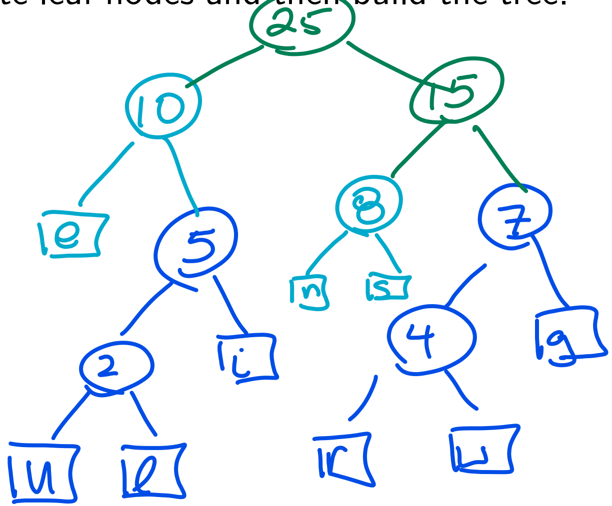
1 Let's build a tree for "`engineering useless rings`"

0010 01 11 00...

Step two : Create leaf nodes and then build the tree.

char	count
~~e~~	~~5~~
~~n~~	~~4~~
~~s~~	~~4~~
~~g~~	~~3~~
~~i~~	~~3~~
~~r~~	~~2~~
~~␣~~	~~2~~
~~u~~	~~1~~
~~l~~	~~1~~



How to Encode Message?

- Encode the tree
- Encode the message
- Decoding is similar

CompSci 161
Winter 2023 Lecture 20:
Greedy Algorithms:
Fractional Knapsack and
Comparison of Techniques

Fractional Knapsack

how much you take

- Decide x_i : $0 \le x_i \le w_i$
- Require $\sum_i x_i \le W$
- Goal: max $\sum_i b_i(x_i/w_i)$. $= \max \sum_i \left(\frac{b_i}{w_i}\right) x_i$

Suppose $W = 10$ and

Item :	1	2	3	4	5
Weight:	4	8	2	6	1
Benefit:	12	32	40	30	50

Greedy Algorithm for Fractional Knapsack

- Sort by benefit per unit wt: b_i/W_i
- For each item in order (smaller i: larger $\frac{b_i}{w_i}$)
  - Take all (if possible) or remaining carrying capacity

- Suppose FSOC solution exists better than ours
- What do we know because of that?

$i < K$ $\quad X_i < W_i$ and $X_K > 0$

but $\frac{b_i}{w_i} > \frac{b_K}{w_K}$

- How do we improve this "~~better~~" alternate solution?

Decrease X_K increase X_i. By $\min(W_i - X_i, X_K)$

Review Conversations

- Why don't these work for fractional knapsack?
  - Sort by weight
  - Sort by benefit
- Why don't these work for 0-1 Knapsack?
  - Sort by weight
  - Sort by benefit
  - Sort by benefit per unit weight