**Faculty of Computing**

**SE-314: Software Construction**

**Class: BESE 13AB**

# Lab 07: Recursion

**CLO-03:** Design and develop solutions based on Software Construction principles.  
**CLO-04:** Use modern tools such as Eclipse, NetBeans etc. for software construction.

**Date: 28th Oct 2024**

**Time: 10:00 AM** **- 12:50 PM   
 02:30 PM – 04:50 PM**

**Instructor: Dr. Mehvish Rashid  
Lab Engineer: Mr. Aftab Farooq**

**Introduction:**

# Lab 07: Recursion

Students will have hands-on experience on designing, testing, and implementing recursive problems. Given a scenario, you will write the specifications and implement it by dividing into base case and recursive step. You may design helper methods to simplify your implementations. Write unit tests that check for compliance with the specifications.

## Lab Tasks

**Task 1: Recursive File Search**

**Objective:** The objective of this lab task is to create a Java program that recursively searches for a file within a directory and its subdirectories. This exercise will help you practice the principles of software construction and recursion.

**Instructions:**

1. Create a Java program that takes two command-line arguments: a directory path and a file name to search for.
2. Implement a recursive function to search for the specified file within the given directory and its subdirectories.
3. The program should display a message when it finds the file, including the full path to the file, or a message indicating that the file was not found.
4. Follow good coding practices, including meaningful variable names, comments, and modular code.
5. Implement error handling to handle cases where the specified directory does not exist or other exceptions may occur.
6. Use appropriate data structures and algorithms to efficiently search through the directory tree.
7. Test your program with different directory paths and file names to ensure its correctness and reliability.

Important: Do not forget to write the specifications and unit tests for the code.

**Optional Enhancements:**

1. Allow the program to search for multiple files in a single run.
2. Implement a feature to count the number of times a specific file appears within the directory and its subdirectories.
3. Provide an option to specify whether the search should be case-sensitive or case-insensitive.

**Task 2: Recursive String Permutations**

**Objective:** The objective of this lab task is to create a Java program that generates all permutations of a given string using a recursive algorithm. This exercise will help you practice recursion and algorithm design.

**Instructions:**

1. Create a Java program that generates all permutations of a given string using a recursive function.
2. Implement a recursive function **generatePermutations** that takes a string as input and returns a list of all its permutations.
3. Use a recursive approach to generate permutations. You can consider swapping characters in the string to create different permutations.
4. Follow good coding practices, including meaningful variable names, comments, and modular code.
5. Implement error handling to handle cases where the input string is empty or other exceptions may occur.
6. Analyze the time complexity of the recursive algorithm. How does the time complexity compare to an iterative solution for large strings?

**Optional Enhancements:**

1. Provide an option for the user to choose whether to include or exclude duplicate permutations, as some characters in the input string may be identical.
2. Implement a non-recursive algorithm for generating permutations and compare its performance with the recursive solution for large strings.

|  |
| --- |
| Solution: |
| **Source Code: Zip your source code along with report and upload one file on LMS as well.    Upload Your Code on Github and share Github link in Report as well.**  **Output Task 1:**    **Output task 2:**    **Git Repo Link:** |

### Deliverables:

Compile a single word document by filling in the solution part and submit this Word file on LMS.

In case of any problems with submissions on LMS, submit your Lab assignments by emailing it to [aftab.farooq@seecs.edu.pk.](mailto:aftab.farooq@seecs.edu.pk.)