CISC106 – Lab 03

This lab is due 06/29/2014 at 11:55 p.m. (submission via Sakai)

- **Please do all of the following problems in ONE file named lab3.py. This is an INDIVIDUAL assignment, please do all work accordingly.**
- **Use comments to separate your program for each problem. For questions where you should write your answers, envelop them as comments.**
- **Use the Design recipe to write functions and the assertEqual function to run our test cases. You need to provide at least 3 test cases for each new function you write, when applicable. Please keep in mind that those elements are worth at least half of the question, so you may not want to forget them!**
- **The problems are worth 90 points + 10 points for attending the lab session.**

Problem 1: (10 points)

In order to call a function that is stored in a module, you have to write an import statement at the top of your program. Import statement tells the interpreter the name of the module that contains the function that you are going to use. For instance if we want to use sqrt function which calculates square root of a number we have to write the "import math" statement at the top of our program.

Write the following function in python.

Given the math function:

$$\text{first\_if\_func}(x,y) = \begin{cases} (y^2/x) + \sqrt{x} * y & \text{if x is greater than 0} \\ (x+2)^3 + y & \text{if x is less than 0} \\ x & \text{otherwise} \end{cases}$$

Problem 2: (12 points)

Use the following functions to answer the questions below:

```
def f(x,y):
    return(x * 2 + y)


def g(x,y):
    return(y**x)


def j(x,y,z):
    return(g(y,z) + f(x,z))
```

```
def k(x,y,z):
        return(g(x,x) + f(y,x))

def l(x,y,z):
        return(g(y+2,y+1) + f(z-x,y*2))
```

(1 point each)

Given the call to the function j: **j(2,3,4)**

1. What value does x hold inside function f?
2. What value does y hold inside function f?
3. What value does x hold inside function g?
4. What value does y hold inside function g?

Given the call to the function k: **k(2,3,4)**

5. What value does x hold inside function f?
6. What value does y hold inside function f?
7. What value does x hold inside function g?
8. What value does y hold inside function g?

Given the call to the function l: **l(3,8,5)**

9. What value does x hold inside function f?
10. What value does y hold inside function f?
11. What value does x hold inside function g?
12. What value does y hold inside function g?

Problem 3: (10 points)

Download mymodule.py file from www.cis.udel.edu/~zengin/106/mymodule.py and save it to the same folder with lab03.py.

$$\text{second\_if\_func}(x) = \begin{cases} \text{firstModFunction}(x) & \text{if } x < 7 \\ \text{secondModFunction}(x) & \text{otherwise} \end{cases}$$

Write the second_if_func function in python.

In order to call the functions defined in mymodule.py, you should import mymodule.py as follows;

from mymodule import *

Problem 4: (10 points)

We have a function calc_grade that calculates the grade of a student. However, while grad students and undergrad students may be in the same class, the undergrad student grade is calculated differently than the grad student grade. So we use the variable q to represent whether a student is a grad student or an undergraduate student. If q= 1, the student is an undergrad, whereas if q = 0, the student is a grad student. So we calculate the grade as follows:

$$\text{calc\_grade}(x,y,z,q) = \begin{cases} \text{ugrade}(x,y,z) & \text{if } q = 1 \\ \text{ggrade}(x,y,z) & \text{if } q = 0 \\ -1 & \text{otherwise} \end{cases}$$

The function ugrade is calculated as follows: 1.2((x+y+z)/320)

The function ggrade is calculated as follows: 0.9((x+y+z)/340)

Write the functions ugrade and ggrade, and then use those functions to write the function calc_grade.

(Note: if you really wanted to write a functional program, you could write yet another function that calculates x + y + z, and use that in both the ugrade and ggrade function.)

Problem 5: (10 points)

A manufacturing company measured the productivity of its workers and found that between the hours of 6am and 10am they could produce 30 pieces/hour/worker; between 10am and 2pm they could produce 40 pieces/hour/worker; and between 2pm and 6pm they could produce 35 pieces/hour/worker.

Develop a function, **pieces_produced**, which takes an hour of the day between 6am and 6pm, **in twenty-four hour format**, along with the number of workers as parameters and returns the total number of pieces produced during that hour.

Problem 6: (15 points)

An Internet service provider charges a base rate per megabyte (MB) transferred depending on market conditions. In addition to the base, transfers between 100 and 500 MB are charged an additional $0.05/MB plus 33% of the base. Data transfers between 500 MB and 1500 MB are charged 1.44 times the base plus $0.08/MB. Above 1500 MB the rate is simply twice the base. All data in a transfer is charged the same rate. For example, if 1600 MB are transferred, then the charge for all 1600 MB is twice the base.

Develop the function, **bill_amount**, which takes two parameters: an amount of data transferred in megabytes and a base rate in dollars, and returns the total charge.

Problem 7: (23 points)

You are tasked with writing a function, **mortgage_approval**, which aims to approve or decline a mortgage loan. The function should take as parameters 6 pieces of information about the mortgage applicant: the loan amount they are applying for, their current yearly salary, their current cash in accounts, their estimated non-cash assets, a numerical credit score, and a last name. The function should return **True** if the loan was approved, **False** otherwise. You are given the following business rules to guide the process:

1. No mortgage will be approved if the applicant has less than 10% of the loan amount as cash in accounts.

2. No mortgage will be approved if the applicant has less than a credit score of 600.

3. For applicants with credit scores between 600 and 700, current cash in accounts must be greater than or equal to 20% of the loan amount.

4. All applicants must have yearly salary greater than one-tenth of the balance of the loan, which is considered to be the loan amount minus the cash in accounts.

5. Any applicant with the last name Smith must have at least $1,000,000 in non-cash assets or the loan is declined.

6. Any applicant that made it past the prior rules and has more cash in accounts than the loan amount is automatically approved

7. For any applicant that made it past the prior rules, a risk metric is calculated and they are approved if the metric is greater than or equal to 2. The formula for the risk metric involves three variables:

credit ratio = (credit score - 550) / 250

adjusted balance = loan amount - cash

expected income = 10 * salary + assets

risk metric = ((expected income * credit ratio) - adjusted balance) / adjusted balance