

# **GIK INSITUTE OF ENGINEERING SCIENCES & TECHNOLOGY**

## **COMPUTER ORGANIZATION & ASSEMBLY LANGUAGE (CE-222E)**

### **Simulator Documentation**



**INSTRUCTOR NAME: PROF DR. GHULAM ABBAS**

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### **GROUP MEMBERS**

- NAQI RAZA (2022574)
- SHAMEER AWAIS (2022428)
- ROOSHAN RIAZ (2022506)
- TAHA JUZAR (2022585)

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## Simulator Dependencies

The simulator is developed using python Tkinter. As such, the simulator requires Tkinter library which can be downloaded and installed on visual studio code Using the link that is given below:  
<https://tkinter.updatestar.com/en>

## Layout

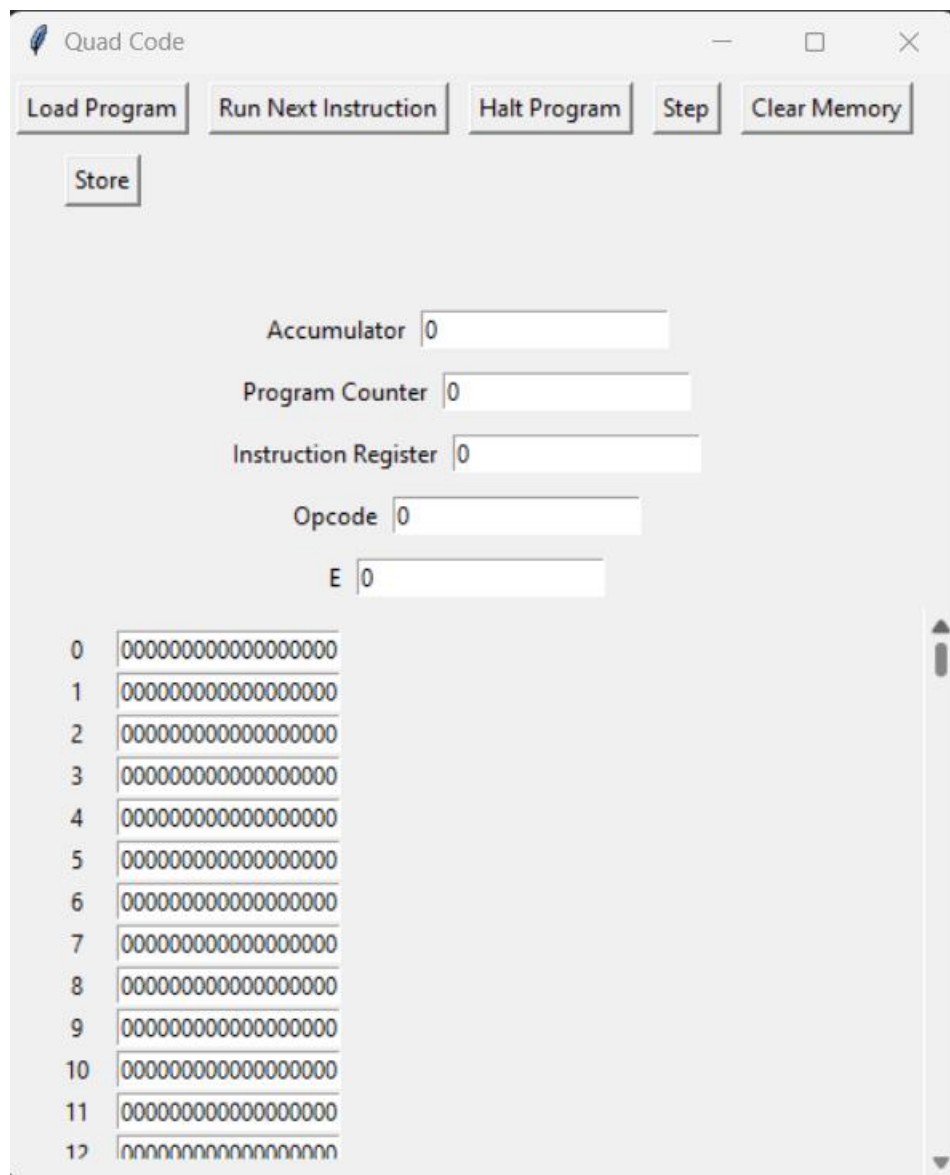


Figure 1: The layout of the simulator

Figure 1 shows the layout of the developed simulator.

## Description of Components

A description of the components is given below.

### The Main Memory:

A representation of the main memory of the computer. Updates whenever a program is loaded, and after each instruction's execution.

### Control Buttons:

These buttons control the computer operations and consist of the following buttons:

- **Load Program From File to Memory:**  
Opens a dialog for the user to select and open a pre-written program from a text file. Automatically loads the instructions to the main memory.
- **Load Written Program to Memory:**  
Loads the program written in 'The Program Input' to the main memory.
- **Step:**  
Executes the instructions sequentially.
- **Run next Instruction:**  
Executes the next instruction.
- **Halt computer and reset:**  
Halts the execution of instructions and resets the computer to the default state.
- **Store the Instructions:**  
The stored instructions represent the program to be executed within the simulator. Storing them allows the simulator to retrieve and execute each instruction in sequence.

