CSC1001: Introduction to Computer Science
Programming Methodology
Assignment 4

Assignment description:
This assignment will be worth 16% of the final grade.

You should write your code for each question in a .py file (please name it using the question name, e.g. q1.py). Please pack all your .py files into a single .zip file, name it using your student ID (e.g. if your student ID is 123456, then the file should be named as 123456.zip), and then submit the .zip file via Blackboard.

Please also write a text file, which provide the details about how to run your code for each question. The text file should be included in the .zip file as well.

Please note that, the teaching assistant may ask you to explain the meaning of your program, to ensure that the codes are indeed written by yourself. Please also note that we may check whether your program is too similar to your fellow students' code using Blackboard.

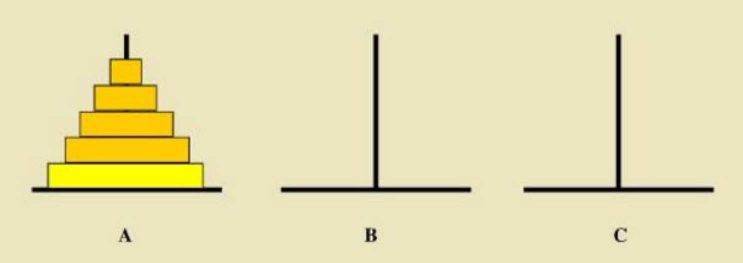
This assignment is due on 5:00PM, 31 Dec. (Sat). For each day of late submission, you will lose 10% of your mark in this assignment. If you submit more than three days later than the deadline, you will receive zero in this assignment.

Question 1 (*20% of this assignment*):
Write a Python function to implement a recursive algorithm which counts the number of nodes in a singly linked list. The input of the function should be a reference pointing to the first node of the linked list. The output of the function should be the number of nodes in that linked list.

Question 2 (*30% of this assignment*):
Write a Python function to implement the quick sort algorithm over a singly linked list. The input of your function should be a variable pointing to the first node of a linked list, and the output of your function should also be a variable pointing to the first node of a linked list, in which the data have been sorted into the ascending order. You may use the LinkedQueue class we introduced in the lecture directly in your program.

Question 3 *(50% of this assignment):*
The Tower of Hanoi is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. The puzzle starts with the

disks in a neat stack in ascending order of size on one rod, the smallest at the top, thus making a conical shape. The following figure shows the initial state of the Tower of Hanoi with 5 disks.



The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

1. Only one disk can be moved at a time.
2. Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.
3. No disk may be placed on top of a smaller disk.

Assume that initially all the disks are placed on rod A. Write a non-recursive Python function to print out the steps to move all the disks from rod A to rod C via rod B (Hint: a recursive algorithm can be converted into a non-recursive algorithm using stack). The header of the function is:

def HanoiTower(n)

Here n represents the number of disks. For example, when n = 3 your function should output:

```
A --> C
A --> B
C --> B
A --> C
B --> A
B --> C
A --> C
```