

Instructions

Before you begin, take out a pen and paper. Put a title of Lab 3 on it and the date. Answer the questions below and make any notes or questions or comments or thoughts on your page. Don't worry if you don't finish everything during the lab but finish them in your before next Thursday. **You should be able to demonstrate and explain a working version of any of the programs in the exercises section in the next lab.**

Today's lab probably looks familiar. We're going to look at the same problems but today we're going to rewrite each of the programs using functions. Create a new project called lab3 in your lab folder on your network drive. Put the files from lab2 into it so you have a copy of the originals and a new set of files you can change. For each problem below, try to rewrite the code using a function: a `main()` function and a function to solve the problem. Take a look at the example listings for problem two below as an example.

Listing 1: tempconvert.py

```
# Convert Celsius to Fahrenheit
# formula is: degC x 9/5 + 32 = degF

tempInCelsius = float(input("Enter temperature in degrees Celsius: "))
tempInFahrenheit = tempInCelsius * 9/5 + 32
print("Temperature in Fahrenheit: ", float(tempInFahrenheit))
```

Listing 2: tempconvert2.py

```
# Convert Celsius to Fahrenheit
def convert_celsius2fahrenheit(tempInCelsius):
    # formula is: degC x 9/5 + 32 = degF
    tempInFahrenheit = tempInCelsius * 9/5 + 32
    return tempInFahrenheit

def main():
    tempInCelsius = float(input("Enter temperature in degrees Celsius: "))
    tempInFahrenheit = convert_celsius2fahrenheit(tempInCelsius)
    print("Temperature in Fahrenheit: ", float(tempInFahrenheit))

main()
```

Exercises

1. (1 point) Suppose the cover price of a book is €24.95, but bookstores get a 40% discount. Shipping costs €3 for the first copy and 75 cents for each additional copy, and the discount is not applied to shipping. What is the total wholesale cost for 60 copies? Create a program called `bookstore.py` to work out the answer. Modify your program so that the user can enter a different price and different number of copies.
2. (1 point) Write a program called `temperatureconvert.py` that converts temperatures in Celsius to Fahrenheit.
3. (1 point) Write a program called `perimeter.py` that gets the length and width of a rectangle from the user and calculates the area and perimeter.
4. (1 point) Write a program `average.py` that calculates and prints the average of three numbers. Test it with 3, 5 and 6. Does it make a difference if you treat the input strings as `float` or `int`? what about if you print the output result as `float` or an `int`?
5. (1 point) Write a program `cube.py` that calculates and prints the volume and surface area of a cube given its width. Run your program with different values of the width to find the point at which volume equals surface area.
6. (1 point) Write a program `triangle.py` that calculates the hypotenuse, h , of a triangle given the adjacent, a and opposite, o sides. The program should ask the user to input the opposite and adjacent side sizes. The formula for calculating the hypotenuse, is:
$$h = \sqrt{a^2 + o^2}$$

Note: that the math library in python has a builtin function called `sqrt`
7. (1 point) What happens if the triangle sides are 3 and 4? What happens if the triangle sides are -3 and 4?
8. (1 point) Create a program which prompts a user for three pieces of information. Based upon the information provided produce trivial facts about the person, e.g. their age in dog years, their weight on the moon. Present the results in an interesting way.

Stretch Goals

If you finish the exercises and want to keep going, type in this listing example with a loop and play around with the loop range.

Listing 2: harmonic.py

```
# harmonic.py

def harmonic(n):
    # Compute the sum of 1/k for k=1 to n.
    total = 0
    for k in range(1, n + 1):
        total += 1 / k
    return total

def main():
    n = int(input('Enter a positive integer: '))
    print("The sum of 1/k for k = 1 to",
          n, "is", harmonic(n))

main()
```

Take a look at adding some of these features to your code. You might need to look up some of the features using python.org or google.

1. Change the float outputs to only give one digit after the decimal place
2. Use a loop to allow multiple iterations of the problem to be tested. e.g. calculate for all values in a range for cube.py and print out the surface area and volume and a comment as to whether they match.
3. Check for invalid inputs, e.g. don't allow the user to input negative numbers for triangle lengths and print out an error message if they do.
4. Continue working through <https://www.codecademy.com/tracks/python>.