

# B561 Assignment 5

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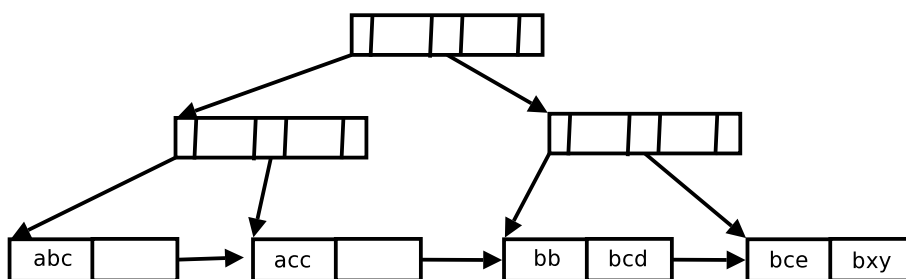


Figure 1: B+-tree

1. Consider the partially specified B+ tree in Figure 1.
  - (a) Fill in the internal nodes without adding new leaf elements.
  - (b) Show the tree in Figure 1 after the element  $bbb^*$  is inserted.
  - (c) Show the tree resulting when the element  $abc^*$  is deleted from your answer to part (b).
  
2. In an extendible hash table a recursive split occurs in case a single insertion necessitates that the size of the hash table increase by a factor of  $2n$ , where  $n > 1$ . (This is equivalent to the global depth increasing by  $n > 1$  on a single insertion.) In this case, we say the recursive split is of order  $n$ . Give an example of an existing hash table and a single element, such that upon insertion of this element, a recursive split of order 4 is caused. Your example should use ordinary integers as elements and hash these elements according to their bitstring equivalents, beginning with the least significant bit (as in your text).

3. Exercise 12.4 in your textbook.
4. Exercise 14.2 in your textbook.
5. Consider the following SQL query

```
SELECT ROADID
FROM ROADS R, ZONES Z1, ZONES Z2
WHERE R.SRCZONE = Z1.ZONEID AND R.ENDZONE = Z2.ZONEID AND
      Z1.TYPE = 'R' AND Z2.TYPE = 'C' AND R.DIST < 10
```

- (a) Translate this query into an RA expression, using the naive translation algorithm.
- (b) Use the rule-based method to transform the RA expression you obtained in (a) into an optimized RA expression. If you make any assumptions (e.g. about the size of the relations involved), state these clearly.