CS 5130 **Advanced Data Structures and Algorithms**

Assignment # 1 Due Date: September 12, 2013

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1. [25 pt] Horner's rule is a means to evaluate a polynomial at a point x_0 using a minimum number of multiplications. If the polynomial is

$$A(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0,$$

Horner's rule is

$$A(x_0) = (\cdots (a_n x_0 + a_{n-1}) x_0 + \cdots + a_1) x_0 + a_0$$

Write an algorithm to evaluate a polynomial using Horner's rule.

2. [25 pt] Consider the problem of adding two n-bit binary integers, stored in two n-element arrays A and B. The sum of two integers should be stored in binary form in an $(n+1)$-element array C. State the problem formally and write pseudocode for adding the two integers.

3. [25 pt] We can express isertion sort as a recursive procedure as follows. In order to sort $A[1..n]$, we recursively sort $A[1..n-1]$ and then insert $A[n]$ into the sorted array $A[1..n-1]$. Write a recurrence for the running time of this recursive version of insertion sort.

4. [25 pt] Determine the frequency counts for all statements in the following two algorithm segments. Also provide asymptotic analysis of both the algorithms.

   (a) Algorithm 1

```
for ( i = 1; i <= n; i++ )
    for ( j = 1; j <= i; j++ )
        for ( k = 1; k <= j; k++ )
            x = x + 1;
```

   (b) Algorithm 2

```
i = 1;
while ( i <= n )
{
    x = x + 1;
    i = i + 1;
}
```

What to handin

Type in your answers in a word/text processor of your choice and generate a PDF. Alternatively, you can write the solutions and scan the handwritten solution into a PDF document. Put this PDF document in a directory called *username*.1 on admiral where *username* is your login name on admiral. Once you are done with everything, issue the following commands:

```
% cd
% ~bhatias/bin/handin cs5130 1
```