(U) Lesson Plan

# Lesson 02: Data Types

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| **Lesson Overview** | | | |
| **Lesson Length** | 3 hours (180 minutes) | | |
| **Overview** | This session will familiarize students with data types related to the Python scripting language. | | |
| **Objectives**   * **Domain:** Cognitive * **Level:** Applying | Using conditionals, loops, Python dictionaries, local data, the CSV Library, and the Glob Library, students will be able to:   * TLO 1: Examine the implications of using computation to solve a problem   + ELO 1.1: Discuss best practices for using computation to solve a problem   + ELO 1.2: Suggest types of problems that can be solved through computation   + ELO 1.3: Show how computation can solve a problem * TLO 2: Recognize key computer science concepts   + ELO 2.1: Identify data types used in Python scripting   + ELO 2.2: Identify data structures used in Python scripting   + ELO 2.3: Define variables and strings * TLO 3: Demonstrate the ability to build basic scripts using Python scripting language   + ELO 3.1: Use various data types and structures in Python scripting | | |
| **Instructional Methods** | Informal lecture, demonstration, guided discussion. | | |
| **Assessment Strategies** | Informal: Guided and practical exercises  Formal: N/A | | |
| **Materials and Equipment Needed** | Required:   * SBU * Jupyter Notebook * Python   Optional:   * N/A | | |
| **Background Resources** | Resource:   * NGA SME * Technical facilitators   Subject matter/content questions may be referred to:   * Jeremy DeBrow, Course Manager   [Jeremy.R.Debrow@nga.mil](mailto:Jeremy.R.Debrow@nga.mil)  [Jeremy.R.Debrow@coe.ic.gov](mailto:Jeremy.R.Debrow@coe.ic.gov)  National Geospatial-Intelligence College (NGC) HDNPE Branch  Unclassified: 571-557-7583 | | |
| **Comments** | ELO 1.1, 1.2, and 1.3 are meant to be covered throughout the entire lesson (informal lecture and assessment). Instructors will be expected to facilitate a classroom discussion that identifies problems best suited to be solved computationally, best practices for solving those problems, and potential solutions. | | |
| **Lesson Sequence** | | | |
| **Lesson Topic** | **Instructional Method** | | **Time**  **(min)** |
| Introduction | Informal lecture | | 5 |
| Review | Informal lecture, guided discussion, demonstration | | 10 |
| Lesson: Data Types | Informal lecture, guided discussion, demonstration | | 60 |
| Assessment | Guided exercise, practical exercise | | 100 |
| Conclusion | Informal lecture | | 5 |
| **Lesson Outline** | | | |
| **Introduction** | | | |
| Introduction | * **Attention** (to be personalized by instructor) * **Motivation** (to be personalized by instructor) * **Overview** (to be personalized by instructor)   + Learning objectives   + Lesson topics/main points * **Rules of Engagement** (to be personalized by instructor) | | |
| **Body** | | | |
| ***Lesson Topic*** | ***Main Points/Notes*** | ***Personalization*** | |
| Review | **Informal Lecture/Guided Discussion/Demonstration (10 minutes)**  **Lesson 2: Data Types**  **2.1. Objectives**  **2.2. Overview**  *(Facilitator Notes:*   * *Have students load the U\_CSCI2011\_L02\_Data\_Types\_SG\_V3.0.ipynb file to begin the session.* * *See the Instructor’s Notebook for instructor guidance on discussion points and guided exercises.* * *Refer back to Lesson 1 and relate the four steps ofproblem solving using Computational Thinking (Decomposition, Pattern Recognition, Abstraction, & Algorithm Design) to lessons, exercises, examples, student questions/comments, etc., as appropriate throughout this lesson.)*   **2.3. Review**   * 2.3.1. Computational Thinking * 2.3.2. Variables * 2.3.3. Jupyter Notebook: Keyboard Shortcuts |  | |
| Lesson: Data Types | **Informal Lecture/Guided Discussion/Demonstration (60 minutes)**  **2.4. Lesson: Data Types**   * 2.4.1. Introduction to Data Types * 2.4.2 Numbers and Arithmetic Operators   + 2.4.2.1. Casting   + 2.4.2.2. Arithmetic Operators   *(Facilitator Note: Ensure that students understand modular division and floor division.)*   * + 2.4.2.3. Assignment Operators * 2.4.3. Strings   + 2.4.3.1. Creating Strings   + 2.4.3.2. Indexing and Slicing a String   + 2.4.3.3. Methods and Operations * 2.4.4. The None Type   *(Facilitator Note: If students ask about another purpose of NoneType, mention the idea of a placeholder in data.)* |  | |
