Discrete Structures. Tutorial 9.

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1. Answer the following questions:

a. Root vertex : a

b. internal nodes: a, c, d, e, g, i

c. leaves: b, f, h, j, k, l

d. children of c : d, e

e. parent of h : e

f. siblings of d : e

2. Answer the following questions:

a) Since we know that a tree with n vertices has n-1 edges, the tree in question will have 10000 - 1 i.e. 9999 vertices

b) A full 5-ary tree ~~will have~~ with 100 internal vertices will have.

$n = mi + 1$ vertices

$= 5 \times 100 + 1 = 501$ vertices

c) A full 3-ary tree with 100 vertices will have:

$n = mi + 1$

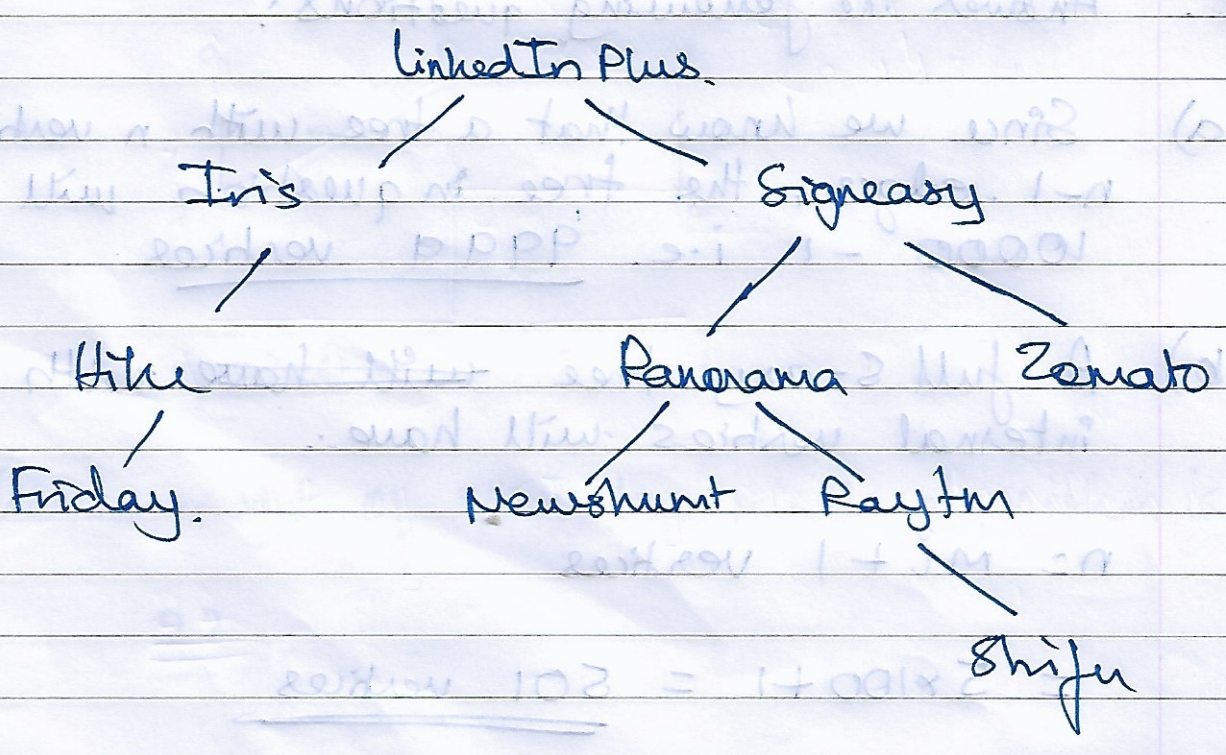
$\Rightarrow i = \frac{n-1}{m}$

i.e. $i = \frac{100-1}{3} = \underline{33}$ internal vertices

$l = (m-1)i + 1$

i.e. $(3-1)33+1 = \underline{67 \text{ leaves}}$

3. The desired binary search tree is:



5. The characters are.

E - 0.30
B - 0.25
D - 0.15
A - 0.1
G - 0.08
F - 0.07
C - 0.05

The huffman encoding for these would be.

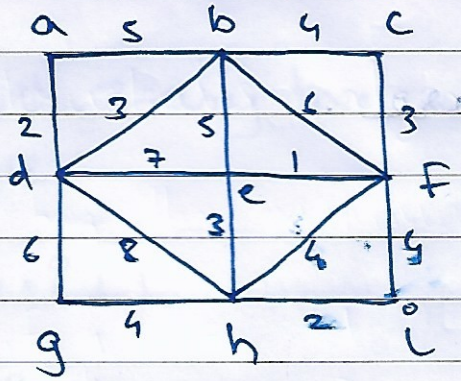
E - 11
B - 01
D - 101
A - 001
G - 000
F - 1001
C - 1000

~~Total bits = 3.57~~

Average bits per character = $\frac{\Sigma \text{ Frequency} \times \text{codelength}}{\Sigma \text{Frequency}}$

$= \underline{2.57}$

4.

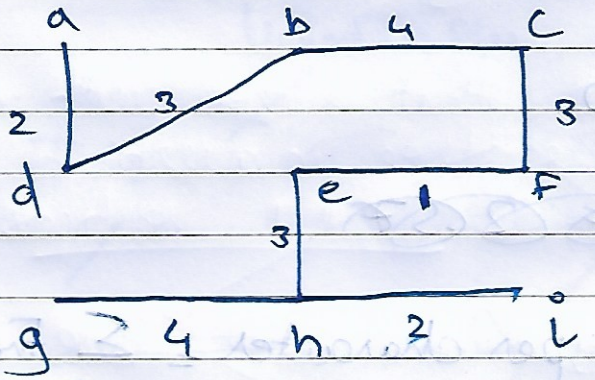


By prim's algorithm, choosing ~~arbitrary~~ ~~vertex~~, the smallest edge, $\{e, f\}$

$\{a, d\}$
$\{d, b\}$
$\{b, c\}$
$\{c, f\}$
$\{f, e\}$
$\{e, h\}$

~~3~~
5
4
5
1
3

$\{e, f\} = 1$.
$\{f, c\} = 3$.
$\{e, h\} = 3$.
$\{h, i\} = 2$.
$\{c, b\} = 4$.
$\{b, d\} = 3$
$\{d, a\} = 2$
$\{h, g\} = 4$.



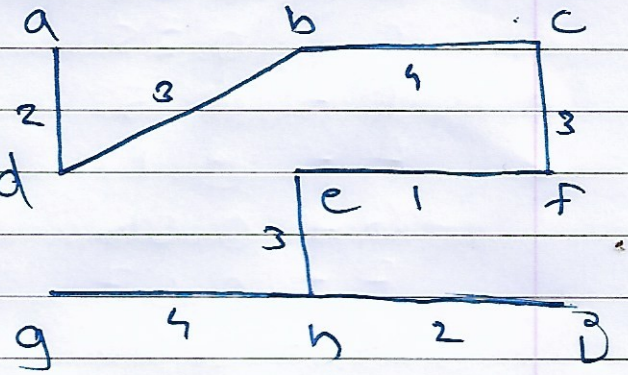
hence, weight of MST by prim's algorithm is:

22.

By kruskall's algorithm,

selecting the minimum weighted edges,

$\{e, f\} = 1$
$\{a, d\} = 2$
$\{b, i\} = 2$
$\{e, h\} = 3$
$\{a, b\} = 3$
$\{c, f\} = 3$
$\{g, h\} = 4$
$\{b, c\} = 4$



Hence, the weight of the MST by kruskall's algorithm is 22