*Name*

COP 4531

Assignment 1

September 11, 2011

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***3-1 Asymptotic behavior of polynomials***

Let , where , be a degree-polynomial in , and let be a constant. Use the definitions of the asymptotic notations to prove the following properties.

***3-2 Relative asymptotic growths***

Indicate, for each pair of expressions in the table below, whether is . Assume that are constants. Your answer should be in the form of the table with "yes" or "no" written in each box.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
| ***a.*** |  |  |  |  |  |  |  |
| ***b.*** |  |  |  |  |  |  |  |
| ***c.*** |  |  |  |  |  |  |  |
| ***d.*** |  |  |  |  |  |  |  |
| ***e.*** |  |  |  |  |  |  |  |
| ***f.*** |  |  |  |  |  |  |  |

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***4-4 Fibonacci Numbers***

This problem develops properties of the Fibonacci numbers, which are defined by recurrence (3.22). We shall use the technique of generating functions to solve the Fibonacci recurrence. Define the ***generating function*** (or ***formal power series***) as

where is the th Fibonacci number.

***a.*** Show that .

***b.*** Show that

 ,

 where

 and

 .

***c.*** Show that

 .

***d.*** Use part (c) to prove that , rounded to the nearest integer. (*Hint:* Observe that

 .)

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***6-1 Building a heap using insertion***

We can build a heap by repeatedly calling MAX-HEAP-INSERT to insert the elements intot he heap. Consider the following variation on the BUILD-MAX-HEAP procedure:

BUILD-MAX-HEAP' (*A*)

1 *A.heap-size = 1*

2 **for** *i* = 2 **to** *A.length*

3 MAX-HEAP-INSERT(*A, A[i]*)

***a.*** Do the procedures BUILD-MAX-HEAP and BUILD-MAX-HEAP' always create the same heap when run on the

 same input array? Prove that they do, or provide the counterexample.

***b.*** Show that in the worst case, BUILD-MAX-HEAP' requires time to build an -element heap.