
# 15-110 Principles of Computing – S19

## Lab 1:
## Python basics

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# Python summary so far

- Scalar type literal objects:
  - `int`: **Integer relative numbers ($\mathbb{Z}$),** 1,2,-3
  - `float`: **Real numbers ($\mathbb{R}$),** 1.3, 2.0,-3.1
  - `complex`: **Complex numbers ($\mathbb{C}$),** 1+2j,1-3j
  - `bool`: **Boolean (logical) values,** True, False
  - `None`: **Type with a single value**

- Variables:
  - `x = 2, y = 3.5, okay = False, car_color="red", a = 3//2, a = b + 2, c = a + b, x = y = 2`

- Functions:

  **`def`** name_of_function (parameters):
  custom instructions …
  **`return`** values
  - **`print()`:** `print(2.5), print(x), print(x, y, 3.5), print(x+1, type(x))`

- Non-Scalar type literal objects:
  - `str`: **String of characters (non-numeric text),** "Hi", "abc", "Hello!", 'z', 'abc', '_wow_', "I'm Joe", ' Say "hello!" to her'

- Operators (numeric types) objects:
  - **Sum:** `i+j`
  - **Difference:** `i-j`
  - **Product:** `i*j`
  - **Integer division:** `i//j`, $i \div j = j \cdot \boldsymbol{n} + r$
  - **Division:** `i/j (float)`
  - **Modulus:** `i%j`, $i \div j = j \cdot n + \boldsymbol{r}$
  - **Power raising:** `i**j`

- Conversions (implicit and explicit) :
  - `x = 2, y = 3.5` → `x = y`
    `x = "hello"` → `x = 2.0, x = 1 + 2/3`
  - `x = int(y), z = float(x)`

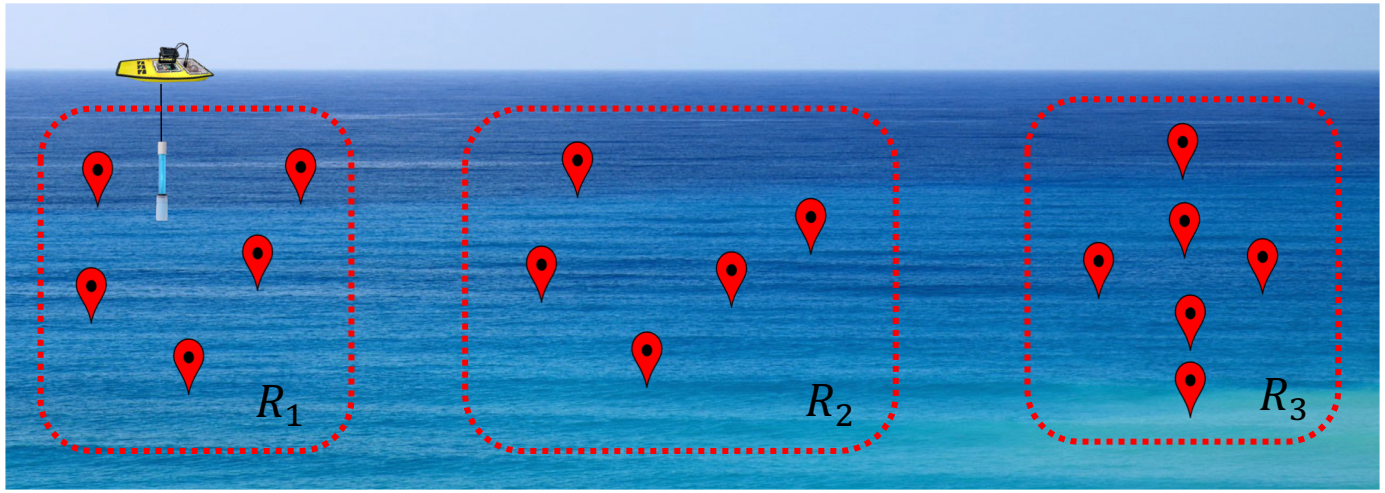
# Reserved language keywords

| | | | | |
|---|---|---|---|---|
| False | class | finally | is | return |
| None | continue | for | lambda | try |
| True | def | from | nonlocal | while |
| and | del | global | not | with |
| as | elif | if | or | yield |
| assert | else | import | pass | |
| break | except | in | raise | |

