

## HW 12 textbook problems and hints

### 7.1 (1 - 10)

6. ▷ The *ancestry problem* asks to determine whether a vertex  $u$  is an ancestor of vertex  $v$  in a given binary (or, more generally, rooted ordered) tree of  $n$  vertices. Design a  $O(n)$  input enhancement algorithm that provides sufficient information to solve this problem for any pair of the tree's vertices in constant time.

#### Author's hint:

Take advantage of the standard traversals of such trees.

### 7.2 (2 - 6, 3 - 9, 4 - 4)

3. How many character comparisons will be made by Horspool's algorithm in searching for each of the following patterns in the binary text of 1000 zeros?
- 00001
  - 10000
  - 01010

#### Author's hint:

3. For each pattern, fill in its shift table and then determine the number of character comparisons (both successful and unsuccessful) on each trial and the total number of trials.

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7. How many character comparisons will the Boyer-Moore algorithm make in searching for each of the following patterns in the binary text of 1000 zeros?
- 00001
  - 10000
  - 01010

#### Author's hint:

7. For each pattern, fill in the two shift tables and then determine the number of character comparisons (both successful and unsuccessful) on each trial and the total number of trials.

8. a. Would the Boyer-Moore algorithm work correctly with just the bad-symbol table to guide pattern shifts?

b. Would the Boyer-Moore algorithm work correctly with just the good-suffix table to guide pattern shifts?

**Author's hint:**

8. Check the description of the Boyer-Moore algorithm.

### 7.3 (5 - 5)

4. Find the probability of all  $n$  keys being hashed to the same cell of a hash table of size  $m$  if the hash function distributes keys evenly among all the cells of the table.

**Author's hint:**

4. The question is quite similar to computing the probability of having the same result in  $n$  throws of a fair die.

### 7.4 (6 - 6)

3. Find the minimum order of the B-tree that guarantees that the number of disk accesses in searching in a file of 100 million records does not exceed 3. Assume that the root's page is stored in main memory.

**Author's hint:**

3. Find this value from the inequality in the text that provides the upper-bound of the B-tree's height.