Algorithm Engineering
27 May 2021 – time 60 minutes

Question #1 [scores 4+4]. Given the probabilities p(a)=0.15; p(b)=0.2; p(c)=0.1; p(d)=0.25; p(e)=0.3,

1. Construct the Canonical Huffman code, showing the steps followed by the algorithm.
2. Then use it to decode the bit sequence 1001001, showing each decoding step.

Question #2 [scores 5+5]. Given the string S = accaracca, compute its

- parsing LZ77
- parsing LZ78 (with its trie data structure)

Question #3 [scores 5]. Given the sequence of integers S=(1, 5, 16, 18, 20, 24, 30), encode them using Elias-Fano coding.

Question #4 [scores 4+3]

- Show the Suffix Array of the string S = bababac
- Show the first two steps of using it to search for the string “ba” into S.

Algorithm Engineering -- THEORY
27 May 2024 – 45 minutes

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Questions [score 8+8+8+6]

- Compute the probability of having a 0 in a specific position of the binary array of the Bloom Filter, whose size is m and number of inserted keys is n; and then derive/prove its overall error probability.
- Given a sequence of n non-negative integers smaller than u, state the space occupancy of Elias-Fano coding and prove it.
- State the I/O-complexity of the multi-way mergesort in terms of M, B, and N
- Given a dictionary D of n strings of variable length, totaling N chars. Discuss at least 3 solutions for their storage by also commenting their space complexity and their time/IO cost to support the retrieval of the i-th string (aka, Access(i)).