COSCI 21a, Assignment W3

Directions: To receive full credit:

- Place your name at the top of each page.
- Start each problem on a new page.

1. For a doubly-linked lists with headers, where each element stores a non-negative integer, using the basic list operations presented in class (CREATE, FIRST, LAST, SIZE, NEXT, PREV, INSERT, DELETE, DATA, etc.), give a recursive algorithm to determine the maximum value in the list (i.e., it returns an integer equal to the maximum of any value stored in the list and leaves the list unchanged). Analyze the time used.

2. Recall the recursive version of binary search presented in class. Give a recursive algorithm to perform 3-ary search that is a generalization of the recursive binary search presented in class. That is, divide the portion of the sorted array $A$ from position $a$ to position $b$ ($0 \leq a \leq b$) that is to be searched for a value $x$ into 3 regions instead of 2 regions. Analyze the time used.

3. Describe in English and give pseudo code for an algorithm MULTP($n, A, B$) that multiplies two polynomials $A[n-1]x^{n-1} + \ldots + A[1]x + A[0]$ and $B[n-1]x^{n-1} + \ldots + B[1]x + B[0]$, where all values are $\geq 0$ and $n$ is a power of 2, and returns an array $C$ of $2n$ elements containing the coefficients of their product (padded with 0's beyond the highest non-zero term), where it works by employing recursive calls to the multiplication of polynomials of degree $n/2$.

4. Consider the following algorithm:

```plaintext
function A(i, n)
    if i=0 then return n+1
    else if n=0 then return A(i-1,1)
    else return A(i-1, A(i,n-1))
end

print A(0,0)
print A(1,1)
print A(2,2)
print A(3,3)
print A(4,4)
```

Implement this program in the language of your choice, include a print out of the program with this assignment, and answer what happens when you run it.