

Honors Class03 Activity: PEMBAS and Modules

Team Members: _____

Learning Objectives

- Order of operations in Python (PEMBAS)
- Using functions from modules
- Turning word problems into code

Part 1: PEMBAS in Python

In Python, the order of operations follows the PEMBAS rule: - Parentheses - Exponents - Multiplication and Division (from left to right) - Addition and Subtraction (from left to right)

Create a Jupyter notebook code the following expressions in Python to find the solutions. Check with your teammates that you are getting the same result:

1. $(4^2 - 5 \times 3) \div (12 \div 3) + 7 =$

2. $3^3 - [2 \times (14 - 3^2)] \div 4 =$

3. $\frac{(5^3 - 2^4) \div (18 \div 3) + 4^2}{(7 - 3)^2} =$

4. $6^2 - \left[\frac{3 \times (2^5 - 4^2)}{(9 - 3)^2} \right] =$

5. $\left(\frac{4^3 + 2^5}{3^2} - 5 \right) \div \left(1 + \frac{8}{2^3} \right) =$

Part 2: Using Modules in Python

Built-in Python Functions

Many math functions are built into the Python programming language.

Create a new Jupyter notebook and try entering the following code:

```
maximum_number = max(3, 4.4, 12, 0, -8)
maximum_number
```

12

You are calling the Python function `max()` and assigning the result to the variable `maximum_number`. Then, when you type the variable name on a separate line the result is displayed. Naturally, there is also a `min()` function.

Try `min()` with the same set of numbers.

External Modules

To keep Python lean, not every function is baked into the language. Often you must load the functions you need from an external module. Here we import the `math` module so we have access to the value `pi`. Try this:

```
import math
print(math.pi)
```

3.141592653589793

After you have imported the `math` module, you have access to all of its functions using the dot notation. Thus, `math.pi` gives you the value for `pi` from the `math` module.

Use `math.pi` to find the area of a circle with a radius of 4: _____

The `math` module contains many functions. **To see the complete list type `dir(math)` in a code cell that comes after you have imported the `math` module.**

There are many, many modules available in Python. Each module is a library of functions designed to assist with a particular task – math problems, machine learning, plotting graphs, working with databases, designing websites, creating games – you name it, there is probably a Python module that does it! Often, more than one. You will become familiar with quite a few python modules in this course.

Turning Word Problems in to Code

Learning to program is all about breaking down a problem into simple steps that can be expressed in code. Computers do precisely what you tell them to do – no more, no less. You need to know exactly what steps you need to before you can create a program that solves a problem. Your instructions have to be clear and free of typos. Let's code some simple word problems for practice.

Problem:

A stream's water level was measured at four times during the day:

1.12, 1.18, 1.09, 1.15 meters.

What is the average water level? _____

Problem:

A pond's water level increased from 0.85 m to 0.92 m after rainfall.

What is the percent increase? _____

Problem:

A student's final grade is:

- Homework: 30% (92)
- Midterm: 25% (85)
- Final: 45% (88)

What is the final numeric grade? _____

Breaking Down Longer Problems

As problems become more complicated, it is important to solve them in steps, creating python variables to hold intermediate values. Let's work an example together.

Problem

An environmental science class is planning a field trip.

- The bus costs \$485 total.
- Each student ticket costs \$12.50.
- There are 28 students and 2 instructors, and instructors do not pay ticket fees.

The department will subsidize 40% of the total cost.

What is the cost per student after the subsidy?

```
bus_cost = 485
ticket_cost = 12.5
num_students = 28
subsidy = 0.4

total_cost = bus_cost + ticket_cost * num_students
print("The total cost is:", total_cost)

cost_with_subsidy = total_cost - total_cost * subsidy
print("Cost after subsidy is:", cost_with_subsidy)

cost_per_student = cost_with_subsidy / num_students
print("Cost per student is:", cost_per_student)
```

The total cost is: 835.0

Cost after subsidy is: 501.0

Cost per student is: 17.892857142857142

Key points:

- Print and check intermediate results. It is easier to debug your code when the final answer is not what you expected.
- Pick variable names that are easy to understand.

Once a solution is programmed this way, it is easy to change a value.

Suppose the department decides to increase the subsidy to 50%. What is the new price per student? _____

Now it is your turn. Create as many code cells as you need.

Problem

A rain gauge recorded rainfall over three consecutive intervals:

- 18 mm in 30 minutes
- 22 mm in 45 minutes

- 10 mm in 15 minutes

What was the total rainfall?

What was the average rainfall rate (mm/hr) over the entire storm?

Problem

A field crew orders sampling supplies:

- 6 test kits at \$18.75 each
- 3 calibration solutions at \$42.00 each

Shipping costs \$24.50.

Sales tax is 7.25% and applies only to the supplies, not shipping.

After everything is purchased, the vendor issues a \$35 rebate.

What is the final total cost?

Reflection

Each team member solved at least one problem using intermediate variables.

- Choose one problem you all attempted.
- How did your variable choices differ?
- Did one approach feel clearer or easier to debug? Why?