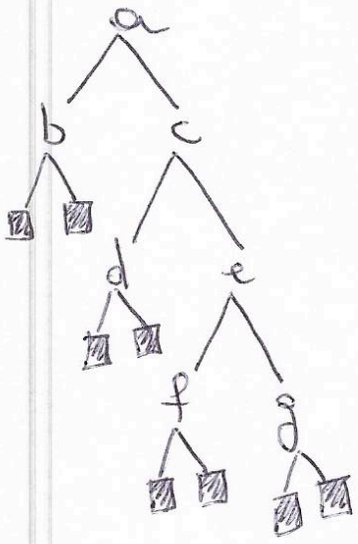
Algo Eng Final Term 15/12/21

Ex 1



LOUDS →

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	0	0	1	1	0	0	1	1	0	0	0	0
1	2	3			4	5			6	7				

"a" → root → x = 1 is the "rank" of the visited node

"c" is the right child of "a" → rank(c) = $rank_1(2x+1)$ = $rank_1(3) = 3$

↑ LOUDS[3] = 1 ≠ 0
↳ node exists.

"d" is the left child of "c" → rank(d) = $rank_1(2 \cdot 3)$ = $rank_1(6) = 4$

↑ LOUDS[6] = 1 ≠ 0
↳ node exists

```
Check (T_Louds, L_Louds, X, d)
    n = #nodes in T;
    for i = 1 To n do
        if (L_Louds[i] == X) then
            y = i ; dist = 0;
            while (y > 1) do
                y = ⌊select_1(y)/2⌋ ;
                dist++;
            if (dist == d) then return TRUE
    return FALSE;
```

Ex 2

Symb	0	1	2	3
1	//	//	//	//
2	A	B	//	//
3	C	D	E	//
4	F	G	//	//

FC	
1	2 ← dummy value
2	2
3	1
4	0

$v = 0$; $l = 1$ → $v < FC[1]$ → continue

$v = (00)_2 = 0$; $l = 2$ → $v < FC[2]$ → continue

$v = (000)_2 = 0$; $l = 3$ → $v < FC[3]$ → continue

$v = (0001)_2 = 1$; $l = 4$ → $v > FC[4]$ → symb $[l, v - FC[0]]$

= symb $[4, 1 - 0]$ = G

$v = 1$; $l = 1$; → $v < FC[1]$ → continue

$v = (11)_2 = 3$; $l = 2$ → $v > FC[1]$ → symb $[2, 3 - 2]$ = B

Ex 3

S = CABABCA $

position of $ (counting from 1)

< 8, ACCBAAB >

	L
$CABABC	A
A$ -----	C
ABA ----	C
ABC ----	B
BAB ----	A
BCA ----	A
CA$ ----	B
CAB ----	$

MTF

0 → A, B, C

2 → C, A, B

0 → C, A, B

2 → B, C, A

2 → A, B, C

0 → A, B, C

1 → B, A, C

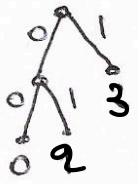
⇒ RLE ∅ does modifies MTF

2 → 3, 1 → 2

0-runs have len 1 so are encoded as ∅.

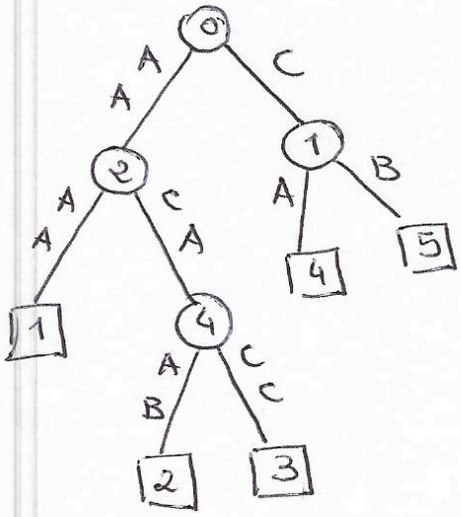
To apply huffman:

$p(0) = \frac{3}{7}$ $p(2) = \frac{1}{7}$ $p(3) = \frac{3}{7}$ →

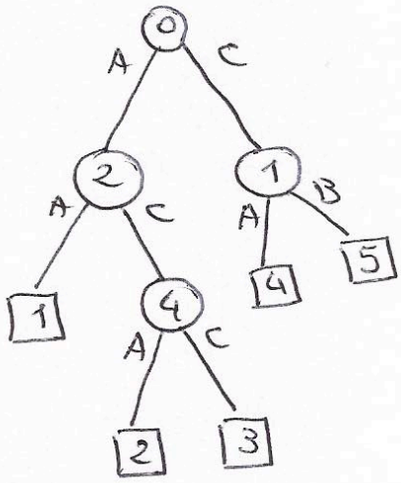


So compressing MTF we obtain: $\underset{0}{\underline{00}}\,\underset{3}{\underline{1}}\,\underset{0}{\underline{00}}\,\underset{3}{\underline{1}}\,\underset{3}{\underline{1}}\,\underset{0}{\underline{00}}\,\underset{2}{\underline{01}}$

Ex 4

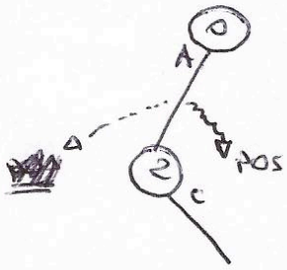


Compacted Trie



Patricia Trie

P1 = ABC ⟶



① we thus select a descending leaf, e.g. [2] = AACAAB

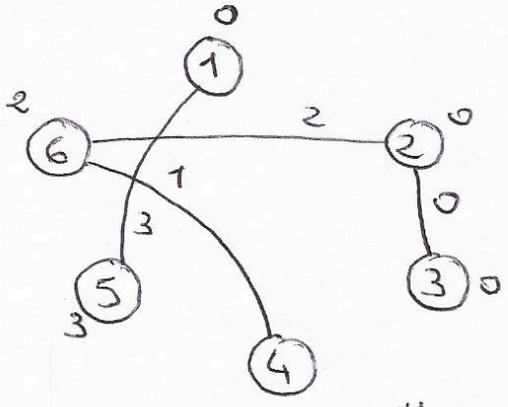
② compute LCP = 1
mismatch P1 → B
s_2 → A

③ so the position of P1 is to the right of [3]

EX 5

	h	h_1	h_2
11	0	2	3
22	1	4	6
33	2	6	2
44	3	1	5

(*) I've not shown the node 0 because this value is not used



It is not acyclic, so the solution for g() does exist

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

$h(t) = g(h_1(t)) + g(h_2(t)) \bmod 4$