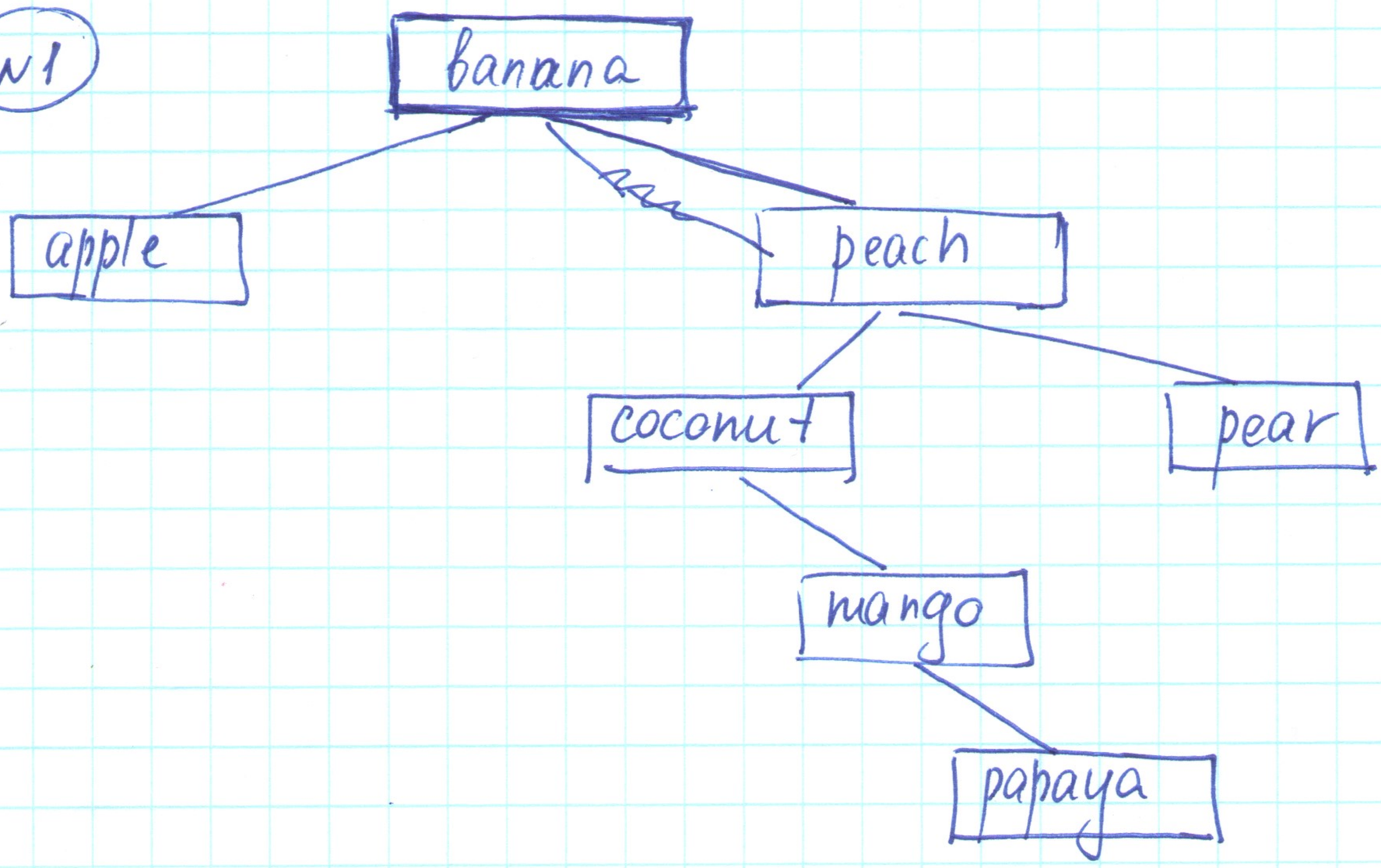
CS135 Section 11.2

N1



N3 a) pear: 2·2 comparisons (with 'banana' and 'peach')
+ 1 comparison (when locating an item)

- following algorithm1 on page 759
- counting comparisons of x (pear) with other vertices.

