

ECE 71/191T – Data Structures and Algorithms

Dr. Gregory R. Kriehn, Fresno State
C++ Homework Assignment: Chapter 15

Code Due By: Midnight on Mon, Mar 20

Write-up Due By: Class on Tue, Mar 21

HOMEWORK #28 – Recursive Power Function

Write a recursive function, **power**, that takes two integers x and y as parameters (assume x is nonzero), and returns x^y . You can use the following recursive definition to calculate x^y . If $y \geq 0$:

$$\text{power}(x, y) = 1 \quad \text{if } y = 0$$

$$\text{power}(x, y) = x \quad \text{if } y = 1$$

$$\text{power}(x, y) = x \cdot \text{power}(x, y-1) \quad \text{if } y > 1$$

$$\text{power}(x, y) = 1/\text{power}(x, -y) \quad \text{if } y < 0$$

Write a program to test your function.

HOMEWORK #29 – Ackermann's Function

The Ackermann's function is defined as follows:

$$A(m, n) = n + 1 \quad \text{if } m = 0$$

$$A(m, n) = A(m-1, 1) \quad \text{if } n = 0$$

$$A[m-1, A(m, n-1)] \quad \text{otherwise}$$

In which m and n are nonnegative integers. Write a recursive function to implement Ackermann's function. Also, write a program to test your function. What happens when you call the function with $m = 4$ and $n = 3$?

HOMEWORK #30 – Standard Deviation

Compute the standard deviation σ for n values of x_k , stored in array `data` and for the equal probabilities $1/n$ associated with them. The standard deviation is defined as

$$\sigma = \sqrt{V}$$

where the variance V is defined by

$$V = 1/(n-1) \sum_k [x_k - \text{mean}(x)]^2$$

And the mean(x) by

$$\text{mean}(x) = 1/n \sum_k x_k$$

Write recursive and iterative versions of both V and mean(x) and compute the standard deviation using both versions of the mean and variance. Run your program for $n = 100$, $n = 1000$, and $n = 10,000$ and compare the run times. In each case, the iterative and recursive value of the variance should be printed out as well as the iterative and recursive execution time for the variance calculation. The `clock()` function and `CLOCKS_PER_SEC` constant found in `<unistd.h>` will be helpful.