Homework #2
Due by Friday 4/27 11:55pm

Submission instructions:

1. You should submit your homework in the NYU Classes system.
2. For this assignment you should turn in 5 files:
   - Four '.cpp' files, one for each question 1 to 4.
     Name your files 'YourNetID_hw2_q1.cpp', 'YourNetID_hw2_q2.cpp', etc.
   - A '.pdf' file with your answers for questions 5-9.
     Name your file 'YourNetID_hw2_q5to9.pdf'
3. For the coding questions, pay special attention to the style of your code. Indent your code correctly, choose meaningful names for your variables, define constants where needed, etc.
4. For the math questions, when you are asked to "Explain your answer", try to give the most formal explanation you can. We will not take off points if your explanations are not completely formal, but you will get extra points for formal proofs.

Question 1:

Write a program that asks the user to enter a number of quarters, dimes, nickels and pennies and then outputs the monetary value of the coins in the format of dollars and remaining cents.

Your program should interact with the user **exactly** as it shows in the following example:
Please enter number of coins:
# of quarters: 13
# of dimes: 4
# of nickels: 11
# of pennies: 17
The total is 4 dollars and 37 cents

Question 2:

Write a program that asks the user to enter an amount of money in the format of dollars and remaining cents. The program should calculate and print the minimum number of coins (quarters, dimes, nickels and pennies) that are equivalent to the given amount.

Hint: In order to find the minimum number of coins, first find the maximum number of quarters that fit in the given amount of money, then find the maximum number of dimes that fit in the remaining amount, and so on.

Your program should interact with the user **exactly** as it shows in the following example:
Please enter your amount in the format of dollars and cents separated by a space:
4 37
4 dollars and 37 cents are:
17 quarters, 1 dimes, 0 nickels and 2 pennies

Question 3:

Suppose John and Bill worked for some time and we want to calculate the total time both of them worked. Write a program that reads number of days, hours, minutes each of them worked, and prints the total time both of them worked together as days, hours, minutes.

Hint: Try to adapt the elementary method for addition of numbers to this use.

Your program should interact with the user **exactly** as it shows in the following example:
Please enter the number of days John has worked: 2
Please enter the number of hours John has worked: 12
Please enter the number of minutes John has worked: 15

Please enter the number of days Bill has worked: 3
Please enter the number of hours Bill has worked: 15
Please enter the number of minutes Bill has worked: 20

The total time both of them worked together is: 6 days, 3 hours and 35 minutes.

Question 4:

Write a program that reads from the user two positive integers, and prints the result of when we add, subtract multiply, divide, div and mod them.

Your program should interact with the user **exactly** as it shows in the following example:

Please enter two positive integers, separated by a space:

14 4

14 + 4 = 18

14 − 4 = 10

14 * 4 = 56

14 / 4 = 3.5

14 div 4 = 3

14 mod 4 = 2

Question 5:

I) Determine whether each of these functions from $\mathbb{Z}$ to $\mathbb{Z}$ is one-to-one. Explain your answer.

    a) $f(n) = n - 1$

    b) $f(n) = n^2 + 1$

    c) $f(n) = n^3$

    d) $f(n) = \left\lceil \frac{n}{2} \right\rceil$

II) Which functions in section (I) are onto? Explain your answer.

Question 6:

Determine whether each of these is a bijection function from R to R. Explain your answer.

a) $f(x) = -3x + 4$

b) $f(x) = -3x^2 + 7$

c) $f(x) = \frac{x+1}{x+2}$

d) $f(x) = x^5 + 1$

Question 7:

Give an example of a function from the set of integers to the set of positive integers that is:

a) one-to-one, but not onto.

b) onto, but not one-to-one.

c) one-to-one and onto.

d) neither one-to-one nor onto

Question 8:

Let $f(x) = ax + b$, and $g(x) = cx + d$, where a, b, c and d are constants. Determine necessary and sufficient conditions on the constants a, b, c and d so that $f \circ g = g \circ f$.

Question 9:

Let $g: A \to B$ and $f: B \to C$ be functions.

a) If $f \circ g$ is onto, does it follow that both f and g are onto functions? Explain your answer.

b) If both f and g are onto functions, does it follow that $f \circ g$ is onto? Explain your answer.