2·2 + 1 = 5 comparisons when locating an item

2·2 = 4 comparisons when adding an item.

the book's answer: 3

clarification is needed:
which comparisons are counted?
=? >? ...

b) banana : 1

c) kumquat: 2×4 + 0 = 8 comparisons when locating

book's : 4 2×4 = 8 comparisons when adding

d) orange: 2×5 + 0 = 10

book's : 5 2×5 = 10

CS135 Section 11.2

(N11) sorting 4 numbers (a, b, c, d)

there are $4 \cdot 3 \cdot 2 \cdot 1 = 24$ possible permutations of a, b, c, d

$$\underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad}$$
$$4 \times 3 \times 2 \times 1$$

we have binary comparisons, therefore a binary tree, i.e. $m = 2$.

By theorem 5 (p. 754 in the book), there are at most 2^h leaves in a binary tree of height h.

$2^h = 24 \leq 2^?$

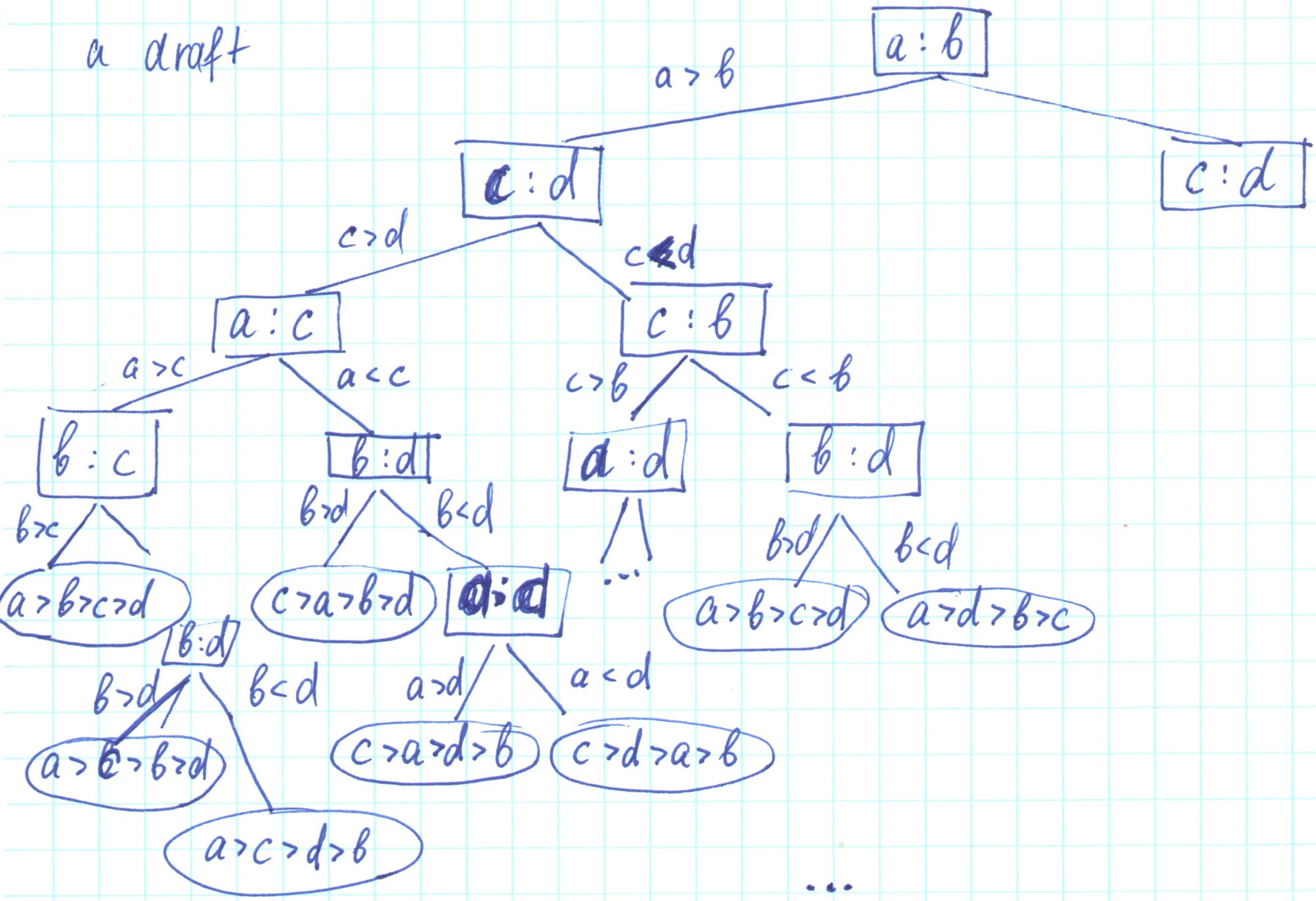
$32 = 2^5$.

