

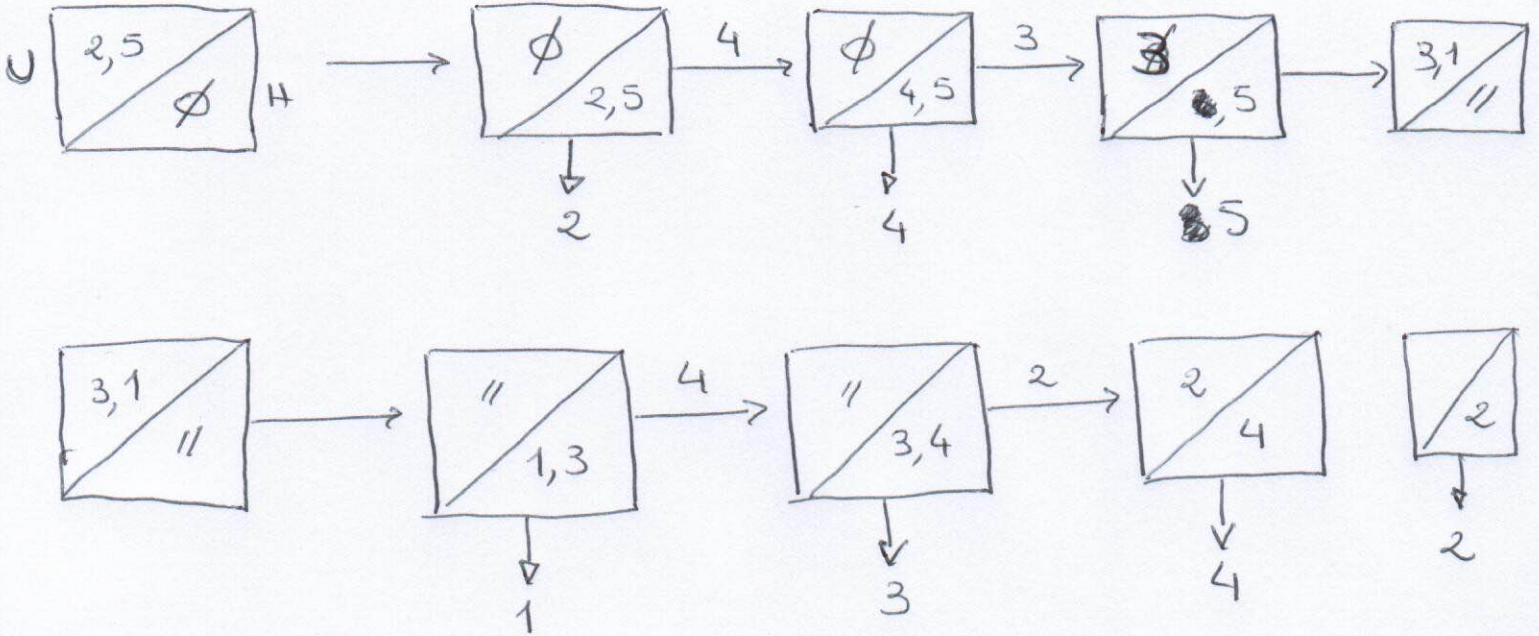
Algorithm Engineering

16/1/23

Q1

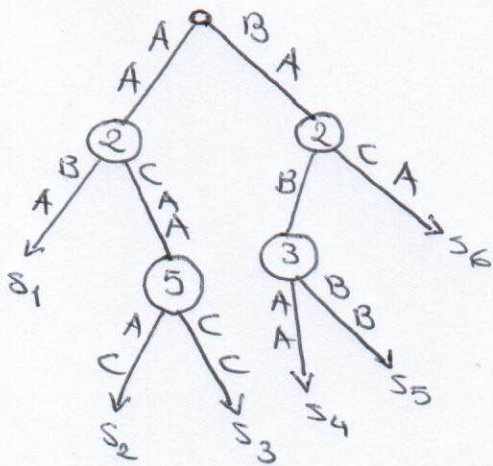
$S = 2, 5, 4, 3, 1, 4, 2$

with $M=2$

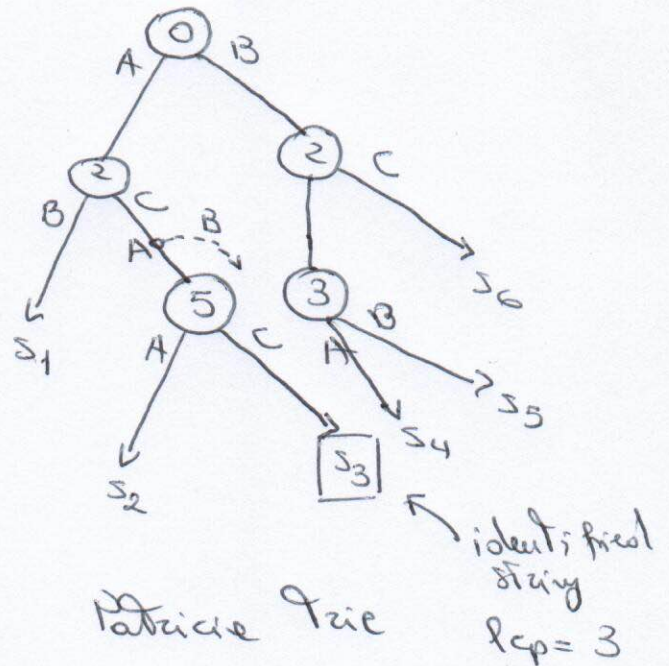


Runs: 2, 4, 5 ; 1, 3, 4 ; 2

Q2

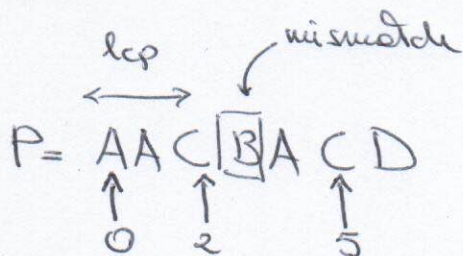


Compacted Trie



Patricia Trie

ident; first string
lcp=3



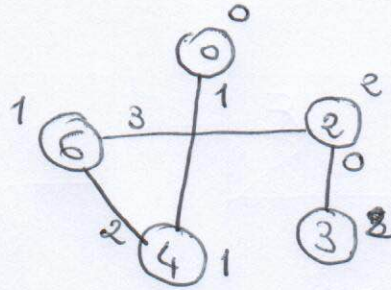
lexicographic pos
between s_3 and s_4

Q3

$h_1(xy) = x+y \pmod 7$ $h_2(xy) = x+2y \pmod 7$

	h_1	h_2	rank $h_1()$
AA	2	3	0
AC	4	0	1
BB	4	6	2
CC	6	2	3

A=1
B=2
C=3

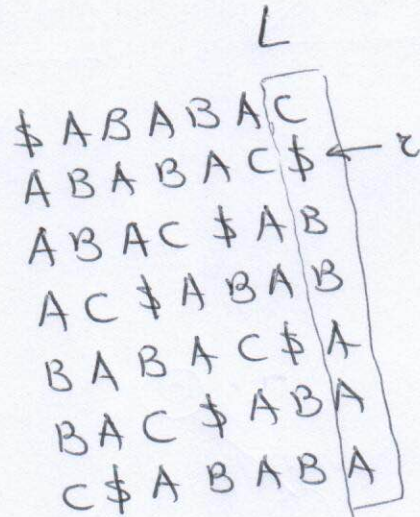


g	z
0	0
0	1
2	2
2	3
1	4
0	5
1	6

~~g(xy) = g(h1(xy)) + g(h2(xy)) mod 4~~
 $h(xy) = g(h_1(xy)) + g(h_2(xy)) \pmod 4$

Q4

T = ABABAC \$
 1 2 3 4 5 6 7
~~ABAB~~
~~ABAB~~



$\langle L, z \rangle = \langle C \$ BBAAA, 1 \rangle$

- Apply HTF to string CBBAAA starting with $L = (A, B, C)$

result is: 220200

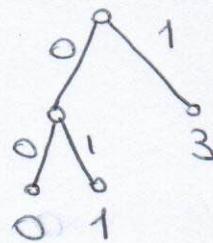
