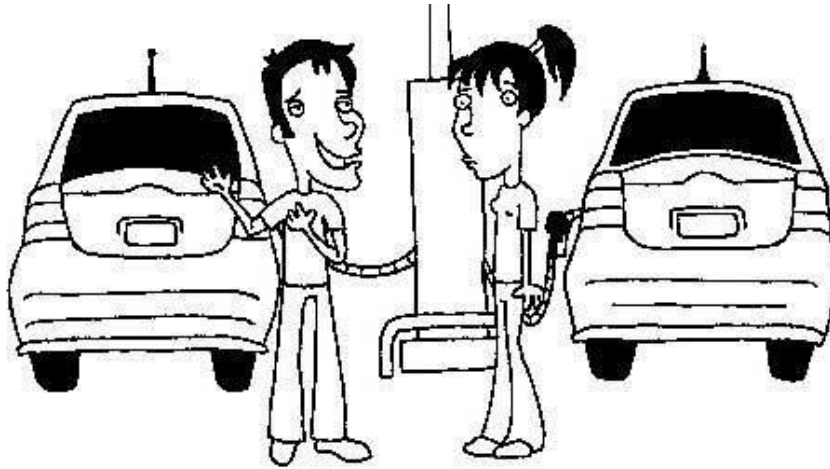




ISAT 252 - Analytical Methods IV  
Python Lab #6: Simple Value Returning Functions (40 pts)  
Spring 2015

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*Calculating your CO<sub>2</sub> emissions in a year*



*Electric? Forget that. MY hybrid runs on a mix of gasoline  
and shredded documents from the EPA's library.*

**Due Date: Wednesday March 18, 2015**

**Objectives**

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When you complete this lab you should be able to:

- Create and use **variables** and **constants** in Python3.4
- Create **user defined functions** that return values after **performing numeric calculations**
- **Format** the output of your calculations in a simple table
- Identify situations in which you can write a program that will help you solve a scientific problem
- ***This is an INDIVIDUAL LAB and should be completed on your own, i.e. do not discuss it with anyone or it is a violation of the honor code!***

## Deliverables:

1. A working program that can calculate emissions given the data below. You should upload all program files (source code) to an appropriate folder on the course FTP server: <ftp://wireless.isat.jmu.edu>
2. Answers to the questions at the end of the lab. You should upload a soft copy (i.e. a Word .doc) to the FTP server.
3. Hard copies of both the answers to your questions and of your Python source code.

## The Problem: Calculating your CO<sub>2</sub> emissions in a year

You have just graduated from James Madison University and you are job hunting. You have been offered two different jobs, one at **Software 4 Us** which is 25 miles from where you live, and one at **Biotech Forever**, which is 15 miles from your home. One of your neighbors already works at **Software 4 Us** and has said you could ride together which would cut the emissions from your car in half. Because you are an ISAT graduate, you want to reduce your commuting CO<sub>2</sub> emissions as much as possible. Based on the emissions from your car in a year, which job should you take?

You decide to use your excellent programming skills to write a program to help you and anyone else calculate CO<sub>2</sub> emissions in a year based on the distance to work and the miles per gallon efficiency of the vehicle. You want to make it more flexible also by allowing for part time work, or ride sharing, so also ask for the number of days worked per week.

**Your program should ask for these 3 things, and then calculate the emissions for the entire year.** Use a global constant to hold the number of pounds emission per gallon of gasoline (*no other variables should be global*). Be sure to use all the correct comments for your program.

Follow the steps used to develop the Python program:

1. Create a function called `yearly_miles_driven` that receives variables that hold the distance to work and the days worked each week. This function should calculate and return the miles driven per year.
2. Create a function called `gallons_used_per_year` that receives the miles driven each year and the miles per gallon for the vehicle. This function should calculate and return the gallons of gas used each year.
3. Create a function called `emission_per_year` that receives the gallons of gas used per year and returns the pounds of CO<sub>2</sub> emitted each year.
4. Create a `main()` function that is used to gather user input, call your functions and display properly formatted output (i.e. the output of your program should be on two lines in a simple table format (see example table below to check correctness of your program)).

