

CIS*2520 Data Structures

Fall 2014

Assignment 1

(1) (30%) Write a C program that outputs all possible strings formed by using the characters 'c', 'a', 'r', 'b', 'o', and 'n' exactly once.

(2) (30%) Ackermann's function $A(m, n)$ is a two argument function defined as follows:

$$\begin{aligned} A(0, n) &= n + 1 \quad \text{for } n \geq 0 \\ A(m, 0) &= A(m - 1, 1) \quad \text{for } m > 0 \\ A(m, n) &= A(m - 1, A(m, n - 1)) \quad \text{for } m, n > 0 \end{aligned}$$

Write a recursive function that gives the value of Ackermann's function. Test your program to find out that for what range of integer parameters, (m, n) , does the output of your implementation not exceed the value of the maximum integer in your C system?

(3) (40%) Let x be a positive real. To calculate the square root of x by Newtons method, so that the square of the solution differs from x to within an accuracy of ϵ , we start with an initial approximation $a = x/2$. If $|a * a - x| \leq \epsilon$, we stop with the result a . Otherwise we replace a with the next approximation, defined by $(a + x/a)/2$. Then, we test the result again. In general, we keep on computing and testing successive approximations until we find one close enough to stop. Write two C functions, using recursion and non-recursion respectively, to implement the above algorithm. You should use a sequence of big real numbers and a small ϵ to test your program, and try to find the differences in execution time.

Due time: 18:00, Friday Sept 26, 2014.