

# SIMP Processor Simulator Documentation

Computer Organization Project

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## 1 Architecture Overview

The SIMP (Simple Instruction Set Processor) is a 16-register processor with a 48-bit instruction format. Key features include:

- 21 instructions including arithmetic, logical, memory, and control operations
- 4096-line instruction memory (48-bit)
- 4096-line data memory (32-bit)
- Three interrupt sources (timer, disk, external)
- I/O devices: LEDs, 7-segment display, monitor, disk

## 2 Implementation Details

### 2.1 Core Components

- CPU: Implements instruction fetch, decode, and execute cycle
- Memory: Separate instruction and data memory management
- I/O: Device control and interrupt handling
- File I/O: Handles all input/output file operations

### 2.2 Interrupt Handling

- Timer interrupt (IRQ0): Highest priority
- Disk interrupt (IRQ1): Medium priority
- External interrupt (IRQ2): Lowest priority
- No nested interrupts supported

## 3 Test Programs

### 3.1 Matrix Multiplication (mulmat.asm)

Implements multiplication of two 4x4 matrices:

- First matrix: addresses 0x100-0x10F
- Second matrix: addresses 0x110-0x11F
- Result matrix: addresses 0x120-0x12F

### 3.2 Binomial Coefficient (binom.asm)

Recursive implementation of binomial coefficient calculation:

- Input n: address 0x100
- Input k: address 0x101
- Result: address 0x102
- Uses stack for recursive calls

### 3.3 Circle Drawing (circle.asm)

Draws a filled white circle on the monitor:

- Radius: address 0x100
- Center: (128,128)
- Uses distance formula for pixel selection

### 3.4 Disk Test (disktest.asm)

Tests disk operations by moving sector contents:

- Moves contents of sectors 0-7 forward
- Handles disk busy status
- Uses interrupt-driven I/O

## 4 File Format Specifications

### 4.1 Input Files

- imemin.txt: 12 hex digits per line (48-bit instructions)
- dmemin.txt: 8 hex digits per line (32-bit data)
- diskin.txt: 2 hex digits per line (8-bit disk data)
- irq2in.txt: Decimal cycle numbers for IRQ2

## 4.2 Output Files

- dmemout.txt: 8 hex digits per line
- regout.txt: 8 hex digits per line (R2-R15)
- trace.txt: PC, instruction, and register values
- hwregtrace.txt: I/O register access log
- cycles.txt: Total cycle count
- leds.txt: LED states
- display7seg.txt: 7-segment display values
- diskout.txt: Final disk contents
- monitor.txt: Monitor pixel values
- monitor.yuv: Raw monitor output