24 is not a power of 2, the closest one is 32

Therefore, the height of the tree is 5.

At least 5 comparisons are needed.

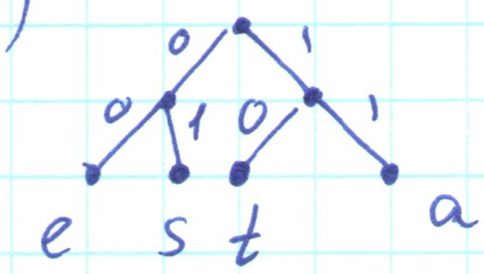
a draft


a : b
a > b
c : d
c : d
c > d
c < d
a : c
c : b
a > c
a < c
c > b
c < b
b : c
b : d
a : d
b : d
b > d
b < d
b > d
b < d
b > c
a > b > c > d
c > a > b > d
a : d
...
a > b > c > d
a > d > b > c
b : d
b > d
b < d
a > d
a < d
a > b > b > d
a > c > d > b
c > a > d > b
c > d > a > b

...

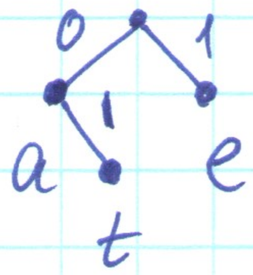
cs135 Section 11.2

(#19) a)



these are prefix codes, because a, e, t and s are leaves

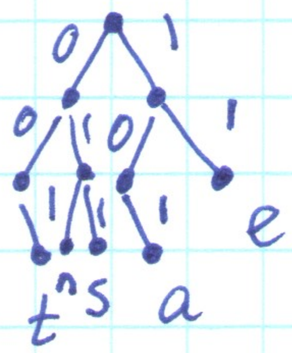
b)



stop, a is not a leaf

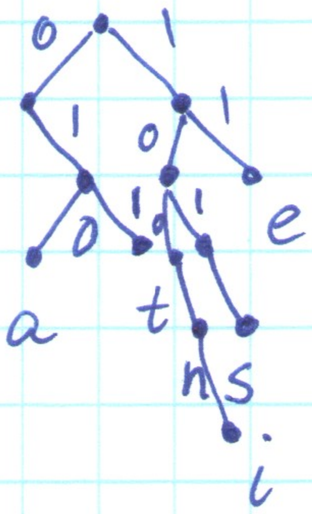
these are not prefix codes
(or we can say that code for a: 0 serves as a prefix for code of t, which is not allowed)

c)



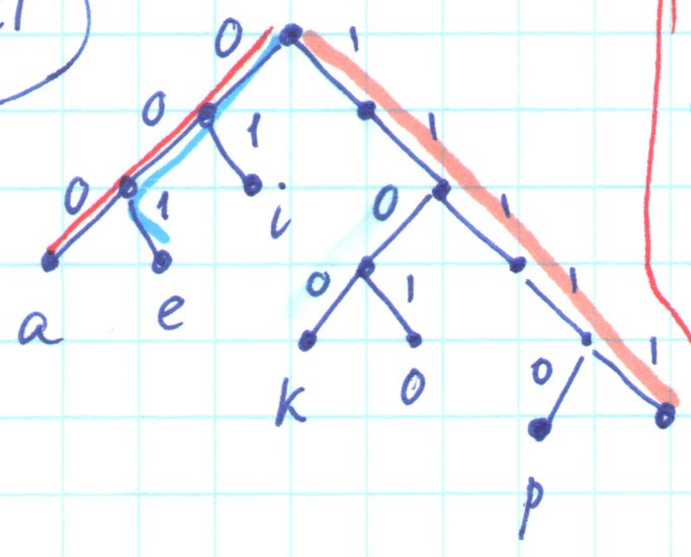
these are prefix codes
(no code is a prefix in code for other letters)

d)



these are prefix codes.

