EC3401301 Introduction to Computers and Computing

Homework #3

2017/12/30

12 points in total, deadline 2018/1/14

註：程式題請將執行結果作為答案

1. (3 pts, 課本習題5.10)。下列Python程式碼會讀取由0到9排列的長度為10的字串，再轉換為list，同時檢查是否輸入的是合於需求的字串。請繼續寫下去，讓這個程式可以達到以下需求：Design an algorithm that, when given an arrangement of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, rearranges the digits so that the new arrangement represents the next larger value that can be represented by these digits (or reports that no such rearrangement exists if no rearrangement produces a larger value). Thus 5647382901 would produce 5647382910. （本題請把程式碼單獨存為eq1.py後上傳）

```
num = input('Type the number: ') # num是一個字串
numlist = list(num) # numlist是由字元組成的list
checklist = [True for i in range(10)] # 長度為10、值都是True的list
if len(numlist) != 10:
  print('Illegal input: wrong length')
  exit(1)
for i in numlist:
  if not i.isdigit():
    print('Illlegal input: ', i, 'is not a digit')
    exit(2)
  else: checklist[int(i)] = False
if any(checklist):
  print('Illegal input: repeated digit')
  exit(3)
```

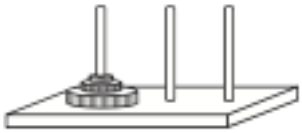
2. (2 pts) Fibonacci數列從0和1開始延伸，有「數列中的某數是其前兩個數的和」這樣的性質，因此若執行課本習題5.22的程式，會列印出1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89。

```
Last = 0
Current = 1
while (Current < 100):
     print(Current)
     Temp = Last
     Last = Current
     Current = Last + Temp
```

請用迴圈撰寫一個Python程式，讀入一個正整數，並判斷該數是否是Fibonacci數。如果是的話，是第幾個數？（在傳統上，Fibonacci數的第一個數和第二個數都是1）（本題請把程式碼單獨存為eq2.py後上傳）

3. (2 pts) 除了算階層和Fibonacci數，另一個適合遞迴解法的經典問題是河內塔(Hanoi Tower)問題(課本習題5.40)。請自撰或到網路上找Python程式，然後上傳eq3.py。請於程式碼開頭註解是自己寫或參考他人程式。若是參考他人程式請註明出處。以下是課本習題內文：The puzzle called the Towers of Hanoi consists of three pegs, one of which contains several rings stacked in order of descending diameter from bottom to top. The problem is to

move the stack of rings to another peg. You are allowed to move only one ring at a time, and at no time is a ring to be placed on top of a smaller one. Observe that if the puzzle involved only one ring, it would be extremely easy. Moreover, when faced with the problem of moving several rings, if you could move all but the largest ring to another peg, the largest ring could then be placed on the third peg, and then the problem would be to move the remaining rings on top of it. Using this observation, develop a recursive algorithm for solving the Towers of Hanoi puzzle for an arbitrary number of rings.



4. Java這個程式語言
   (1) (0.5 pt) 在課本第6章中分類的四種程式語言中算哪一種？
   (2) (1.5 pts) Java語言在推廣初期(1990年代)喊出"compile once, run everywhere"的口號，強調它machine independent的特性，但是當時的程式語言本來就具備移植性(portability)，可以容易的將一個程式轉移到另一個作業系統。請問Java進步的地方在哪裡？

5.
   (1) (1 pt) 請解釋以下的C語言程式片段在做什麼？

```
out = 0;
sum = 0;
for (int i = 0; i < 10 && out == 0; i++) {
   for (int j = 0; j < 20; j++)
      if (a[i][j] < 0) {
         out = 1;
         break;
      }
      else
         sum += a[i][j];
}
```

   (2) (1 pt) 為了讓break指令可以一次脫離雙重或更多重的迴圈，Java語言提供了break label語法，所以上述的程式片段在Java語言可以改寫如下：

```
sum = 0;
out: for (int i = 0; i < 10; i++) {
   for (int j = 0; j < 20; j++)
      if (a[i][j] < 0)
        break out;
     else
         sum += a[i][j];
}
```

   請問Python語言是否有類似的機制？

6. (1 pt, 課本習題6.22) Draw a flowchart representing the structure expressed by the following `if` and `else` conditional statements.

```
if (a > b) {
if (c > a) {
if (d > c) {
}
```

```
print(d) }
} else if (b > a) {
if (c > b) {
if (d > c) { print(d) } }}
```