

## Programming Project #1

### Assignment Overview

This project focuses on some mathematical manipulation, in particular integer operations. It involves coding and testing of a program similar to the “Hello World” program from the first lab.

The basic design consists of prompting the user for information, receiving information, processing that information, and then displaying the result.

This programming project will use the `input` and `print` functions along with some simple mathematics for extracting the digits of an integer. One important part of the project is to learn the skills needed to access the class web site to download a project description, to create a new program in Python and run it, and finally to hand your program in.

This assignment is worth 20 points (2% of course grade), and must be completed before 11:59 PM on Monday, May 23.

### Problem

Here is a simple number puzzle:

I am a three-digit number.  
My tens digit is 5 more than my ones digit.  
My hundreds digit is 8 less than my tens digit.  
**What number am I?**

If you play around with 3-digit numbers for a bit, you might be able to guess the answer to this puzzle.

You are going to write a program to generate number puzzles of this form from an answer to the puzzle.

### Program Specifications

Your program will prompt the user for a three-digit number whose tens digit is at least as big as its ones digit and the tens digit is also at least as big as its hundreds digit.

Then you are to calculate the differences between the digits and print out a puzzle that has the given number as an answer. (It might have other possible answers, as well.)

Later, we will learn other ways to extract the digits from a number, but for pedagogical reasons, your program should extract the digits using integer operations. See **Assignment Notes** below.

## Deliverables

`proj01.py` -- your source code solution (*remember to include your section, the date, project number and comments in this file; but do **not** include your PID or name*).

1. Be sure to use “`proj01.py`” for the file name (or `handin` won't accept it!)
2. **Save a copy of your file in your CS account disk space (H drive on CSE computers).** This is the only way we can check that you completed the project on time in case you have a problem with `handin`.
3. Electronically submit a copy of the file.

## Assignment Notes:

To input the numbers you should use the `input` function. The `input` function takes a string, a sequence of characters between quotes, as a prompt to print to the user. It then waits until the user types a response, terminated by the user typing the “Enter” key. Finally, it returns what the user typed (without the “Enter”) as a string (again, a sequence of characters).

The returned string must be converted to a number. In this assignment we are strictly working with integer numbers: a string is converted to an integer using the `int` function. The `int` function takes as an argument a single string and returns the integer number that the string represents. A typical interaction would be something like:

```
num_str = input('Please enter a number: ')
int_var = int(num_str)
```

`print` is a function that will print on the output window any combination of variables, values and strings. Each item to be printed must be separated from other items by a comma. All the items will be printed together, followed by a new line. For example:

```
an_int = 3
print('The number ', an_int, ' times two is ', an_int*2)
```

This function has 4 items to print: a string ('The number '), the value in the variable `an_int` (3), another string (' times two is ') and the result of an expression (6). What it will print is:

```
The number 3 times two is 6
```

Look at the program `number_input.py` in the `proj01` directory as an example of using `input`, `print` and `int`

Another issue is that we are working with integers, and division with integer numbers is a little different.

Integer division returns an floating-point result, but we also have the quotient and remainder operations. For example, the quotient `10//3` yields 3. Similarly, `4//5` yields 0.

The remainder operator, also called the modulus operator, returns the remainder after a division. The remainder (modulus) operator is indicated by the “%” sign. Thus,  $10\%3$  is 1 (3 goes into 10 three times with a remainder of 1) and  $4\%5$  is 4 (5 goes into 4 zero times with a remainder of 4).

What do you get when you find the quotient of an integer divided by the integer 10? What is the remainder of an integer divided by 10? You can use these facts to gather the digits in the hundred’s, ten’s and one’s place of a three digit integer. Try some experiments in the Python shell to see how to accomplish this task.

To clarify the problem specifications, we provide at the end of this document a snapshot of interaction with the already written program.

### **Getting Started**

1. Using IDLE create a new program.
2. If you are in a CSE lab, select the H: drive as the location to store your file. (If you are not, be sure to back it up by copying it to your CSE account periodically.)
3. Save the name of the project: `proj01.py`
4. Using the example from `number_input.py`, write the code. Track down any errors (shouldn’t be any at first).
5. Run the program
6. Use the web site to hand in the program (to make sure you can do it)
7. Edit the program
8. Now you enter a cycle of edit-run to incrementally develop your program.
9. Hand in your final version.

### **Questions for you to consider (not hand in)**

1. What happens when the user enters a letter instead of a number at the prompt?
2. What happens if the user enters a 3-digit number whose 10’s digit is smaller than one of the other digits?
3. What happens if the user enters a 2-digit number?
4. What happens if the user enters a 5-digit number?
5. Under what conditions does the puzzle you generate have multiple answers?

### **Sample Interactions:**

```
Python Shell
Please enter a 3-digit number.
The tens digit should be atleast as large as the one's and hundreds digits

==> 194

I am a 3-digit number.
My tens digit is 5 more than my ones digit.
My hundreds digit is 8 less than my tens digit.

What number am I?
>>> ===== RESTART =====
>>>

Please enter a 3-digit number.
The tens digit should be atleast as large as the one's and hundreds digits

==> 491

I am a 3-digit number.
My tens digit is 8 more than my ones digit.
My hundreds digit is 5 less than my tens digit.

What number am I?
>>> ===== RESTART =====
>>>

Please enter a 3-digit number.
The tens digit should be atleast as large as the one's and hundreds digits

==> 231

I am a 3-digit number.
My tens digit is 2 more than my ones digit.
My hundreds digit is 1 less than my tens digit.

What number am I?
>>>
```