Don't forget to use the correct program sections:

```
#Purpose of Program  
#Programmer: [Your Name]  
#Language: Python 3.4  
#program name
```

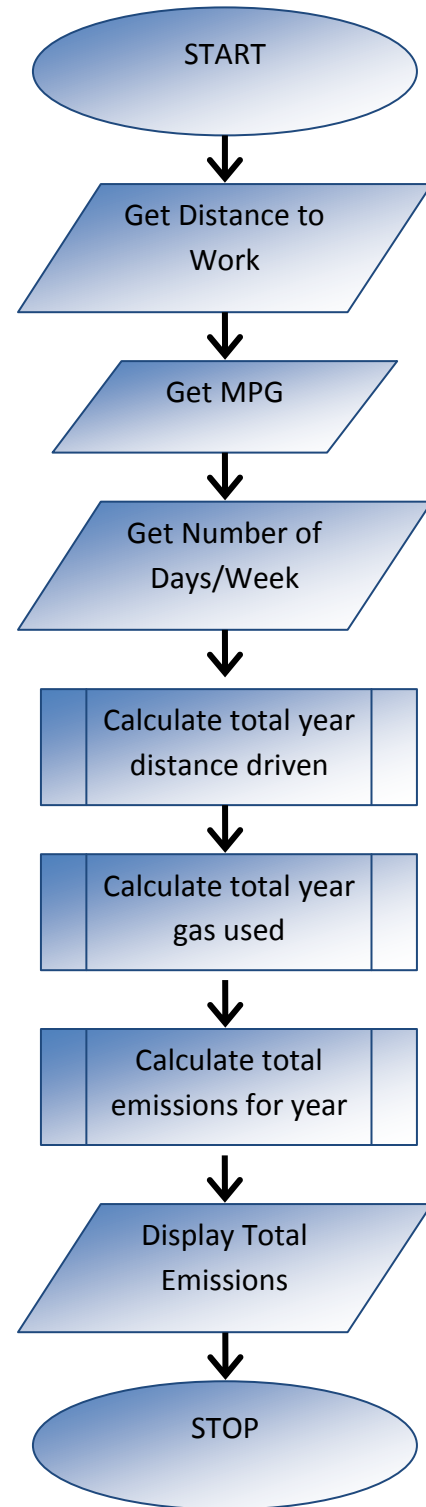
```
#create and initialize variables and constants
```

```
#input
```

```
#process
```

```
#output
```

### The Flowchart for the program is:



## Calculating CO<sub>2</sub> emissions

The Government website below provides a method for calculating the pounds of CO<sub>2</sub> emissions per gallon of gasoline used.

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

According to this website:

The [Intergovernmental Panel on Climate Change](#) (IPCC) guidelines for calculating emissions inventories require that an oxidation factor be applied to the carbon content to account for a small portion of the fuel that is not oxidized into CO<sub>2</sub>. For all oil and oil products, the oxidation factor used is 0.99 (99 percent of the carbon in the fuel is eventually oxidized, while 1 percent remains un-oxidized).

Finally, to calculate the CO<sub>2</sub> emissions from a gallon of fuel, the carbon emissions are multiplied by the ratio of the molecular weight of CO<sub>2</sub> (m.w. 44) to the molecular weight of carbon (m.w.12): 44/12.

- **CO<sub>2</sub> emissions from a gallon of gasoline = 2,421 grams x 0.99 x (44/12) = 8,788 grams = 8.8 kg/gallon = 19.4 pounds/gallon**
- **CO<sub>2</sub> emissions from a gallon of diesel = 2,778 grams x 0.99 x (44/12) = 10,084 grams = 10.1 kg/gallon = 22.2 pounds/gallon**

*Note: These calculations and the supporting data have associated variation and uncertainty. EPA may use other values in certain circumstances, and in some cases it may be appropriate to use a range of values.*

To check the correctness of your program, run it with this data to see if yours reproduces this output. (Don't forget that the distance to work is only one way - you'll need to double it in your calculations for the miles per day.):

Distance to work	MPG of vehicle	Number of days/week	Emissions for a year
20 miles	25 mpg	5	8070.4

## ISAT 252

### Worksheet 6: Simple Functions

Name: \_\_\_\_\_ Section: \_\_\_\_\_

1. value-returning function is \_\_\_\_\_.
  - a. a single statement that perform a specific task
  - b. called when you want the function to stop
  - c. a function that will return a value back to the part of the program that called it
  - d. a function that receives a value when it is called

2. What is the output of the print statement:  

```
print('Name\tAddress\tPhone Number\n'+ 'Python\t'+ '1Way\tNone')
```

3. Given the following function definition, what would the statement `print magic(5)` display?

```
def magic(num):  
    return num + (num%3)**2
```

4. What mpg did you use for your vehicle? Fill out this chart that shows your inputs to compare the two jobs?

Distance to work	Number of days	MPG of vehicle	Emissions for a year

5. Based on your data generated by your program above, which job should you take and why? Are there other extenuating circumstances that might change this decision?