Algorithm Engineering – FINAL TERM
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Question #1 [score 4] Given the set of strings S = {abab, abca, abma, baa, bbb}, build a Patricia trie and show the steps for the lexicographic search of the strings P1 = aaa, and P2 = abb.

Question #2 [score 4+4]. Given the sequence of integers S = (2, 3, 4, 5, 6, 10, 11), compress it via:
- (2,6)-dense code [showing the first 12 codewords of the integers from 0 to 11]
- Interpolative Coding [compressing the integers 5, 3, 10]

Question #3 [rank 4]. Given the tree of root labeled "a", show its succinct encoding:

T = { a➔b (right child); b➔c (left child); b➔e (right child); c➔d (right child) }

Question #4 [score 4]. Decompress the 6th integer encoded via Elias-Fano in the two arrays:

L = 01 11 00 01 01 00 11 11 00 11 00 and
H= 110 110 10 0 10 10 10 110 0 0 10 0 0 0 0 0

(*hint*: derive first the number of keys, and then the length of the low and high part)

Question #5 [scores 4] Given the text T = bababac, apply the pipeline BWT+MTF+RLE0 (with Wheeler's code) and finally apply Arithmetic coding on the first 3 numbers of the output of this pipeline.

Question #6 [score 4+4] Two theoretical questions:
- Prove the upper-bound in bits of Arithmetic coding, as a function of the Entropy and the input text length.
- Show and prove the space bound in bits of the **succinct** data structure built to support a Rank operation in constant time over a binary array B[1,n].