SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

CMPT 120: Introduction to Computing Science and Programming 1

Procedural programming in Python

Reminders

One-Stop Access To Course Information

- Course website: **One-stop access** to all course information.

  http://www2.cs.sfu.ca/CourseCentral/120/liaqata/WebSite/index.html

- Course Outline
- Exam Schedule
- Python Info
- CourSys/Canvas link
- Learning Outcomes
- Office Hours
- Textbook links
- and more…
- Grading Scheme
- Lab/Tutorial Info
- Assignments

- **Canvas**: Discussions forum - https://canvas.sfu.ca/courses/39187
- **CourSys**: Assignments submission, grades - www.coursys.sfu.ca

How to Learn in This Course?

A **Attend** Lectures & Labs

R **Read** / review Textbook/Slides/Notes

R **Reflect** and ask Questions

O **Organize** – your learning activities on weekly basis,

and finally…

W **Write** Code, Write Code, and Write Code.

Deliverables

1. Deliverables are due by the given date and time.
2. For the course, we are using IDLE to write and run our Python code.
3. You can use the CSIL lab computers outside your lab hours.
4. Plan ahead your assignments and other deliverables. Computer crash, network problems etc. are not acceptable excuses for delays in deliverables.
5. You may use online Python interpreters for running and testing your codes, such as:
   https://repl.it/languages/Python3

Labs

1. Each lab has an assigned TA.
2. Attend your assigned lab and show your work to your TA for the participation marks.
3. Class enrolments and lab swaps are closed now.

Course Topics

1. General introduction
2. Algorithms, flow charts and pseudocode
3. **Procedural programming in Python**
4. Data types and control structures
5. Fundamental algorithms
6. Binary encodings
7. Basics of computability and complexity
8. Basics of Recursion
9. Subject to time availability:
    - Basics of Data File management

Today’s Topics

1. Operators
   1. Arithematic Operators (+, - , *, /)
   2. Comparison operators (<, >, <=, >=, ==, !=)
   3. Binary and unary operators
   4. Logical Operators (and, or, not)
2. Variables / Variable Names
3. Assignment Statements
4. Statement

Review

Can you name or describe the following?

In Python…

1. 5 is _____
2. total is ______
3. + is _____
4. == is a
5. a + b is _____
6. midterm > 95 is _____

1. a value
2. a variable
3. an arithmetic operator
4. a conditional or relational operator
5. an arithmetic expression
6. a Boolean expression

Review: 2

In Python:

1. x - 5 is _____
2. X != 5 is ______
3. % is _____
4. (a >= 60) is a
5. (a < 70) is _____
6. (a >=60) and (a < 70) is _____

1. an arithmetic expression
2. a Boolean expression
3. an arithmetic operator
4. a Boolean expression
5. a Boolean expression
6. a Boolean expression.
   - More specifically, a complex Boolean expression.

Binary and Unary Operators

- **Binary operator**: The operator that requires two operands.
  - To add we need two numbers or two operands, so **+** is a binary operator. For example, **10** + **6. Other examples:**
    - All arithmetic operators. We need two operands for +, -, *, /, //, and %.
    - All the conditional operators (<, <=, >, >=, ==, !+).
- **Unary operator**: The operator that requires only one operand.
  - For example, positive or negative operator: -50 or +30. Here **–** and **+** are act as unary operators.

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Logical Operators

Logical Operators

- The symbols **and** , **or** , **and** **not** are called **logical operators.**
- We use **and** and **or** **logical operators** to create **compound** Boolean expressions.
- We use **not** **logical operator** to **reverse** the result of its operand. not(a>70)
  - By compound we mean to join **two or more** Boolean expressions.
  - For example in a Boolean expression total >= 85 and total < 90:
    - the symbol **and** is a **logical operator**,
    - total >= 85 and total < 90 are two **Boolean expressions**.
- A compound Boolean expression returns a **True** or **False** result.

Logical Operators: In Compute Grade Example

```
midterm = 0
final   = 0

midterm = input(“Enter midterm:”)
final   = input (“Enter final:”)

total = float(midterm) + float(final)

if total>=95: print("A+")
elif total>=90 and total<95: print("A")
elif total >= 85 and total < 90: print("A-")
elif total >= 80 and total < 85: print("B+")
elif total >= 75 and total < 80: print("B")
elif total >= 70 and total < 75: print("B-")
elif total >= 65 and total < 70: print("C+")
elif total >= 60 and total < 65: print("C")
elif total >= 55 and total < 60: print("C-")
elif total >= 50 and total < 55: print("D")
else: print("F")
```

Logical operators

Logical Operator: *and*

- and: The ***and*** is a *binary* logical operator that connects two Boolean expressions into one compound expression.
  - The result of ***and*** compound binary expression is **true** when **all** the sub expressions are **true**.
  - For example, the result of a compound Boolean expression **marks >=90 and marks < 95** will be true, when the results of:
    - marks >=90 Boolean expression is true, and
    - marks < 95 Boolean expression is true.

