# **UVSim Software Requirements Specification**

## **1. Introduction**

This document specifies the software requirements for the UVSim simulator, a basic CPU simulator that executes machine language instructions with support for arithmetic operations, memory management, and input/output.

## **2. Functional Requirements**

### **Memory Management Requirements**

**1:** The system shall maintain exactly 100 memory locations for storing four-digit signed integer words.

**2:** The system shall read values from memory locations using addresses ranging from 0 to 99.

**3:** The system shall write values to memory locations using addresses ranging from 0 to 99.

**4:** The system shall load program instructions from text files into memory.

**5:** The system shall validate that all memory addresses are within the bounds of 0 to 99.

### **CPU Operation Requirements**

**6:** The system shall maintain a program counter that tracks the current instruction address.

**7:** The system shall maintain an accumulator register for arithmetic operations.

**8:** The system shall increment the program counter by one after executing each instruction.

**9:** The system shall decode each instruction into a two-digit opcode and two-digit address.

### **Arithmetic Operation Requirements**

**10:** The system shall perform addition by adding a memory value to the accumulator when opcode 30 is executed.

**11:** The system shall perform subtraction by subtracting a memory value from the accumulator when opcode 31 is executed.

**12:** The system shall perform division by dividing the accumulator by a memory value when opcode 32 is executed.

**13:** The system shall perform multiplication by multiplying the accumulator with a memory value when opcode 33 is executed.

### **Branching Requirements**

**14:** The system shall support unconditional branching to a specified memory address when opcode 40 is executed.

**15:** The system shall support conditional branching when the accumulator is negative and opcode 41 is executed.

**16:** The system shall support conditional branching when the accumulator equals zero and opcode 42 is executed.

## **3. Non-Functional Requirements**

**1:** The system shall execute at least 1000 instructions per second during normal operation.

**2:** The system shall detect and handle division by zero operations by throwing an appropriate exception without crashing.

**3:** The system shall provide clear error messages when invalid file paths or malformed input data are encountered.