(#21)

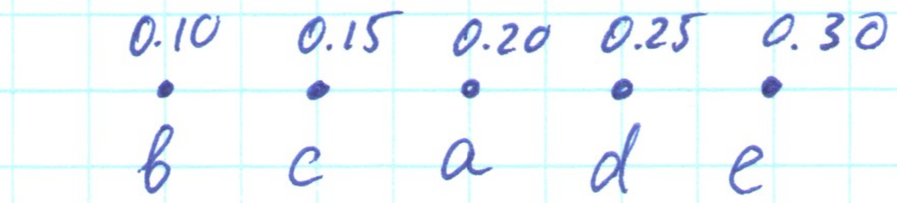


a : 000
e : 001
i : 01
k : 1100
o : 1101
p : 11110
u : 11111

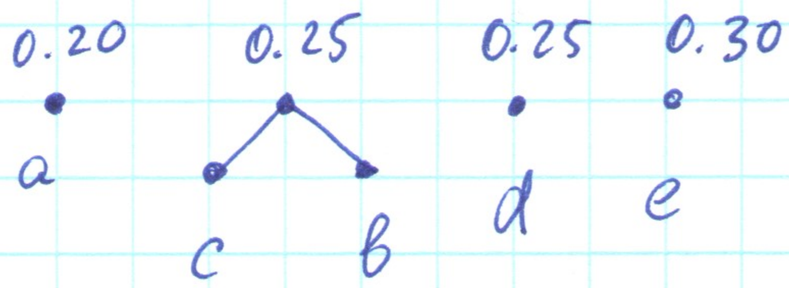
CS135 (#23)

Section 11.2

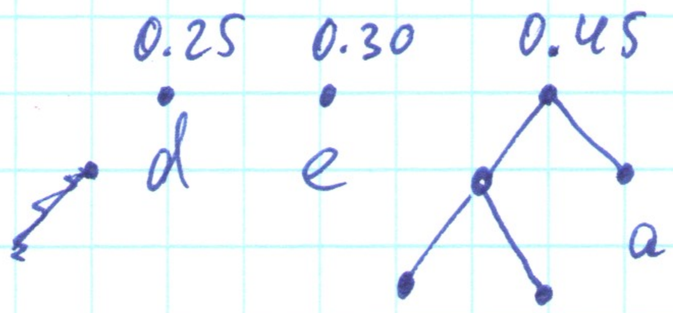
a : 0.20
b : 0.10
c : 0.15
d : 0.25
e : 0.30



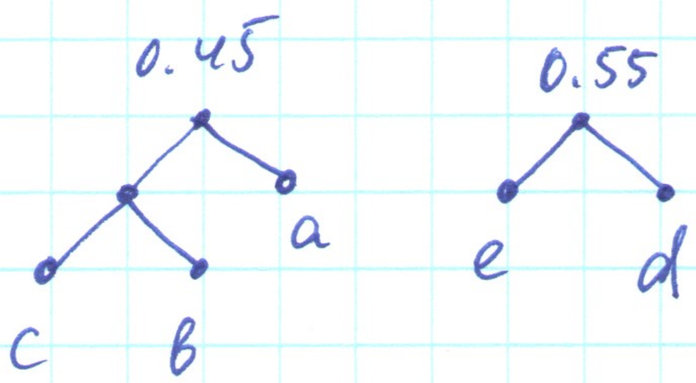
Initial forest



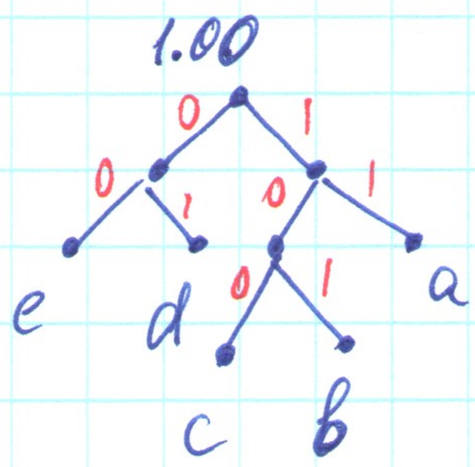
Step 1



Step 2



Step 3



a : 11
b : 101
c : 100
d : 01
e : 00

The average number of bits used to encode a symbol = $2 \times 0.2 + 3 \times 0.1 + 3 \times 0.15 + 2 \times 0.25 + 2 \times 0.3 =$

$= 0.4 + 0.3 + 0.45 + 0.5 + 0.6 = 2.25$