Math 15 – Discrete Structures – Homework 21 Solutions – 5.4

5.4#20: Suppose *U* is a set of *n* integers. Approximate the worst-case complexity of an algorithm that runs through all possible subsets of *U* and adds up the elements in each subset to see if there is a subset whose elements add to 0.

SOLN: There are 2^n subsets of *U* and adding the elements of each takes about *n* operations (in the worst case $n - 1$). Checking is the sum is 0 just takes one comparison for each subset, so the complexity is $\Theta(n \cdot 2^n)$.

5.4#22: Suppose *P* is a formula in propositional logic containing *n* variables. Approximate the worst-case complexity of an algorithm that runs through all possible true/false values of the *n* variables to see if there is an assignment that makes *P* true.

SOLN: There are 2^n possible assignments of true/false values to *n* variables. These are then fed to presumable binary operations like "or" and "and" which will take another order *n* number of operations for each combination, so the total complexity is $\Theta(n \cdot 2^n)$.