- Apply RLE to the result of HTF

→ 330300 → 33031
 +1 to numbers greater than 0
 wheeler's code

- Apply Huffman

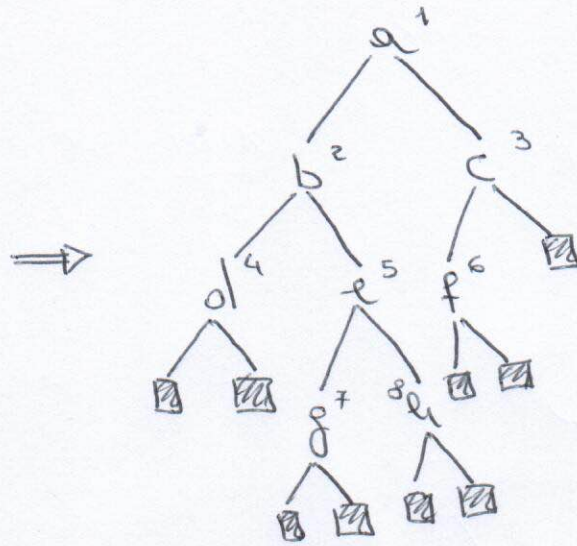
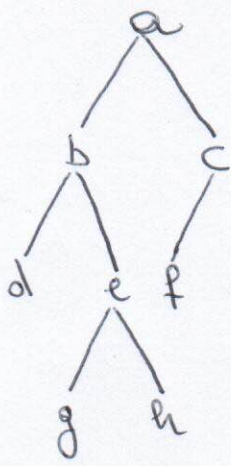
$p_0 = 1/5$
 $p_1 = 1/5$
 $p_3 = 3/5$

Huffman tree



⇒ $\frac{1100101}{33031}$

Q5



$$B = \begin{matrix} 1 & 11 & 1110 & 001100 & 0000 \\ 1 & 23 & 456 & 78 & \end{matrix}$$

$$L = \begin{matrix} a & bc & def & gh \\ 1 & 23 & 456 & 78 \end{matrix}$$

•) root = a is at position 1 in B, rank = 1 (bold numbering)
BFS

•) right child = c is at position $2 \cdot 1 + 1 = 3$ in B, which is a 1
the label c is $L[\text{rank}_1(B, 3)] = B[3] = c$
BFS-numbering over T is 3

•) left child = f is at position $2 \cdot 3 = 6$ in B, which is a 1
the label f is $L[\text{rank}_1(B, 6)] = L[6] = f$
BFS-numbering over T is 6

•) f is a leaf of T because its left and right children are null
 $B[2 \cdot 6] = 0$
 $B[2 \cdot 6 + 1] = 0$

•)