit hash values in 4-bit binary for the given key values.

(b) [5 pts] Identify the key values which lead to bucket splits during insertion.

(c) [20 pts] Show the final contents of the hash table and the bucket address table after all the search-key values are inserted.