

EE4371: Assignment 3a - Stacks, Recursion

August 26, 2016

This assignment is in two parts. Submit a C file for each.

1. Read Chapter 3 of Tanenbaum
2. Read Chapter 2 of Aho, Hopcroft and Ullman
3. Consider the knapsack problem in Aho:

Given a set of objects with weights $\{w_i\}_{i=0}^{N-1}$, we need to select a subset of these objects so that their total weight is exactly W . W and w_i are positive integers, and N is given.

- (a) Following the pseudocode below from Aho, write the C code to implement this problem.

```
Boolean knapsack(int W, int i) {
    if W==0
        return True
    else if W<0 or i>=N
        return False
    else if knapsack(W-w[i], i+1)
        print w[i]
        return True
    else
        return knapsack(W, i+1)
    end
}
```

- (a) Use a static scalar integer, count, to accumulate the number of times knapsack is called.
- (b) Write a main program that randomly generates 10^4 N (uniform in 1 to 20), W (uniform in 0 to $N^2/2$) and the w_i values (uniformly random in 0 to N). For each such set, determine the number of times knapsack was called. Write out a table as follows:

| N | Min | Max |
|-----|-----|-----|
| 1 | 1 | 1 |
| ... | ... | ... |
| 20 | ? | ? |

- (c) In the comments, include the output of Min and Max vs N shown above. What scaling is it? Can you justify the scaling?