Joanna Klukowska
joannakl@cs.nyu.edu

Assignment 2
Due Date for Worksheets: by the end of the class
Due Date for Programs: September 21, 2016

The parts of this assignment marked with the "together" icon,  , should be completed in the groups of 2-3 students.

The parts of this assignment marked with the "alone" icon,  , should be completed individually by each student.

You may discuss any parts of the assignments with your classmates and tutors (or anyone else) but you are responsible for understanding all of the parts of the assignment that you submit. Any sharing or copying of the parts of the assignments marked with "alone" icon,  , will be considered cheating.

You should not use any features of Python that have not been covered in class or recitations. If you have doubt if you are allowed to use certain structures, just ask one of the instructors.

For this assignment you will be writing 3 programs which should be saved independently as their own ".py" file. The filename you should use for each program is outlined in the sections below. When you're finished you should submit your programs to the Assignment 2 category inside of NYU Classes.

Problem 1 (10 points): Traffic Fatalities

Note: You can work with a partner on this problem.

The recent article from NBC News, *Traffic Fatalities on the Rise as Americans Drive More, Text More* (see, http://www.nbcnews.com/business/autos/traffic-fatalities-rise-americans-drive-more-text-more-n636526) states that in the first six months 19,100 people were killed in crashes on U.S. roads. Deborah Hersman, CEO of the National Safety Council, said "We cannot keep accepting these highway fatalities,... It would be the equivalent of two major plane crashes happening every week. Our hair would be on fire [if that happened]. We wouldn't accept that. Why do we accept it on highways?"

Use the worksheet to figure out how big (i.e., how many passangers) are the planes that Ms Hersman was thinking about when she made her statement. Is that a reasonable size of a plane?

What to Submit
You should hand in the completed worksheet to your instructor during the lab session.

Problem 2 (10 + 20 points): 10,000 steps

Review of *How many seconds* In class, we computed approximately how many seconds a twenty year old has been alive. Here is a short python program that performs this calculation exactly.

```
1  # author: Joanna Klukowska
2  #
3  # This program converts different number of years
4  # to the corresponding number of seconds.
5
6  number_of_seconds_in_minute = 60
7  number_of_minutes_in_hour = 60
8  number_of_hours_in_day = 24
9  number_of_days_in_year = 365
10
11 #calcululate the number of seconds in one year
12 number_of_seconds_in_1_year = number_of_days_in_year * \
13                               number_of_hours_in_day * \
14                               number_of_minutes_in_hour * \
```

Joanna Klukowska
joannakl@cs.nyu.edu

```
15                                  number_of_seconds_in_minute;
16
17 #use the number of seconds in one year to calculate the values
18 #in 5, 10, 15 and 20 years
19 print("Number of seconds in  1 year  is:", number_of_seconds_in_1_year ) ;
20 print("Number of seconds in  5 years is:", 5 * number_of_seconds_in_1_year ) ;
21 print("Number of seconds in 10 years is:", 10 * number_of_seconds_in_1_year ) ;
22 print("Number of seconds in 15 years is:", 15 * number_of_seconds_in_1_year ) ;
23 print("Number of seconds in 20 years is:", 20 * number_of_seconds_in_1_year ) ;
24
```

Take note of the following things in the code above:

- Lines 1-4 are a comment that tells the reader of the code what the code does and who wrote it. All your programs should start with such a comment.
- To increase readability of the code, we created variables to represent number of seconds in a minute, number of minutes in an hour, etc. Notice their names. The person reading the code can easily figure out the meaning of variables if their names are descriptive.
- The lines 12-14 end with a single backslash. When a single computation or other line of code does not fit in a single line, we can use the backslash, `\`, to tell python that the expression continues on the next line.
  Use this to avoid creating looooong lines that require the reader to scroll horizontally.
- Once we computed the number of seconds for one year, we can easily find out the number of seconds in 5, 10, 15, and 20 years, by multiplying that value by `number_of_seconds_in_1_year`.

How many inches in 10,000 steps

You might have heard a recommendation that taking 10,000 steps each day will keep you healthy and in a better shape. Let's figure out some details about the 10,000 steps.

Work this out on paper:

Note: You can work with a partner on this part of the problem. You should complete the paper worksheet for this part of the problem. Your instructor has blank copies.

Try to guess how many inches it might be.

Try to guess how many miles it might be.

Follow the steps similar to the ones that we took in class when we estimated the number of seconds in a lifetime to estimate the number of inches in 10,000 steps. You will need to figure out some standard conversions: how long is a step of an average adult? (Feel free to actually measure your own step length and ask your classmates to do the same. You can also try to find out the answer on the Internet.) This should allow you to estimate the number of inches in 10,000 steps.

Once you estimate the answer to the first question, you should try to estimate the number of miles in 10,000 steps. You may need to lookup some other conversions:

- how many inches in a foot?
- how many feet in a mile?

Were your initial guesses close to your estimates?

What to Submit

You should hand in the completed worksheet to your instructor during the lab session.

Write a program:

Note: You should work alone on this part of the problem.

