# Data Structures and Algorithms

# INFO 6205

# Homework 3

# Due: September 26, 2019

1. The Recursive operations for Factorial and Fibonacci sequence was discussed in class.

A) For factorial 6!a) Show recursive stack operations, provide details step-by-step, b**)** Walk through your stack operations and provide the result. c**)** Write Java code with input factorial 6! d**)** Compile and run your program, what is the running time of your algorithm?

B) For Fibonacci sequence with n=5, a) Show recursive stack operations, provide details step-by-step, b**)** Walk through your stack operations, provide the result. c) Provide Iterative algorithm for Fibonacci function, d**)** Write Java code for both recursive and iterative algorithms. e**)** Compile and Run your program.

C) For Towers of Hanoi problem with n=5 discs, how does the algorithm work? What data structures would you use? provide step by step operations. Write Java code, compile and run program.

2. For the LinkedList implementation of Queue example discussed in class, write a TestLinkedListQueue class to test enqueue, dequeue,, isEmpty and other operations as needed.

3. Describe the Array Implementation of Queue with one example. You need to provide a sample data and walk through the enqueue and dequeue, and other operations as necessary and manage the head and tail pointers. Note: I have already provided you with one example.

4. Java Generics allow you to build collections with unique data type. To perform uniqueness, comparisons of object types need to be made:

A) Using compareTo() method from Comparable interface, the equals, and hashcode.

Explain the differences?

B) Java String class object hashcode is described as following: pasted-image.tiff

What is the hashcode 32-bit integer number for string =“Hello to the World“,

a) mathematically by hand, b) Write Java code

5. Write a Iterative method to sumDigits that has one integer parameter and returns the sum of the digits in the integer specified. The method should throw IllegalArgumentException if the integer specified is negative. Remember, your method should not use iterative loops. For example, if the integer is 26497, then this method should return 28.

6. Write a recursive method countStringBinary that has one integer parameter n and returns the number of binary strings of length n that do not have two consecutive 0's. For example, for n = 4, the number of binary strings of length 4 that do not contain two consecutive 1's is 8: 1111, 1110, 1101, 1011, 1010, 0111, 0110, 0101

7. Consider the following Algorithm to convert Infix expression to Postfix.

a) Infix expression example: A \* B / C + (D + E - (F \* (G / H)))

b) Apply Algorithm to Infix example, show step-by-step

c) Write Java code for the algorithm to convert Infix to Postfix expression

Algorithm:

while there are more symbols to read

read the next symbol

case:

operand --> output it.

’(’ --> push it on the stack.

’)’ --> pop operators from the stack to the output

until a ’(’ is popped; do not output either of

the parentheses.

operator --> pop higher- or equal-precedence operators

from the stack to the output; stop before

popping a lower-precedence operator or

a ’(’. Push the operator on the stack.

end case

end while

pop the remaining operators from the stack to the output