C200 Programming Assignment № 1

Functions
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In this homework, you'll write functions. **As always, all the work should be with you and your partner; but *both* of you should contribute.** You must complete this before **Thursday, February 3 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.

If your timestamp is 11:01PM or later, the homework will not be graded. So do not wait until 10:59PM to commit and push your changes. If you have any questions about or problems with version control, please visit office hours or make a post on Inscribe. Since you are working in pairs, your paired partner is shown in this week's PAIRS link.

A remark: often numerical values will be infinite. Python will give you **be 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.

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:

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

For example, 2 cm radius and 5 cm height,

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

For 3 cm radius and 7 cm height

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

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:

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

percent of its normal level. For example,

$$f(0) = 100 \tag{5}$$

$$f(10) = 75 \tag{6}$$

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 $P(t)$ waching television during the weekdays (about a decade ago) starting at 4:00P for eight hours is:

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

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

$$P(0) = 31.6074 \tag{8}$$

$$P(3) \approx 54.0225 \tag{9}$$

$$P(8) \approx 29.99999999999982 \tag{10}$$

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:

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

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

$$cost(50) = \$.5 \text{ million} \tag{12}$$
$$cost(70) \approx \$1.17 \text{ million} \tag{13}$$
$$cost(90) = \$4.5 \text{ million} \tag{14}$$

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:

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

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

$$D(t, a) \approx 104.17 \text{ mg} \tag{16}$$
$$\tag{17}$$

Deliverables Problem 5

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

Student Pairs

Refer the following list to find your partner's email address. Each line contains one pair. There could be few pairs with more than 2 students and students must work only with partners in their pair.

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