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| **Laboratory Activity No. 5** | |
| **Functions, Modules, and Packages** | |
| **Course Code:** CPE103 | **Program:** BSCPE |
| **Course Title:** Object-Oriented Programming | **Date Performed:** 02/15/25 |
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| **1. Objective(s):** | |
| This activity aims to introduce students to the concept of modules and packages in Python. | |
| **2. Intended Learning Outcomes (ILOs):** | |
| The students should be able to:   * 1. Use the different Python built-in functions, modules, and packages.   2. Create a program with user-defined functions   3. Create a program that will import or load a user-created module and import its functions.   4. Create a program that will import or load a user-created package and import its modules. | |
| **3. Discussion:** | |
| As the program gets larger and more complex, it will be unavoidable for a programmer to split related and repeated codes into separate files, this in Python is referred to as Modules and Packages.  A **module** contains variables and functions that can be imported or used again in another program (Python file) without the programmer having to code the same variables and functions again. A python program (.py file) is considered to be a module. A **package** is simply a group of related modules or .py files combined together. A package commonly is considered to be a library which contains an enormous amount of functions and modules.  Python comes with built-in modules and packages such as the **math** module, **statistics** module, **random** module. For scientific computing, the following packages is mentioned here. The **NumPy** package is a general-purpose array-processing package. It provides a high-performance multidimensional array object. The **NumPy** package is used for scientific computing. Another well-known Python package is **Scikit-learn** which is an open source machine learning library that supports supervised and unsupervised learning for implementing Artificial Intelligence related tasks. For Software Development, the **Tkinter** and the **PyQt5** are the most commonly used. For Web Development, **Flask** and **Django** are the most widely used framework(composed of packages) for building websites with Python.  **Functions**  To implement a simple module or package, we need to refamiliarize ourselves with the concept of functions. Recall that a function is composed of a block of codes stored together that when called it executes those codes stored inside it. Functions help programmers organize related code into modular pieces that can be called upon to perform repetitive tasks. The Python interpreter has a number of functions and types built into it that are always available but programmers can add their own custom functions to implement more customized logic. The image below shows an example of a function written in Python.    The def is a special keyword used to indicate a function definition or creation. The function\_name is the name of the function  to be created. Recall that a function is also declared using parenthesis. Inside the parenthesis are inputs or arguments that can be accepted in the function through the declaration of parameters. Parameters are temporary variables or placeholder that can | |

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| be used inside the function. In Python, a return value is optional since the interpreter automatically makes the decision if it will be a void datatype function, an int datatype function, string datatype function, boolean datatype function and adjusts memory allocation accordingly.  Functions can be built-in or user-defined, for instance the Python print() is an example of a built-in function. The len() is also a built-in function. Other examples of built-in functions are: int(), str(), float(), bool(), list(), tuple(), dict(), open(). Functions will be used in the activity to create modules and packages. More built-in functions can be found in the official Python documentation.    Source: <https://docs.python.org/3/library/functions.html>  In this activity, you will be exploring the various built-in Python functions, modules, and packages, and how to create functions in Python, put those functions in a module, call functions from a module to another program, and create your own package of modules.  For more information you may also visit the official python documentation: <https://docs.python.org/3/tutorial/modules.html> <https://docs.python.org/3/tutorial/modules.html#packages> |
| **4. Materials and Equipment:** |
| Desktop Computer with Anaconda Python or Google Colab Windows Operating System |

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| **5. Procedure:** |
| For this activity we will be creating Python programs using the Spyder IDE.  **Functions**  **Exploring built-in functions**   1. Create a folder named **builtinfunctions** 2. Create a Python file inside the functions1 folder named **evaluator.py** and copy the code shown below:     **Note:** and, or, not must be small cases.   1. Run the program and observe the output. Try to analyze the purpose of the built-in functions used in the program (the keywords in color violet). 2. You may modify the code in order to study it as it will be used later in the next sections of the activity.   **Using the open() function for file handling**   1. Create a folder named **filehandling** outside of **builtinfunctions** folder 2. Create a Python file inside the **filehandling** folder named **filewriter.py** 3. Open the **filehandler.py** using Spyder IDE and type the code as shown below: |

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| **Note:** You may use help(open) either in a Python program or in the shell for more information about the built-in function.   1. Run the program and observe the output. 2. Modify the program to create a file called **newfile2.txt** and print the message (excluding the “ “)   “This message was created using Python!”   1. Create another Python file inside the **filehandling** folder named **filereader.py** and type the code as shown below:      1. It should display an error. Identify and resolve the cause of the error based on the message given by Python. The file that should be read is newfile1. 2. After fixing the error, run the program again and observe the output. 3. Modify the filereader.py program so that the message of **newfile2.txt** is displayed. 4. Modify again the program with the following code below:      1. Create a new Python file still inside the oop1 folder called **fileappender.py** and copy the code shown below:      1. Run the program and observe the output.   **User-defined Functions**   1. Create a new folder called **userfunctions** outside of **filehandling** folder 2. In the **userfunctions** folder create a program called **truthtablegenerator.py** and copy the code below:      1. Run the program and observe the output. 2. Modify the program by changing *print(generate\_truthtable(3))* to *print(generate\_truthtable())* then run the program 3. An error should occur, modify the program according to the code shown below: |

