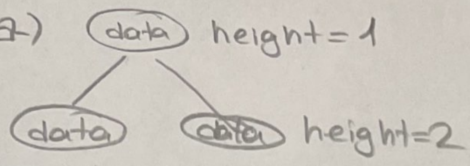
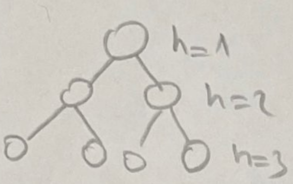
Q1:

a-)



depth $= 2 \times 2 + 1 = \underline{\underline{5}}$



$3 \times 4 + 2 \times 2 + 1 = 17$ ... $4 \times 8 + 3 \times 4 + 2 \times 2 + 1 = 49$

Total depth of height n

$h \times 2^{h-1} + h-1 \times 2^{h-2} + \dots 1$

b-)

When we want to find how many steps required for a succesfull search. If we have node x has k data, x's depth is $d(x)$, so the number of comparisons required to find key k in tree. In this situation we should handle "probability" for finding k. probability for k is p. According to probabilistic assumption, all nodes has same probability which is $\frac{1}{n}$. So our equation is;

$$\sum_{i=1}^{N} \frac{1}{n} \cdot d(x_i)$$

$d(x_i) \rightarrow$ with section a, it becomes $i.2^{i-1}$. So,

$$\sum_{i=1}^{\log(N+1)} \frac{1}{N} \cdot i.2^{i-1} < \log(N+1) \Rightarrow O \log(N)$$

c-) No. If a full binary tree has n nodes, internal nodes number is $\frac{n-1}{2}$ and If a full binary tree has n nodes, leaves number is $\frac{n+1}{2}$

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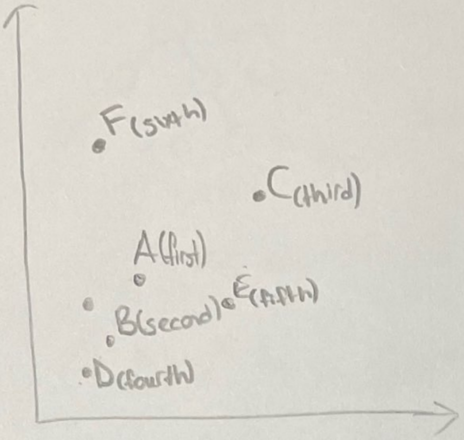
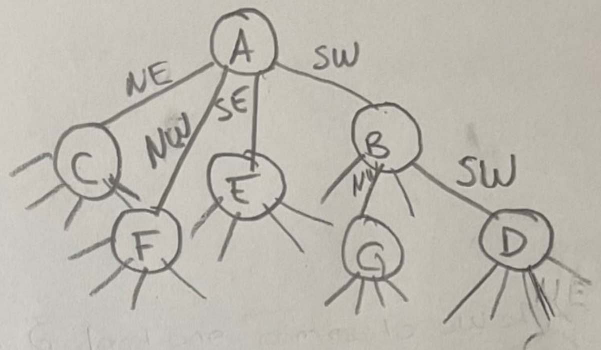
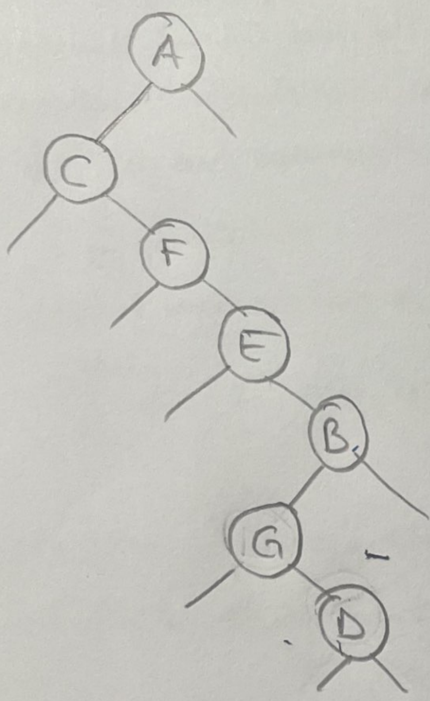
Q2

(30,30), (20,15), (50,40), (10,12), (40,20), (25,60), (15,25)
A B C D E F G





when we want to rearrange for binary tree



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