

# Honors Homework 3 (Solutions) :

## Dynamic Programming

CMSC 250H

Due Date:

1. Write a program to calculate  $a_n$  if  $a_0 = 1$  and

$$a_n = a_{n-1} + a_{\lfloor \frac{n}{2} \rfloor}$$

Do this by

- (a) Recursion
- (b) Dynamic Programming with a bottom up approach
- (c) Dynamic Programming with memoization

Warning this is psuedocode

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**Algorithm 1:** Recursion

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```
recursion(n):  
  if  $n = 0$  then  
    | return 1  
  else  
    | return recursion(n-1) + recursion(floor( $n / 2$ ))  
  end
```

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**Algorithm 2:** Bottom up

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```
bup(n):  
  a = array of length n  
  a[0] = 1  
  for  $i = 1$  to  $n$  do  
    | a[i] = a[i-1] + a[floor( $i / 2$ )]  
  end  
  return a[n]
```

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**Algorithm 3:** Memoization

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```
memo(n):  
  a = array of length n  
  if  $n = 0$  then  
    | return 1  
  else  
    |  $a[n] = a[n-1] + a[\text{floor}(n / 2)]$   
  end  
  return a[n]
```

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2. What does this recurrence look like? (linear, sub-linear, ect.)

Super Linear