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| **Note:** The code modifications are underlined in red.   1. In the same file/program, create a new function with the name **evaluate\_propositional\_logic()**. The parameter is c\_list(combinations list) and the code can be found under the **# main program** comment in the first program made earlier. 2. After successfully placing the code in the function, call the function using this code   **evaluate\_propositional\_logic(generate\_truthtable(3))**   1. Analyze why in the generate\_truthtable function we needed to print the function whereas in the evaluate\_propositional\_logic function, it prints the values on its own. 2. Compare the program **truthtablegenerator.py** with **evaluator.py**. Identify the advantages of placing code within functions against the sequential code done in the first.   **Modules**  **Built-in Modules math module**   1. Create a new folder called **modules1** outside of the **userfunctions** 2. Create a new Python file called **mathmodule.py** and copy the following codes as shown below:      1. Run the program and observe the output. You may switch between the two sets of values. 2. Create a new Python file called **mathmodule2.py** and copy the following codes as shown below: |

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| 5. To view additional functions in the module. Type and run help(math) while it is imported.  **time and datetime module**   1. Create a new file in the folder named **dateandtime.py** 2. Copy and run the code as show below:      1. Observe the output. 2. In the same file, copy and add the code to the file as shown below:      1. Run the program, and observe the output. 2. In the same file, copy and add the code to the file as shown below:      1. Run the program, and observe the output.   **User-defined Modules**   1. The previously created dateandtime.py is considered to be a module that you can import. 2. In the same **modules1** folder, create a new file called main.py and copy the following code:      1. The program will not run as expected, and you will need to remove the following codes in the dateandtime.py which are underlined in red. |

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| 1. Run the main.py program again and you will now see the correct output which is the current time. 2. Modify the main.py to also display the current date using the current\_date() in dateandtime.py 3. To remove the need to constantly indicate the module name dateandtime. in each function, modify the code as shown below:     **FOR CHECKING THE RUN PROGRAM, PLEASE REFER TO THE LAB ACT #5 IN GITHUB** |
| **6. Supplementary Activity:** |
| **Tasks**  Simple Word Filter   1. Create a function that would accept two inputs: a sentence(string), and a list containing bad words that the user would like to censor but not remove. The function should return the newly filtered sentence wherein the bad words are replaced with asterisks equal to the length of the censored word. 2. Given a certain Physics problem create a function(projectilemotion\_solver) that would take in the following inputs below and return the needed information when the function is called. Name the program containing the function projectilemotion.py then create another program main\_program.py and import projectilemotion.py   “A long jumper leaves the ground at an angle of 20.0° above the horizontal and at a speed of 11.0 m/s. “   * 1. How far does he jump in the horizontal direction?   2. What is the maximum height reached?   Given a projectile motion problem like this where the angle and speed are given, the range or distance travelled in the horizontal direction can be determined by using the formula:  𝑣𝑖2𝑠𝑖𝑛2𝜃𝑖  𝑅 =  𝑔  The maximum height can be determined using the formula:  𝑣𝑖2𝑠𝑖𝑛2𝜃𝑖  ℎ =  2𝑔  Reference: Serway, Jewet (2019), Physics for Scientists and Engineers 9e   1. Create a quadratic equation solver module that would write the inputs of the user and the corresponding output into text files.   **FOR CHECKING THE RUN PROGRAM, PLEASE REFER TO THE LAB ACT #5 IN GITHUB** |

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| **Questions**   1. Why do built-in functions exist?   Built-in functions simplify programming by providing pre-defined tools for common tasks, saving time and improving efficiency. They ensure consistency across programs, as they are standardized and extensively tested, reducing the risk of errors. By improving code readability, built-in functions facilitate collaboration among developers, making it easier to understand and maintain code. Overall, they empower programmers to focus on complex problems rather than reinventing basic functionalities.   1. What is the advantages/disadvantages of placing code inside functions vs sequential codes.   Placing code inside functions provides better organization, as tasks are encapsulated into reusable blocks, reducing redundancy and improving maintainability. Functions make code more readable and easier to debug, as specific operations can be isolated and tested independently. However, sequential code can be simpler for small programs, as it avoids the complexity of defining and invoking functions. Nevertheless, sequential code becomes harder to manage in larger projects, whereas functions ensure structure and scalability.   1. What is the difference between a function and a module?   A function is a block of reusable code that performs a specific task, often taking inputs (parameters) and returning a result. It is a fundamental unit of code designed to solve a specific problem within a program. A module, on the other hand, is a file or package that organizes related functions, variables, and classes into a single unit. It allows developers to group and reuse code across multiple programs, promoting modularity and maintainability. In essence, a function solves smaller tasks, while a module serves as a container for organizing and sharing related code functionalities.   1. What is the difference between a module and a package?   A module is a single file containing Python code, which can include functions, classes, and variables, designed to perform specific tasks and be reused in different programs. A package, however, is a collection of related modules organized within a directory, often accompanied by an \_\_init\_\_.py file to indicate that the directory is a package. While a module is a standalone unit for organizing code, a package serves as a higher-level structure for grouping multiple modules into a cohesive library. This modular organization provided by packages helps developers manage and scale complex projects by logically organizing code into smaller, reusable components. |
| **7. Conclusion:** |
| In this activity, we implemented user-defined functions, modules, and packages to solve different problems efficiently. The simple word filter function demonstrated the use of string manipulation and loops, while the projectile motion server used mathematical formulas for physics-based calculations. Additionally, the quadratic equation solver stored results in a text file, illustrating file handling in Python. This approach enhances modularity, reusability, and maintainability in programming. |
| **8. Assessment Rubric:** |