Logical Operator: *and* Truth Table

- We can simplify the and results, or decision structure, using a table. We call it a Truth Table.
- Truth table for the and operator:

Expression 1 marks >= 90	Expression 2 marks < 95	Expression 1 and expression 2 marks >= 90 and marks < 95 (A)
False	False	False
False	True	False
True	False	False
True	True	True

Logical Operator: *or*

- or: The ***or*** is a *binary* logical operator that connects two Boolean expressions into one compound expression.
  - The result of ***or*** compound binary expression is **true** when **either** of the sub expressions is **true**.
  - For example, the result of a compound Boolean expression **gpa >= 2.5 or height >= 7** (closing hours) will be true, when either the result of:
    - gpa > 2.5 Boolean expression is true, or
    - height > =7 Boolean expression is true.

Logical Operator: *or* Truth Table

- We can simplify the and results, or decision structure, using a table. We call it a Truth Table.
- Truth table for the or operator:

Expression 1 gpa >= 2.5	Expression 2 height >= 7	Expression 1 and expression 2 gpa >= 2.5 or height >= 7 (Admit)
False	False	False
False	True	True
True	False	True
True	True	True

Short-Circuit Evaluation (I would call it a smart evaluation)

- **Short-circuit** is deciding the value of a compound Boolean expression after evaluating only one sub expression.
- Performed by the ***and*** and ***or*** operators.
- For **and** operator: If left operand is **false**, compound expression is false. Otherwise, evaluate right operand.
- For **or** operator: If left operand is **true**, compound expression is true. Otherwise, evaluate right operand.

Logical Operator: *not its* and Truth Table

- not: It reverses the logical value of the Boolean expression.
  - It turns a **true** into **false**, and a **false** into a **true**.
  - It take only one operand. So **or** is a unary operator.
  - It is recommended to place parentheses around a Boolean expression to clarify to what you are applying the not operator.
    - **not(gpa >= 2.5)**

Expression	Not(expression)
True	False
False	True

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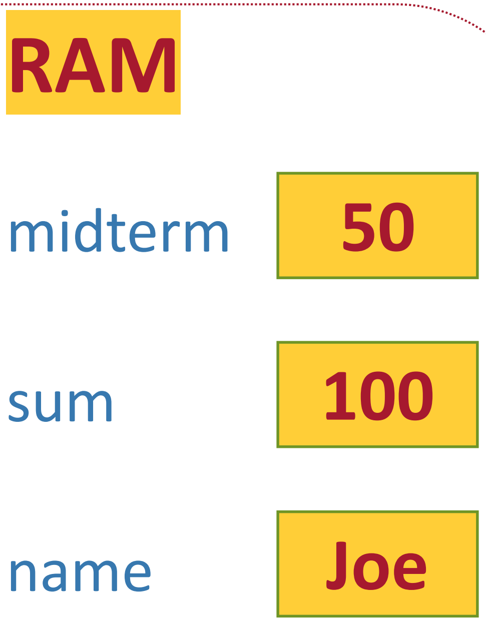
Variables / Assignment Statement

Variables

- **Variable** is a name that represents a value stored in the computer memory (RAM).
  - We store data in computer memory via variable names.
  - We access and manipulate data in in memory via variables.
  - Examples: **marks**, **midterm**, **sum**, or **total**.
- **Assignment Statement** assigns a value to a variable. (**Variable that receive value should be on left.**)
  - midterm = 50
  - sum = 100
  - name = “Joe”
- You can only use a variable if a value is assigned to it.



Variable Naming Rules

- Rules for naming variables in Python:
  - Variable name cannot be a Python key word, like input, print, if
  - Variable name cannot contain spaces.
    - total marks in invalid, but totalmarks is valid.
  - First character must be a letter or an underscore.
    - 7stars is invalid, but _7stars is valid.
  - After first character may use letters, digits, or underscores.
    - a7_b3 is valid.
  - Variable names are case sensitive.
    - Abc is differenct from abc.
- Variable name should reflect its use.
  - xyz is not good but midterm_marks is better.

Statement

- **Statement** is a unit of code that has an effect, like creating a variable or displaying a value.
- For example,

  n = 17 is a statement.

  print(n) = 17 is a statement.

  marks = input(“Enter marks: “) is a statement.

Questions?