**COMPUTER SIMULATOR MANUAL**

**Components:**

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| I: Basic Machine | Design and implement the basic machine architecture.  Implement a simple memory  Execute Load and Store instructions  Build initial user interface to simulator |

**Characteristics:**

* Registers
  + 4 General Purpose Registers (GPRs) – each 16 bits in length
    - The four GPRs are numbered 0-3 and are referred to as GPR0 – GPR3
  + 3 Index Registers – 16 bits in length
    - The three IXRs are numbered 0-3 and are referred to as IXR1 – IXR3
  + Program Counter (PC) – 12 bits in length
  + Instruction Register (IR) – 16 bits in length
  + Memory Address Register (MAR) – 16 bits in length
  + Memory Buffer Register (MBR) – 16 bits in length
* Simple Memory
  + 2048 words, expandable to 4096 words
  + Upon powering up the system, all elements of memory are set to zero
  + 16-bit words
  + Word addressable
* GUI
  + Operator’s Console
    - Display for all registers
    - Display for machine status and condition registers
    - Buttons
      * Load
        + Loads user-inputted instruction into memory
      * LD (10x)
        + Loads user-inputted instruction into relevant register
      * Store
        + Stores user-inputted instruction into memory
      * IPL
        + the ROM contents are read into memory and control is transferred to the first instruction of the ROM Loader program. The ROM can be either a file on your computer or just an array of instructions in your program
      * Run
        + Runs the loaded program until finished
      * SS
        + Runs the next instruction of the program
      * St+
        + Stored the value of MBR into MEM[MAR] and iterates the MAR
      * Reset
        + Resets the computer so that memory and all registers are empty.
        + Clears program data, so new program can be loaded
    - Switches (simulated as buttons) to load data into registers, to select displays, and to initiate certain conditions in the machine.
  + Field Engineers Console
    - Command-line interface
    - Displays memory status after each instruction
    - Displays the execution steps of each instruction as it is executed

**Implemented Instructions**:

* Load
  + Load Register (LDR) – 000001
  + Load Register with Address (LDA) - 000011
  + Load Index Register (LXR) - 100001
* Store
  + Store Register (STR) – 000010
  + Store Index Register (STX) – 100010

**Quick Start Guide:**

* Double-click on “main.exe” executable
* Then you have 2 options:
  + Click “IPL” Button
    - Press “Run” button to run entire program
      * “Run” light is turned on until program finishes execution
      * When program is finished executing, “Halt” light will turn on
    - Press “SS” button to run next instruction
      * “Run” light is turned on until instruction finishes execution
      * When instruction is finished executing, “Halt” light will turn on
    - Press “St+”
  + Manually run command
    - Provide user-input instruction at bottom of the GUI
    - Press “Load”, “LD”, or “Store” button
* Press “Reset” button to restart simulator