COMP 141

CS1: Programming Fundamentals

Variables, math operations, input from keyboard

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Displaying Output with the `print` Function

- **Function:** piece of prewritten code that performs an operation
- **Argument:** data given to a function
- Statements in a program execute in the order that they appear
  - From top to bottom
- **Example:**
  - `print("Hello World")`

Function that displays output on the screen

Data that will be displayed

Variables

- **Variable:** name that represents a value stored in the computer memory
  - Used to access and manipulate data stored in memory
  - A variable references the value it represents
- **Assignment statement:** used to create a variable and make it reference data
  - General format is `variable = expression`
    - Example: `age = 29`
    - Assignment operator: the equal sign (=)

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Displaying Multiple Items with the `print` Function

- **Python allows one to display multiple items with a single call to `print`**
  - Items are separated by commas when passed as arguments
  - Arguments displayed in the order they are passed to the function
  - Items are automatically separated by a space when displayed on screen
- **Example:**

```
>>> dogName = "May"
>>> print("My dog's name is", dogName)
My dog's name is May
```

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Numeric Data Types, Literals, and the `str` Data Type

- **Data types:** categorize value in memory
  - e.g., int for integer, float for real number, str used for storing strings in memory
- **Numeric literal:** number written in a program
  - No decimal point considered int, otherwise, considered float
- Some operations behave differently depending on data type
- **Example:**

```
>>> a = 5                    >>> a = "5"
>>> b = 7                    >>> b = "7"
>>> print(a + b)             >>> print(a+b)
12                           57
```

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Variable Reassignment

- Variables can reference different values while program is running
- **Garbage collection:** removal of values that are no longer referenced by variables
  - Carried out by Python interpreter
- **A variable can refer to item of any type**
  - Variable that has been assigned to one type can be reassigned to another type

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Reassigning a Variable to a Different Type

- A variable in Python can refer to items of any type

```
>>> x = 90
>>> x = "Take me to your leader"
```

- **If you're using the same variable name for different uses, Python will assume you mean the most recent use**

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Performing Calculations

- **Math expression: performs calculation and gives a value**
  - Math operator: tool for performing calculation
  - Operands: values surrounding operator
    - Variables can be used as operands
  - Resulting value typically assigned to variable
- **Two types of division:**
  - / operator performs floating point division
  - // operator performs integer division
    - Positive results truncated, negative rounded away from zero

The Exponent Operator and the Remainder Operator

- **Exponent operator (**): Raises a number to a power**
  - `x ** y` = x^y
- **Remainder operator (%): Performs division and returns the remainder**
  - a.k.a. modulus operator
  - e.g., `4%2=0, 5%2=1`
  - Typically used to convert times and distances, and to detect odd or even numbers

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Operator Precedence and Grouping with Parentheses

- **Python operator precedence:**
  1. Operations enclosed in parentheses
     - Forces operations to be performed before others
  2. Exponentiation (**)
  3. Multiplication (*), division (/ and //), and remainder (%)
  4. Addition (+) and subtraction (-)
- **Higher precedence performed first**
  - Same precedence operators execute from left to right

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Converting Math Formulas to Programming Statements

- **Operator required for any mathematical operation**
- **When converting mathematical expression to programming statement:**
  - May need to add multiplication operators
  - May need to insert parentheses

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Performing Calculation Practice

You're working at a fast food restaurant where a burger costs $3.99 and French fries cost $1.99.

- Write a program (save this as a script) that uses 2 variables to store these two prices.
- Your program should then print out the cost of buying 2 burgers and 3 fries.
- If you finish early, make your program add in 9.25% sales tax.

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Reading Input from the Keyboard

- **Most programs need to read input from the user**
- **Built-in `input` function reads input from keyboard**
  - **Returns** the data as a string
  - Format: *`variable`* `= input(`*`prompt`*`)`
    - *`prompt`* is typically a string instructing user to enter a value
  - Does not automatically display a space after the prompt

Example:

```
>>> name = input("Please enter your name: ")
```

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Reading Numbers with the `input` Function

- **`input` function always returns a string**
- **Built-in functions convert between data types**
  - `int(`*`item`*`)` converts *`item`* to an `int`
  - `float(`*`item`*`)` converts *`item`* to a `float`
  - Nested function call: general format: *`function1`*`(`*`function2`*`(`*`argument`*`))`
    - value returned by function2 is passed to function1
  - Type conversion only works if item is valid numeric value, otherwise, throws exception

Input from Keyboard

- For integers:

```
variable = int(input("Prompt"))
```

- For floats:

```
variable = float(input("Prompt"))
```

- For strings:

```
variable = input("Prompt")
```

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Practice

1. Modify your food program (burger and fries) to prompt the user for the price of a burger and the price of fries instead of having those values hard-coded in.

2. Write a short program (new file) that will calculate the proper tip on a bill.
   - Prompt the user for the total cost of the bill.
   - Assume you are leaving an 18% tip.
   - Calculate the total tip for the bill.
   - Output the tip amount
   - If you're done early, prompt the user for the tax rate, then use it to calculate the total cost of the bill with tax and tip.