



Homework 1: Input/Output

Introduction

The most basic function of any piece of software is to transform input into output. When thinking about the requirements of a program, software developers often speak of the "Input/Output (I/O) Specification": What form of input will the program receive, and what is the target output that the program must produce. A program is written or *implemented* to meet these I/O requirements. It's up to you, as the coder, to figure out how to perform this transformation. For example, with electronic medical records, a doctor might enter a patient's age and weight and the name of a medication into a computer. A program then computes the correct dosage - the output. In this first homework you'll write several small programs that transform input into output. We'll specify the required user-inputs and you will write a small program to generate the expected outputs. You'll use some built in python functions in your implementation including **input**, **print**, and **round** along with arithmetic operators (+, -, *, /, //, %, **).

Expectations

Write a separate program (program.py) to answer each question. Be sure to document your code with a descriptive header and concise comments. It isn't necessary to comment every line, particularly those lines whose purpose is obvious. Instead, use comments to *outline* the main steps of your program. Use variable names that are descriptive, concise, and not excessively verbose. Practice good style: $x = 5$, not $x=5$ and separate sections of your program by blank lines. For your homework submission, submit these files:

- **running.py**: your program for question 1
- **mortgage.py**: your program for question 2
- **light.py**: your program for question 3
- **output.pdf** or **output.txt**: The output for each of your programs combined into a single file. This can be either a simple text file, or you can paste screenshots into a word document and save the resulting file to a .PDF. (Do *not* submit a .DOC or .DOCX file. Please convert the document to a PDF-formatted file so that the graders can see your output in gradescope without having to download your output file.)

You are welcome to upload a file multiple times, but only your last submission will be graded. Verify that all files have been submitted.

Question 1 (running.py)

Write a program where a runner inputs their running distance (kilometers - float) and time (minutes and seconds - integers). The program should output the *average pace* measured in minutes per mile. There are 1.61 kilometers per mile. Note that the program should accept the distance as a floating point (decimal) number, where as the total running time is entered as two integers (minutes and seconds).

```
Enter distance [km]: 5.2
Enter time [minutes]: 29
Enter time [seconds]: 18
Your pace was 9 minutes 4.3 seconds per mile.
```

Question 2 (mortgage.py)

Suppose you are buying a house. Write a program to calculate your monthly mortgage payment. The inputs are:

1. P - The principal loan amount
2. i - The *annual* interest rate ($5\% = 0.05$)
3. y - The number of years over which to pay back the loan.

Your *monthly* interest rate is therefore: $r = \frac{i}{12}$ and the number of payments is $n = y * 12$ (because you are making 12 monthly payments per year.) The formula for the monthly mortgage payment is then:

$$payment = \frac{P r (1+r)^n}{(1+r)^n - 1}$$

```
Principal loan amount: 300000
Annual interest rate : 0.05
Loan term (years)    : 30
Monthly payment      : 1610.46
```

Question 3 (light.py)

Light travels at 299,792,458 meters per second. Input an astronomical object's distance in miles - an integer. Report the number of hours, minutes, and seconds it takes for light from that object to reach the Earth. Seconds should be rounded to one decimal place. The examples below are for the approximate distances to the Moon, the Sun, and Pluto in miles. Assume that 1.61 kilometers = 1 mile and 1000 meters = 1 kilometer.

```
Enter distance [miles]: 240000
Light travel time: 0h 0m 1.3s
```

```
Enter distance [miles]: 93000000
Light travel time: 0h 8m 19.4s
```

```
Enter distance [miles]: 3000000000
Light travel time: 4h 28m 31.1s
```