S-Emulator

- Name: Mor Greenberg  
- ID: 212465678  
- Email: morgr@mta.ac.il  
- GitHub: <https://github.com/Mor-Greenberg/S-Emulator_>

# Project Overview

S-Emulator is a Java-based simulator for S-language. It allows loading a program from an XML file, expanding synthetic instructions to basic ones according to a user-defined degree, and executing the program with output statistics and history.

# System Structure

The project is divided into two modules:

## 1. console (User Interface and Menu Handling)

This module manages interaction with the user and includes the program's entry point and printing mechanisms.  
  
- Main: Program entry point. Runs the menu.  
- PrintMenu: Handles the UI for running programs and choosing execution or expansion.  
- HandleExecution: Executes loaded and expanded programs.  
- PrintExpansion: Handles how the expanded instructions are displayed.  
- ProgramDisplay: Formats and prints program instructions, including synthetic expansion in one line.  
- InstructionFormat: Responsible for formatting instruction strings for display.

## 2. engine (Core Logic and Emulation)

This module handles the emulation logic, instruction expansion, and execution.  
  
- execution  
 - ProgramExecutor: Executes the instructions.  
 - ExecutionContextImpl: Maintains program state (variables, labels, instructions activated).  
- instruction  
 - Instruction: Interface for all instruction types.  
 - AbstractInstruction: Common base for instructions.  
 - Synthetic instructions: AssignmentInstruction, DecreaseInstruction, IncreaseInstruction, etc.  
 - Jump instructions: JumpEqualConstantInstruction, JumpNotZeroInstruction, etc.  
- program  
 - Program: Holds the list of instructions and variables, supports expansion.  
 - ProgramImpl: Implementation.  
- history  
 - RunHistoryEntry: Represents a snapshot of the program state after each instruction.  
- label  
 - Label, FixedLabel: Represent labels in the program.  
- xml  
 - XmlLoader: Loads and parses the XML file describing the program.  
 - XmlValidation: Ensures the XML is valid.  
- Variable  
 - Variable, VariableImpl: Represent variable names and values.

# Features

- Load programs from XML files using JAXB.  
- Expand synthetic instructions based on a selected degree (0 = no expansion, full expansion = maximum degree).  
- Execute programs step-by-step and print detailed execution log.  
- Print program after expansion with proper formatting.  
- Display the program state after each instruction.