# **Software Requirements Specification (SRS) Document for UVSim**

## **1. Introduction**

### **1.1 Purpose**

This document specifies the requirements for the UVSim simulator, a tool designed for computer science students to learn and execute BasicML machine language programs. The document outlines both the functional and non-functional requirements necessary for the development and operation of the UVSim.

### **1.2 Scope**

UVSim is a virtual machine simulator that will allow students to load, execute, and interact with BasicML programs. It features a CPU, an accumulator register, and a 100-word memory. The simulator will interpret BasicML instructions and provide functionalities for I/O operations, load/store operations, arithmetic operations, and control operations.

### **1.3 Definitions, Acronyms, and Abbreviations**

* **BasicML**: Basic Machine Language used by UVSim.
* **CPU**: Central Processing Unit of the simulator.
* **Accumulator**: A special register used for arithmetic operations and storing temporary results.
* **Instruction**: A command in BasicML consisting of an opcode and an operand.
* **Memory**: Storage area of UVSim, comprising 100 words.
* **UI**: User Interface.

### **1.4 Overview**

This document provides a detailed description of the UVSim, including system functionalities. The functional requirements specify what the system should do, while non-functional requirements define system attributes such as performance and usability.

## **2. Overall Description**

### **2.1 Product Perspective**

UVSim is a standalone educational tool intended to run on personal computers and simulate a virtual machine environment for learning BasicML. It will provide a command-line or graphical interface for students to input programs, execute instructions, and view results.

### **2.2 Product Functions**

* Load BasicML programs into memory.
* Execute BasicML instructions.
* Provide real-time feedback and error reporting.
* Support for arithmetic and control operations.
* I/O operations for interaction with the user.

### **2.3 User Characteristics**

The primary users are computer science students and educators. Users should have a basic understanding of basicML concepts but are not expected to have advanced technical skills.

### **2.4 Constraints**

* The system must be able to run on Windows, macOS, and Linux platforms.
* It must handle BasicML instructions efficiently and provide accurate results.
* The memory size is fixed at 100 words.

### **2.5 Assumptions and Dependencies**

* Users have basic familiarity with computer systems and programming concepts.
* The simulator will be used primarily for educational purposes.

## **3. Functional Requirements**

### **3.1 Memory Management**

**FR1**: The system shall initialize with a 100-word memory, each capable of holding a signed four-digit decimal number.

**FR2**: The system shall load a BasicML program into memory starting from location 00.

### **3.2 Instruction Handling**

**FR3**: The system shall interpret the first two digits of a BasicML word as the opcode and the last two digits as the operand.

**FR4**: The system shall execute the READ instruction (opcode 10) to read a word from the keyboard into a specified memory location.

**FR5**: The system shall execute the WRITE instruction (opcode 11) to write a word from a specified memory location to the screen.

**FR6**: The system shall execute the LOAD instruction (opcode 20) to load a word from a specified memory location into the accumulator.

**FR7**: The system shall execute the STORE instruction (opcode 21) to store the word in the accumulator into a specified memory location.

**FR8**: The system shall execute the ADD instruction (opcode 30) to add a word from a specified memory location to the accumulator, handling overflow by wrapping around.

**FR9**: The system shall execute the SUBTRACT instruction (opcode 31) to subtract a word from a specified memory location from the accumulator, handling underflow by wrapping around.

**FR10**: The system shall execute the DIVIDE instruction (opcode 32) to divide the accumulator by a word from a specified memory location, leaving the result in the accumulator.

**FR11**: The system shall execute the MULTIPLY instruction (opcode 33) to multiply the accumulator by a word from a specified memory location, handling overflow by wrapping around.

**FR12**: The system shall execute the BRANCH instruction (opcode 40) to jump to a specified memory location.

**FR13**: The system shall execute the BRANCHNEG instruction (opcode 41) to jump to a specified memory location if the accumulator is negative.

**FR14**: The system shall execute the BRANCHZERO instruction (opcode 42) to jump to a specified memory location if the accumulator is zero.

**FR15**: The system shall execute the HALT instruction (opcode 43) to stop the program execution.

## **4. Non-Functional Requirements**

### **4.1 Performance**

**NFR1**: The system shall execute instructions and respond to user inputs

**4.2 Reliability**

**NFR2**: The system shall provide accurate execution of BasicML instructions

**4.3 Usability**

**NFR3**: The system shall have a user-friendly interface that is easy to navigate and understand, suitable for educational purposes.

## **5. External Interface Requirements**

### **5.1 User Interfaces**

* The system shall provide a command-line interface (CLI) for text-based interactions.
* the system will provide a graphical user interface (GUI) for a more visual interaction.