| Assessment | **Guided Exercise/Practical Exercise (100 minutes)**  *(Facilitator Note: All assessments should incorporate a facilitator directed discussion on computational thinking techniques as they relate to the assigned problem. Utilize student handouts, performance support tools, or projected code cells to capture facilitator/student discussion.)*  **2.5. Guided Exercise: Example Practical Exercise**  *(Facilitator Notes: Refer back to Lesson 1 and relate the four steps of problem-solving using Computational Thinking (Decomposition, Pattern Recognition, Abstraction, & Algorithm Design) as appropriate throughout these exercises.)*   * We will be walking through an example practical exercise and examining the best practices for approaching it, in addition to explaining the intention behind different aspects of the format and setup.   **2.6. Practical Exercises**  *(Facilitator Notes:*   * *Refer back to Lesson 1 and relate the four steps of problem-solving using Computational Thinking (Decomposition, Pattern Recognition, Abstraction, & Algorithm Design) as appropriate throughout these exercises.* * *The practical exercises deemed most important for this lesson, due to content and/or a cumulative result, which should be completed first in the interest of maximum training value in relation to time are Practical Exercises 1, 3, and 4. Ensure you go over the exercise solutions and (as necessary) the processes to arrive at the solutions with the students.* * *Follow-up questions are designed to be asked by the facilitators individually as each student completes the task and has it looked at by a facilitator.)*   **2.6.1. Practical Exercise 1: Casting**   * Cast the following two values into floats and then add them together.   **2.6.2. Practical Exercise 2: How big is Washington, D.C.?**   * In accordance with the Residence Act of 1790, Washington, D.C., was declared a square diamond 10 miles wide by 10 miles wide using land ceded from Maryland and Virginia. However, in the 1840s the Virginia state government said, "Give us our land back! We want those citizens to vote in our commonwealth," and Virginia got 31.6518 square miles of land back from the nation's capital. So, how big is D.C. today? Assign numeric values to variables before doing calculations. Use print() to give your final answer as a full sentence. (see notebook)   **2.6.3. Practical Exercise 3: Cleaning Data**   * In the code cell below there are four string values representing coordinates in Degrees-Minutes-Seconds (DMS) format. Standardize the format of each the coordinates below. Each example requires different code to fix, so treat each coordinate seperately. Do not attempt to write one script to reformat all of the examples at once.   **2.6.4. Practical Exercise 4: Radio Signal Travel Time**   * Calculate to see how long, in hours, a radio signal (which travels at the speed of light) takes to reach Earth from the Voyager 1 spacecraft. First use comments in the code cell below to write out the steps of calculation or unit conversion that are needed to find the answer. Then write the code to execute these steps. Make your answer print out as a complete sentence. HINT: Start with the speed of light in kilometers per hour to write less code.   **2.6.5. Practical Exercise 5: Restaurant Bill**   * Calculate the overall cost of a restaurant bill given the pre-tax total, tax rate, and tip percentage. Apply a tip to the post-tax cost of the meal to get your final output.   **2.6.6. Practical Exercise 6: Hours, Minutes, and Seconds**   * Problem 1: Given a number of seconds (int or float), output the equivalent amount of time in minutes and seconds as a string. * Problem 2: Incorporate the number of hours into the output as well so that the output is in the format 'X hours, Y minutes, and Z seconds'.   **2.6.7. Practical Exercise 7: String Slicing Exercises**   * Problem 1: Using slicing and concatenation, print out the Bond's name as 'Bond, James Bond' * Problem 2: Slice the following text to just get the mission, start date, location, and coordinates (without the labels).   **2.7. Appendix** |  | |
| Administrative Notes | N/A |  | |
| **Assessment** | | | |
| ***Assessment Type*** | ***Instructions/Prompts/Notes*** | | |
| Guided Exercise | See the facilitator notes located above for additional guidance. All exercises will be conducted inside of the Jupyter Notebook lesson file. | | |
| Practical Exercise | See the facilitator notes located above for additional guidance. All exercises will be conducted inside of the Jupyter Notebook lesson file. | | |
| **Conclusion** | | | |
| Conclusion | * **Final Summary** (to be personalized by instructor)   + Review learning objectives   + Review lesson topics/main points * **Remotivation** (to be personalized by instructor) * **Closure** (to be personalized by instructor) * **Next Lesson Introduction** (to be personalized by instructor) | | |