NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 1 EXAMINATION 2014-2015

CE1003/CZ1003 – INTRODUCTION TO COMPUTATIONAL THINKING

Nov/Dec 2014 Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 5 pages.
2. Answer **ALL** questions.
3. This is a closed-book examination.
4. All questions carry equal marks.

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1 (a) Explain why the interpreter approach allows cross-platform program execution while the compiler approach does not.

(4 marks)

(b) Write a Python program that reads the number of terms from the user, and then displays the result of the summation series below:

$$\frac{1}{1}+\frac{1}{3}+\frac{1}{6}+\frac{1}{10}+\frac{1}{15}+\frac{1}{21}+\ldots$$

Note that the denominator of the 2nd term can be computed by adding 2 to the denominator of the 1st term; the denominator of the 3rd term can be computed by adding 3 to the denominator of the 2nd term, etc. No error checking on the user input is required.

(8 marks)

(c) In Python, is it always possible to rewrite a `while` loop as a `for` loop? If no, explain why. If yes, describe how.

(3 marks)

Note: Question No. 1 continues on Page 2

(d) Trace the following program carefully and write down what it prints out.

```
a = b = c = d = e = 0

for i in range(3):
    a = a + 1
print( a )

for i in range(4,0,-4):
    b += i
print( b )

while c < 4:
    if c % 3 == 1:
        break
    c = c + 2
else:
    c = c + 1
print( c )

while d < 15:
    if d <= 4:
        d = 10 / ( d + 1 )
    d = d + 3
print( d )

while e < 12:
    e = e + 1
    if e > 10:
        e = 100 // e
        continue
    e = e + 1
print( e )
```

(10 marks)

2. (a) (i) Given two integer variables (`a=10` and `b=3`) in a Python program, someone develops the following code to swap their data values:

```
a = a - b    # statement 1
b = b - a    # statement 2
a = b - a    # statement 3
```

However, there is an error in the code. Describe how you fix the error. Note that you can only modify one of the three statements.

(3 marks)

(ii) In Python, can we swap the values of two integer variables by one instead of three statements? If so, how would you do it?

(2 marks)

Note: Question No. 2 continues on Page 3

(b) How do we perform statement continuation in Python? Why do we use statement continuation in writing programs?

(4 marks)

(c) In the Olympic diving game, we calculate the score for a dive by excluding the top and bottom scores from seven judges and averaging the remaining five. Write a Python program that reads seven float values from the judges, and then computes and displays the resulting score. No error checking on the user input is required.

(8 marks)

(d) The program below should print a simple tree pattern based on `Nlevels`.

```
Nlevels = int( input("How many levels: ") )
n       = Nlevels
for level in range( 1 , Nlevels*2+2 ):
    # odd rows on top and main branch on bottom
    if ( level % 2 == 0 ):
        for i in range( Nlevels ):
            print( " " , end="" )
        print("|")
    # even rows on top
    else:
        for i in range( n ):
            print( " " , end="" )
        for i in range( Nlevels-n ):
            print( "-" , end="" )
        print( "+" , end="" )
        for i in range( Nlevels-n ):
            print( "-" , end="" )
        n = n - 1
    print()
```

For `Nlevels=2` and `Nlevels=4`, the program should display the patterns shown in Figure Q2.

```
How many levels: 2
  |
 -+-
  |
--+--
  |
  |
```

```
How many levels: 4
    |
   -+-
    |
  --+--
    |
 ---+---
    |
----+----
    |
    |
    |
    |
```

Figure Q2

However, the program has *several* errors. Identify the errors and describe how to fix each of them.

(8 marks)

3. (a) Using strings, write a Python program to check if an integer `N` is palindromic, which means `N` is positive and has digits that read the same backwards and forwards. For example, `3773` is palindromic. Your program must obtain `N` as input from the user, and print out `True` if the integer is palindromic, and `False` otherwise.

(6 marks)

(b) Describe briefly the following Python composite data types:

(i) Set

(3 marks)

(ii) Dictionary

(3 marks)

(c) Write a Python function that takes as input an eight-digit phone number, stored as a string with a hyphen separator, and returns `True` if the phone number has at least `4` unique digits, and `False` otherwise. For example, the phone number `'1053-4000'` has `5` unique digits, while `'9999-1211'` has only `3`.

(8 marks)

(d) Determine the printed output of the following program, and explain your reasoning.

```
C = {0.5:'Fifty', 0.2:'Twenty', 0.1:'Ten', \
     0.05:'Five', 1.0:'Dollar'}
N = 2.45
while N>0:
      if N>=1.0:
            N=N-1.0
            print(C[1.0])
      elif N>=0.5:
            N=N-0.5
            print(C[0.5])
      elif N>=0.2:
            N=N-0.2
            print(C[0.2])
      elif N>=0.1:
            N=N-0.1
            print(C[0.1])
      else:
            N=N-0.05
            print(C[0.05])
```

(5 marks)

4. (a) What happens to the contents of an existing file when it is opened for writing by using `open('filename','w')`? What about for appending by using `open('filename','a')`?

(4 marks)

(b) What is the printed output of the script in Figure Q4, if the inputs are `X=10`, `Y=0`, and `Z=4`?

```
def div(A,B):
      return A//B

X=int(input('X='))
Y=int(input('Y='))
Z=int(input('Z='))
try:
      print('X div Z is ',div(X,Z))
      print('X div Y is ',div(X,Y))
      print('Z div X is ',div(Z,X))
except:
      print('Something failed!')

print('All done')
```

Figure Q4

(6 marks)

(c) The script shown in Figure Q4 cannot distinguish and report which of the three function calls to `div` actually raise a `ZeroDivisionError` exception, if any. Describe how we can modify the script to identify and print out the related `div` function call when such an exception is raised.

(6 marks)

(d) The Python statement

```
Myscript = open( __file__ , 'r' )
```

allows a script to open its own source code as a text file. Show how to modify the script in Figure Q4 to print out the source code of the script in the event of any `ZeroDivisionError` exception.

(9 marks)

END OF PAPER

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Please read the following instructions carefully:

1. **Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**

2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.

3. Please write your Matriculation Number on the front of the answer book.

4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.