Algorithm Engineering
20 January 2021 – time 45 minutes

Question #1 [ranks 4]. Simulate the behavior of the algorithm MultiKey-Quicksort on the following array of 5 strings S=[bus, bath, abacus, aargh, cat], by assuming that the pivot string is always the first one of the recursive set of strings.

Question #2 [ranks 5]. Given the integer sequence S = (1, 2, 3, 4, 6, 8, 9), show how Interpolative Coding compresses the "first three" integers according to its algorithm.

Question #3 [ranks 4]. Let us given the probabilities: p(a) = 1/2, p(b)=p(c)=1/4. Decompress the first 2 symbols of the Arithmetic coded bit sequence: 111.

Question #4 [ranks 4]. Perform the intersection between the two sets S1 = {1, 8} and S2 = {1, 2, 5, 7, 10, 15, 20} via the algorithm based on "binary search with exponential jumps" (or, doubling search).

Question #5 [rank 3+3+4+3]. Given the binary strings S={001, 10010, 10011, 101}.
- Build the Patricia Trie for S
- Show how to search for the lexicographic position of the string P=110 among the strings of the set S.
- Propose a succinct encoding of the Patricia Trie of S that allows navigation in constant time per traversed edge.
- Simulate the downward search for P=110 in this succinct encoding.