# Style writing programs ….

- **Readability** and **clarity** of a program are essential, for you and for whoever will read / use your programs
- Moreover, you'll be graded also based on readability and clarity of your homework!
  - Even if you will pass all tests (i.e., your program is correct and does the expected job), you might lose points if the code is not *properly* written
- *First* rules of thumb of writing clear and readable programs:
  - ✓ Give brief but self-explanatory names to variables and functions
    - E.g., a variable representing interest rate, shouldn't be called, `a` or `b`, but rather `interest_rate`
    - A variable representing a color, should be called `color`, not something (unclear) else
    - A function returning a DNA sequence, should be defined as `dna_sequence()`
  - ✓ Use the form with lower letters and underscores to define variables' and functions' names (upper case letters will be used later on for defining classes, for instance, or global variables)
    - Use `car_velocity` instead of `CarVelocity` or `carVelocity`, or other possible forms
  - ✓ Use spaces in statements: `x = 2 + y` is more readable than `x=2+y`, or, `print(x, y, z)` is better than `print(x,y,y)` …
  - ✓ Use comments using # and `'''` to document your code if necessary (we'll see this next time)

# A practical problem




- **3 regions,** $R_i, i = 1,2,3$ to where make an assessment of water quality
- **5 water samples** per region, $w_{ij}, i = 1,2,3;\ j = 1,2,3,4,5$
- Each water sample is a **real number** between 0 and 100, $w_{ij} \in [0,100]$ expressing the presence of a specific pollutant

1. For each region $R_i, i = 1,2,3$ I want to compute an estimate of the average presence of a pollutant, $p$ → Arithmetic average!

$$p_i = \frac{\sum_{j=1}^{5} w_{ij}}{5}$$

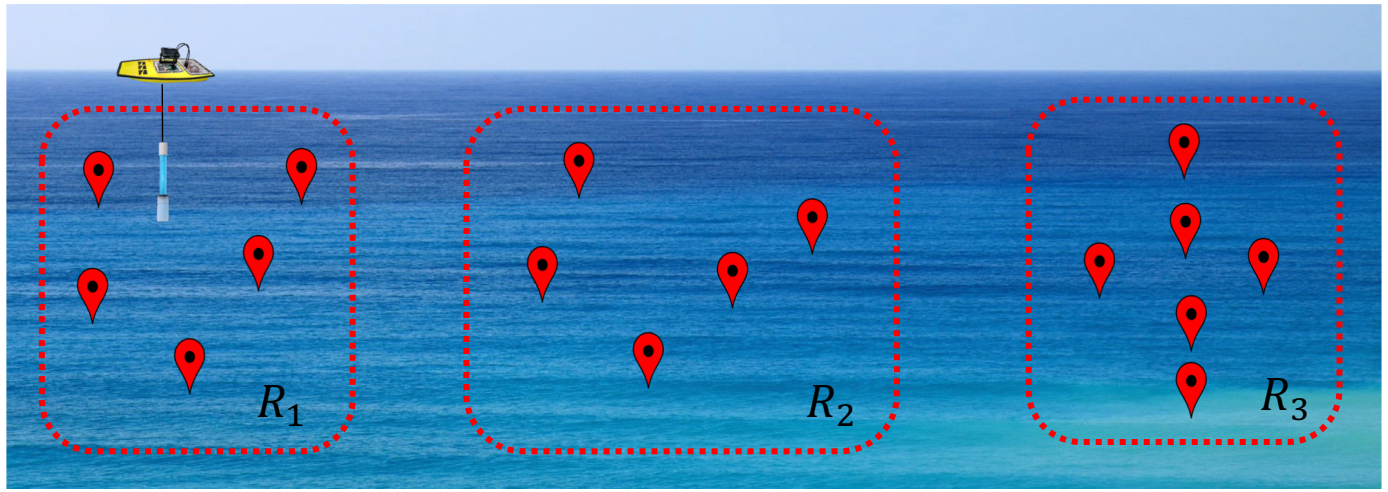
2. For the whole zone including the three regions $R_i, i = 1,2,3$ I want to compute an estimate of the average presence of a pollutant, $p$, averaged over the 3 regions

$$\bar{p} = \frac{\sum_{i=1}^{3} p_i}{3}$$

3. The sample averages for each region I want to see it a **real number**, while the one for the entire zone under monitoring I want to see it as an **integer** since I do not expect decimals playing an important role, but I want to compute also the standard deviation of estimate

$$\sigma_p = \sqrt{\frac{\sum_{i=1}^{3} (p_i - \bar{p})^2}{3}}$$

# A practical problem: Data




| | | |
|---|---|---|
| 1.5 | 12.5 | 8.5 |
| 10.6 | 11.6 | 7.6 |
| 20.0 | 21.0 | 11.0 |
| 25.6 | 15.6 | 19.6 |
| 33.1 | 30.1 | 20.1 |

# A practical problem: Code for questions 1 and 2