MERCY COLLEGE

Department of Mathematics and Computer Sciences

CISC 311 Object/Structure/Algorithm I

Fall 2018

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Office Hour: Tuesday 3:00 – 5:00 pm & Wednesday 12:00 – 2:00 pm

Textbook:

Data Structures & Algorithms in Java, by Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, 6th ed., Wiley, 2014. ISBN-13: 978-1118771334, ISBN-10: 1118771338

Homework (100 pts):

1. Write a method that accepts two arguments into the parameters *x* and *y*. Assume *x* and *y* hold positive nonzero integers, the method should return the value of *x* times *y*. Multiplication can be performed as repeated addition as follows:

   $$5 \times 6 = 6 + 6 + 6 + 6 + 6$$

   a. Solve the problem by using recursion and recursion with memoization
   b. Analyze the time and space complexity of each solution.

2. Ackermann's Function is a recursive mathematical algorithm that can be used to test how well a system optimizes its performance of recursion. The two-argument Ackermann's function, is defined as follows for nonnegative integers *m* and *n*:

$$A(m,n) = \begin{cases} n+1 & \text{if} \quad m = 0 \\ A(m-1,1) & \text{if} \quad m > 0 \text{ and } n = 0 \\ A(m-1, A(m,n-1)) & \text{if} \quad m > 0 \text{ and } n > 0 \end{cases}$$

   a. Given the arguments *m* and *n*, write a method that solves the Ackermann's function by using Recursion

b. Given the arguments *m* and *n*, write a method that solves the Ackermann's function by using Recursion with memoization
c. Analyze the time and space complexity of each method.

Submission Instructions:

1. Write all the programs into a .java file and name it *Lastname_Firstname*_HW3.java, e.g. John Adam's file name should be Adam_John_HW3.java.
2. Submit it through blackboard → Course Material→Assignment→Assignment_3.

Due: 09/30/2018 11:59pm