Welcome!

We'll get started shortly ...

CS 49 Section

Week 5

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Agenda

- Logistics and check-ins
- Review of lecture concepts
  - Expressions
  - Constants
  - The **`random`** module and **`math`** library
- Coding Template
- Section Problem: Mars Weight

Logistics

How to get hold of me / get help+

- The section forum, 24 hr turnaround
- Email: bosesurajit@fhda.edu, 24 hr turnaround
- Office hours:
  - On campus: Tuesdays 12:00 noon to 1:30 pm, room 4218 in the STEM center. Entry is from room 4213
  - By appointment on Zoom
- Other resources:
  - Contact Lane via Canvas
  - Online or in-person tutoring via the STEM center (Room 4213)

Poll and Survey

- Zoom poll: How caught up do you feel with this class?
  - I'm great: On top of lectures/reading/assignments; feel confident
  - I'm good: Understand the concepts; did most of the coding assignments; getting through fine
  - I could be better: Behind on lecture/assignments, struggling a bit with conceptual understanding/coding practice/time
- Section Survey

Lecture Review: Expressions

Expressions

- A statement that can be evaluated
- We've seen boolean expressions in Karel: `front_is_clear()`, `beepers_present()`, that evaluate to `True` or `False`
- There are also arithmetic expressions: given `x = 3` and `y = 4`,
  - `z = x + y` `# z = 7`
  - `z = x - y` `# z = -1`
  - `z = x * y` `# z = 12`
  - `z = x / y` `# z = 0.75`
  - `z = x // y` `# z = 0`
  - `z = x % y` `# z = 3`
  - `z = x ** y` `# z = 81`
  - `z = -y` `# z = -4`

Expressions

- The symbols **+**, **-**, **/**, etc. are the operators
- The terms operated upon (**x** and **y** in the previous slide) are the operands
- The evaluated result of the expression is typically stored in a variable (**z** in the previous slide) using the assignment operator **=**
- Keep in mind the difference between the two division operators:
  - **/** will always result in a float
  - **//** will always result in an integer, any remainder being discarded
  - **%** is the modulus operator for the remainder of integer division
- Given x = 8 and y = 2, what is the value and type of these expressions?

```
x ** y  # ?        x / y  # ?      x < y  # ?
```

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- Given x = 8 and y = 2, what is the value and type of these expressions?

```
x ** y  # 64      x / y  # 4.0      x < y  # False
```

Expressions

- Watch out for floating point values! They are not stored precisely:

```
x = 1.9
y = 1
z = x - y
print(z)                    # 0.8999999999999
```

- Precision of float results is not reliable beyond the precision determinable by the inputs. Here, the value of **z** is not reliable past one decimal place.
- Can use `round(a, b)` where **a** is the value to round, **b** the number of decimal places:

```
print(round(z, 1))     # 0.9
```

Expressions

- Operators have the following precedence:

( )	parentheses
******	exponentiation
–	unary negation
***, /, //, %**	multiplication, division, integer division, modulus
+, –	addition, subtraction

- Operators with the same precedence (e.g., multiplication, division) are evaluated from left to right

Expressions

- Compound operators: **+=**, **-=**, ***=**, etc. combine the arithmetic and assignment operators in a single command
- Given initial values **x = 3** and **y = 2**, what would the following expressions evaluate to?
  - **x *= y** *# x = x * y*
  - **x += 4** *# x = x + 4*
  - **x /= y** *# x = x / y*
  - **x %= y** *# x = x % y*

Expressions

- Compound operators: `+=`, `-=`, `*=`, etc. combine the arithmetic and assignment operators in a single command
- Given initial values `x = 3` and `y = 2`, what would the following expressions evaluate to?
  - `x *= y` `# x = x * y, x = 6`
  - `x += 4` `# x = x + 4, x = 10`
  - `x /= y` `# x = x / y, x = 5.0`
  - `x %= y` `# x = x % y, x = 1.0`
- Notice that the types of the results depend variously on the operands, the operators, or the results themselves
- Remember that types can be cast to a different type

Any Questions?

Lecture Review: Constants

Constants

- In Python, a constant is a variable whose value does not change during the execution of the program
- By convention, constants are named in **UPPER_SNAKE_CASE**
- Why use constants?
  - To avoid "magic numbers"
  - To allow easy updates
  - To follow the principle of programming for the general case
- Unlike most other programming languages, Python does not enforce constants; they are a convention

Constants

- Suppose I have a program that calculates various resources needed for running an office building based on its square footage. E.g., how many smoke detectors it needs, what the budget should be for HVAC, etc.
- What constants would I need so I can reuse the program for any building?

Constants

- Suppose I have a program that calculates various resources needed for running an office building based on its square footage. E.g., how many smoke detectors it needs, what the budget should be for HVAC, etc.
- What constants would I need so I can reuse the program for any building?
  - **SMOKE_DETECTOR_FACTOR**

    ```
    # e.g. 1 per 2000 sq.ft. or 0.0005
    ```

  - **HVAC_FACTOR**

    ```
    # how many dollars to budget per sq.ft.
    ```

Any Questions?

Lecture Review: `random` and `math`

The `random` module and `math` library

- A module is a python file (with the extension .py) that contains code that can be reused in a different program.
- The **`random`** module allows generation of pseudo-random numbers
- A library, loosely speaking, is a collection of many modules
- The **`math`** library allows mathematical operations such as calculating square roots
- To use such external modules or libraries, your program needs an **`import`** statement such as **`import math`** or **`import random`**
- We've seen such a statement: **`from karel.stanfordkarel import *`**

The random module and math library

```
from math import sqrt
import random

def main():
    for i in range(4):
        my_num = random.randint(200, 1000)
        my_sqrt = sqrt(my_num)
        print(f'Number is: {my_num}, square root is: {my_sqrt}')

if __name__ == '__main__':
    main()
```

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    main()
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Any Questions?

Where do all these go?

The structure of a Python program

- Python programs have a typical order:
  - Comment with filename, program overview, and programmer name
  - import statements
  - constants
  - `main()` function
  - helper functions
  - guard clause and invocation of `main()`
- A template for your use is here

Let's use all that to solve this week's problem!

Section problem: Mars Weights

https://codeinplace.stanford.edu/foothill-cs49/ide/a/marsweight

Mars Weights

Due to the weaker gravity on Mars, an Earthling's weight on Mars is 37.8% of their weight on Earth. Write a Python program that prompts an Earthling to enter their weight on Earth and prints their calculated weight on Mars. The output should be rounded to two decimal places when necessary. Example:

```
Enter a weight on Earth: 120
The equivalent weight on Mars: 45.36
```

- What constant should we use?
- As what type should the input from the user be cast?

Let's get to work!

That's all, folks!

Next up: Control Flow!