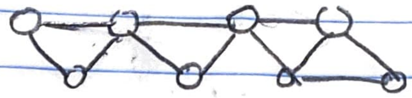
Module 11 11/20/22

11.1 Opt: Given a weighted connected graph of v vertices and e edges, find the minimum spanning tree

Decision: Given a weighted connected graph of v vertices, e edges, and some number w, is there a minimum spanning tree with a weight of at most w

11.2



11.3

11.4 yes if x_1 is false and x_2 is true

11.5 Optimization: Given n items with weights w_i, and k people to carry the items find the most even distribution.

Decision: Given n items with weights w_i, k people to carry the items and some number w is there a distribution where any person k_n carries at most w.

This is identical to bin problem. Change weight w to sizes, the number of people to the bin size and it becomes the same problem. In fact both problems revolve around finding a distribution where a bin/person holds items of size/weight than some number k/w

11.8 An n-sized set has subsets of sizes from 0 to size n. There are, consequently, $\sum_{i=0}^{n} \binom{n}{i} = 2^n$ ways to make subsets.

Base case: Let $n=0$. $S_0 = \emptyset$, so number of subsets is $2^0 = 1$

Inductive case: Let $S_n = \{x_1, x_2, x_3 \ldots x_n\}$ have 2^n subsets

Now, S_{n+1} contains more element x_{n+1}, so we now have a new version for each subsets that adds x_{n+1}. So because we have two versions of each subset in S_n the new amount of subsets is 2^{n+1}

11.9 The next subset is "01000" = $\{2\}$

11.11 Let the set be $\{1,2,3,4,5\}$. The number of size 3 subsets is: $\{1,2,3\}$ $\{1,2,4\}$ $\{1,2,5\}$ $\{1,3,5\}$ $\{1,3,4\}$ $\{1,4,5\}$ $\{2,3,4\}$ $\{2,3,5\}$ $\{2,4,5\}$

10 ways, also expressed as $\binom{5}{3} = \frac{5!}{3!(5-3)!}$

11.6 Algorithm: PreOrder(treeNode n)

```
if n = null
    return null
print(n)
preOrder(n.left)
preOrder(n.right)
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