

C200 PROGRAMMING ASSIGNMENT № 1

FUNCTIONS & LEARNING ABOUT HOMEWORK

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The purpose of this homework is two-fold: (1) you'll develop your skills in implementing functions, formal and actual parameters, environment and scope (2) how homework will be delivered and submitted. Although the problems can be used for individuals, this course uses paired-programming. Please carefully read about pair-programming below.

Paired-Programming

Homework is generally done with a randomly selected partner. In the last section, some information about contacting and communicating with this likely new student will be facilitated.

As always, all the work will be with only you and your partner; but *both* of you should contribute. If your partner does not respond, you must complete the homework on your own. You will not be assigned a new partner—this is infeasible for such a large class. Both students must submit their individual homework, since you are graded individually. Your grade may be different from your partner's grade, since there can be differences in code.

You must complete this before **Thursday, September 15 2022 11:00PM EST**. You will submit your work by committing your code to your GitHub repository. Please remember that

- You will **not** turn anything in on canvas.
- You do **not manually upload files** to your repository using GitHub's "Upload files" tool.
- You must submit your individual program even though you have a partner, since you'll be graded individually.
- Your github will accept pushes at *any* time. Once the deadline for homework is passed, if you push again, you'll rewrite over the correct time and the solution will be past the deadline and not graded. If your timestamp is 11:01PM or later, the homework will not be graded under almost any circumstance. So do not wait until 10:59PM to commit and push your changes. Pushing with only a few minutes left is **not** a valid reason to be graded.

A remark: often numerical values will be infinite. Python will give you **by default** about 15 decimal places. We'll learn how to shorten these values later. For now, for example we'll write 104.17 for 104.16666666666667.

Comments about Homework

You will be given the function signature without a body. For each problem, you'll replace the Python keyword **pass** with code. Do not change any signature. If you do, the autograder will fail and you'll receive a zero. If you add any extra functions, they must be local to the function you are building; otherwise, the autograder will fail. This is a very short homework to help you get started with understanding the process.

Keyboard Quickies

To uncomment multiple lines (Windows):

1. select the lines to be commented
2. Ctrl+k+u

To comment multiple lines (Windows):

1. select the lines to be commented
2. Ctrl+/

To comment or uncomment multiple lines (Mac):

1. select the lines to be commented
2. cmd + /

To undo (Windows):

- Ctrl+Z

To undo (Mac)

- Command+Z

Some of these problems were taken or inspired by the excellent introductory *Applied Calculus* by Tan, 2005.

Problem 1: Volume of a Cone

The volume of a cone with radius r and height h is:

$$c(r, h) = \frac{1}{3}\pi r^2 h \quad (1)$$

For example, 2 cm radius and 5 cm height,

$$c(2, 5) \approx 20.94 \text{ cm}^3 \quad (2)$$

For 3 cm radius and 7 cm height

$$c(3, 7) \approx 65.97 \text{ cm}^3 \quad (3)$$

Deliverables Problem 1

- Complete the cone volume function in the file a1.py.
- You must use math.pi from the math module.

Problem 2: Oxygen Content of a Pond

The oxygen content t days after the organic waste has been dumped into a pond is given by:

$$f(t) = 100 \frac{t^2 + 10t + 100}{t^2 + 20t + 100} \quad (4)$$

percent of its normal level. For example,

$$f(0) = 100 \quad (5)$$

$$f(10) = 75 \quad (6)$$

Deliverables Problem 2

- Complete the oxygen content function in the file a1.py.

Problem 3: TV Viewing Patterns

According to A.C. Nielsen Co. the percent of U.S. households $P(t)$ watching television during the weekdays (about a decade ago) starting at 4:00P for eight hours is:

$$P(t) = 0.01354t^4 - 0.49375t^3 + 2.58333t^2 + 3.8t + 31.60704 \quad (7)$$

if $0 \leq t \leq 8$ where $t = 0$ corresponds to 4:00P. For example,

$$P(0) = 31.6074 \quad (8)$$

$$P(3) \approx 54.0225 \quad (9)$$

$$P(8) \approx 29.999999999999982 \quad (10)$$

Deliverables Problem 3

- Complete tv percent function in the file a1.py.

Problem 4: Toxic Waste

A city's main well was recently found to be contaminated with trichloroethylene, a cancer-causing chemical, as a result of an abandoned chemical dump leaching chemicals into the water. A proposal submitted to city council members indicates that the cost, measured in millions of dollars, of remove $x\%$ of the toxic pollutant is given by:

$$\text{cost}(x) = \frac{0.5x}{100 - x} \quad (11)$$

for $0 < x < 100$. For example, 50%, 70%, and 90% cost

$$\text{cost}(50) = \$0.5 \text{ million} \quad (12)$$

$$\text{cost}(70) \approx \$1.17 \text{ million} \quad (13)$$

$$\text{cost}(90) = \$4.5 \text{ million} \quad (14)$$

Deliverables Problem 4

- Complete the percent cost function in the file a1.py.

Problem 5: Cowling's Rule

Cowling's rule is a method for calculating pediatric drug dosages. If a denotes the adult dosage (in milligrams) and t is the age of the child (in years), then the child's dosage is given by:

$$D(t, a) = \frac{t + 1}{24} a \quad (15)$$

For example, if $a = 500$ mg and $t = 4$ yo, then

$$D(t, a) \approx 104.17 \text{ mg} \quad (16)$$

$$(17)$$

Deliverables Problem 5

- Complete Cowling's rule function in the file a1.py.

Communication

When connecting with a new person, you should introduce yourself, give a short message describing the purpose, then salutation. Please use and adapt this format when connecting to a new partner. The student pairs are given on the next page.

Dear Student,

My name is X Y and I'm a student in your C200, but a different section. It looks like we're partners this week. I'm generally free on Thursday, Saturday, Sunday. I'm hoping we can knock most of this out on our first meeting. Luddy is a great place if we can snag a conference room.

Take care,

Another Student

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