## Registers

Registers are shown in the simulator such as Program Counter which points to the next instruction, Accumulator stores the value and Instruction Register holds the current instruction being executed.

## Opcode & E

The opcode that is specified in the instruction is fetched and shown in the opcode box which makes it easier for the program to perform required operations in accordance with opcode. E is for overflow bit. It serves its purpose in Arithmetic and Shift Operations.

## Format for Writing Instructions

### Memory Reference

Memory Reference Instructions are written such that 6 bits specify the opcode and addressing mode, while the remaining 12 bits are reserved for memory addressing.

An example of the

*Load* instruction is as follows:

00XXXX

(A *direct addressing mode load instruction* pointing to location 11 of the main memory)

The screenshot shows the Quad Code emulator window. At the top, there are five buttons: "Load Program", "Run Next Instruction", "Halt Program", "Step", and "Clear Memory". Below these is a "Store" button. The main display area shows the state of the emulator after a "Load AC instruction executed".

Accumulator: 0000000000000011

Program Counter: 1

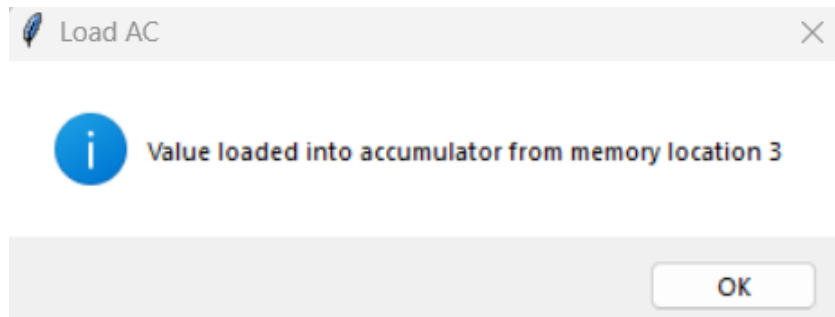
Instruction Register: 0

Opcode: 000000

E: 0

Below the registers is a memory table with 13 rows, indexed 0 to 12. Each row contains a 16-bit binary value:

0	0000000000000011
1	0000000000000000
2	0000000000000000
3	0000000000000011
4	0000000000000000
5	0000000000000000
6	0000000000000000
7	0000000000000000
8	0000000000000000
9	0000000000000000
10	0000000000000000
11	0000000000000000
12	0000000000000000



## Register-Operation Instructions

Register operation instructions are written in the form of HEX CODE:  
Such as F800 for Clear AC

## I/O Instructions

I/O instructions are also written in the form of HEX CODE:  
Such as 1F080 for skipping the input flag.

## Operands

The operands are specified in the memory location and also depend on which type of addressing mode is being used.

## Loading a program to memory

The loading of a program can be accomplished from either a text file input. methods are described below.

### Loading a program from a file

Clicking on the '*Load Program from File to Memory*' button opens a dialog (Figure 2) where the user can select a text file whose contents are loaded to both the textbox and the main memory. Figure 3 shows a loaded program.

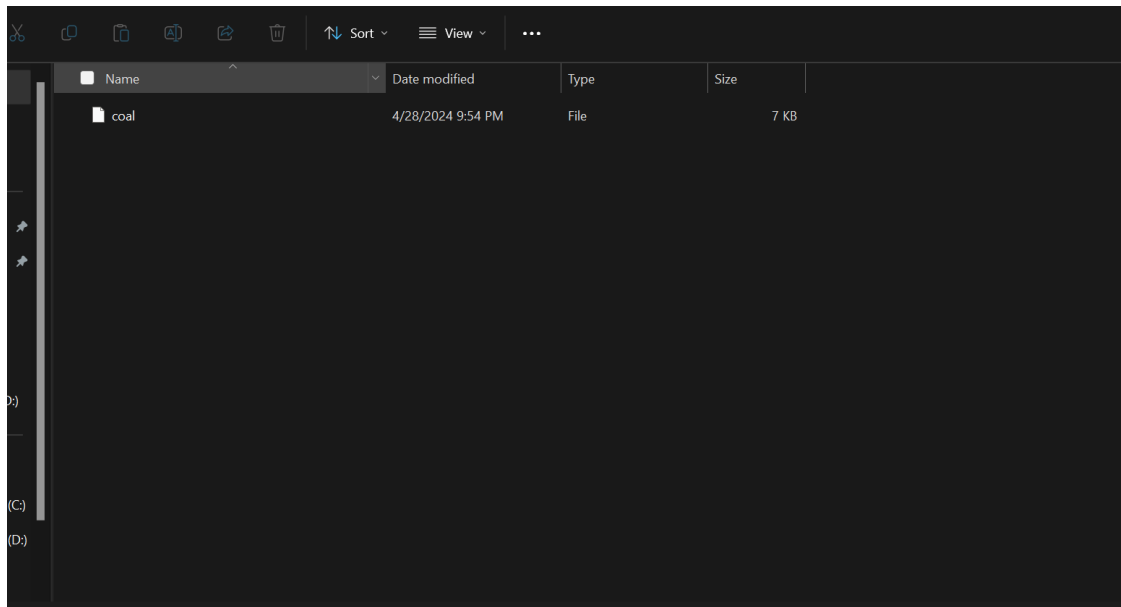


Figure 2: show a test file