Write a program that computes the exact answers to the above questions assuming a certain number of inches in a step. (HINT: the number of inches in a step should be a value in your program that can be quickly changed by modifying a single line of code). The program should print the number of inches in 10,000 steps and the number of miles in 10,000 steps. The output of the program should look as follows (although the actual numbers may be different and will depend on your estimate of the step length).

Output:

```
Assumption: 1 step =  30 inches
```

Joanna Klukowska
joannakl@cs.nyu.edu

```
  Number of inches in  10,000 steps: 300000
  Number of miles  in  10,000 steps: 4.734848484848484
```

or

Output:

```
Assumption: 1 step =  28 inches
  Number of inches in  10,000 steps: 280000
  Number of miles  in  10,000 steps: 4.419191919191919
```

What to Submit

This program should be named (i.e., the name of the file containing the program should be) `steps.py`. You only need to submit the source code for this problem.

Problem 3 (30 points): Save the water

The Environmental Protection Agency (EPA) claims that we can save up to 8 gallons of water each day just by turning off the tap while we are brushing our teeth (see, https://www3.epa.gov/watersense/kids/tap-off.html). Assuming this is correct, write a program that displays the number of gallons of water saved in a year by 1) an individual, 2) a family of four, 3) 50,000 students currently enrolled at NYU, 4) the entire United States (you will need to figure out what the current population is; feel free to use the Internet as the resource and include your sources as a comment in your program).

Your program needs to perform the actual calculations! You should write your program so that the changes to the family size, number of students in NYU and population of USA can be made easily (i.e., in one place)!

Here is what the output of the program should look like (some numbers have been X-ed out since you need to figure them out yourself):

Output:

```
Assumptions:
   Number of family members: 4
   Number of NYU students: 50000
   Entire USA population: XXXXXXXXX
Possible number of gallons of water saved
  ... by a single person: 2920
  ... by a family: 11680
  ... by NYU students: 146000000
  ... by the entire USA: XXXXXXXXX
```

What to Submit

This program should be named (i.e., the name of the file containing the program should be) `water.py`. You only need to submit the source code for this problem.

Problem 4 (30 points): How much does it cost to go a thousand miles?

Recall the class discussion about fuel efficiency. You can use the lecture slides as a refresher.

Write a program that computes the actual cost of going for a 1,000 mile long trip. Your program should be interactive, i.e., it should prompt the user for some information, save it in the appropriately named variables and then compute the cost.

Your program should prompt the user for the following values (in that order):

- MPG of his/her vehicle
- current price of the fuel

Notice, that for the calculation you will need to convert the MPG value to gallons per mile (GPM) measure (or gallons per 1000 miles if you prefer). See the lecture notes if you do not remember how this was done.

Here are a few sample runs of the program:

Joanna Klukowska
joannakl@cs.nyu.edu

```
What is the approximate fuel usage of your car
in miles per gallon (MPG)? 14
How much is the price of fuel (per gallon)? 2.39
You will use approximately 71.42857142857143 gallons of fuel.
You will spend approximately 170.71428571428572 dollars.
```

```
What is the approximate fuel usage of your car
in miles per gallon (MPG)? 36
How much is the price of fuel (per gallon)? 2.39
You will use approximately 27.777777777777775 gallons of fuel.
You will spend approximately 66.38888888888889 dollars.
```

```
What is the approximate fuel usage of your car
in miles per gallon (MPG)? 36
How much is the price of fuel (per gallon)? 2.59
You will use approximately 27.777777777777775 gallons of fuel.
You will spend approximately 71.94444444444443 dollars.
```

What to Submit

This program should be named (i.e., the name of the file containing the program should be) `mpg.py`. You only need to submit the source code for this problem.

Grading

The only way to receive the credit for the worksheet problems is to hand them in before the end of the lab session in which they are given.

The programs are graded based on correctness, style of code, design and documentation.

What and how to submit?

You should submit the source code file for each program to NYU Classes by the due date stated above. Make sure that you get an email confirmation after you submit the assignment. You should keep that email until the grades are returned - it is your proof that the assignment was submitted! If you do not get an email confirmation, you should try to resubmit the assignment. If you do not get that email, it means that we did not get your assignment.

Traffic Fatalities

Name(s) and NetId(s):

---

1. What is the **approximate** number of people killed in the first six months of 2016? _____
2. What is the **approximate** number of people killed in each month? _____
3. What is the **approximate** number of people killed in each week? _____
4. How many passangers would be on each of the planes that Ms Hersman mentioned? _____
5. Does the answer to your last question seem like a reasonable number? _____

Use the space below for your work, but enter all of your approximations above.

10,000 Steps Worksheet

Name(s) and NetId(s):

1. Enter your initial guesses:
   - number of inches in 10,000 steps: _____
   - number of miles in 10,000 steps: _____
2. Conversion values:
   - number of inches in 1 step: _____

     how did you estimate that value:

     _____

     _____

     _____

     _____
3. number of inches in 10,000 steps: _____
4. number of miles in 10,000 steps: _____

   how did you estimate that value:

   _____

   _____

   _____

   _____

   _____

[Use the back of this page, if you need more space to answer any of the questions.]