Algorithm Engineering
04 July 2022 – time 60 minutes

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Question #1 [ranks 5]. Given the integer 6 show how the (s,c)-dense code with parameters s=3 and c=5 encodes it. (*hint*: Derive first the number of bits used for stoppers and continuers)

Question #2 [ranks 4+4+4]. Given the string S = "cbababaa":

- Show the result of the computation of the Burrows-Wheeler Transform for the string S. Call the result bwt(S).
- Apply the transformation Move-To-Front (MTF) to the string bwt(S), by assuming that the initial MTF-list is (a,b,c) and counting symbol positions from 0 in the MTF-list.
- Show the result of Huffman's compression applied to the sequence of MTF-integers generated by the previous step, using their empirical frequencies as "probabilities".

Question #3 [ranks 5]. Construct a minimal ordered perfect hash for the set of 5 strings S={aba, abb, bbb, caa, cba}. Assume m = 7 > 5, and choose the values of $h_1(X)$ as the **sum** of the codes of the three characters in X, and $h_2(X)$ as the **multiplication** of the codes of the three characters in X, where code(a)=1, code(b)=2 and code(c)=3.

Question #4 [ranks 5+3]. Describe the interpolation-search data structure over the set of items S={2,3,4,9,10,18,20,21,28,30,32,36}. Comment how it is searched the key y = 31.