9 Information Retrieval (SHT)

In the inverted index of an information retrieval system, dictionary terms can be represented using different data structures.

(a) Consider the trie in the figure above, which encodes several dictionary terms.

(i) List the terms contained in this trie. [2 marks]

(ii) Explain how terms are looked up in a trie. [2 marks]

(b) Alternatively, we could store the terms in a binary search tree.

(i) Draw the binary search tree with minimal depth that stores the dictionary terms from the figure above. [3 marks]

(ii) Compare the worst-case time complexity of dictionary lookup for a binary tree and a trie. What are the conditions where the binary tree is preferable to a trie? [3 marks]

(c) Next consider a radix tree, a space-optimised trie data structure where each node with only one child is merged with its child.

(i) Draw the radix tree containing the dictionary terms from the figure above. [2 marks]

(ii) Give an algorithm for insertion of a new index term $t = t(0)\ldots t(k)$ into a radix tree. Use examples to illustrate your algorithm. You may use pseudocode as long as you clearly explain your thoughts. [8 marks]