

Software CPU Design Report

CMPE-220: Systems Software

Team Members

(Team 13)

Charles Im

Jainil Narendrakumar Rana

Mohit Manoj Barade

Shrivaikunth Krishnakumar

Date: November 29, 2025

GitHub Repository

Repository Link:

<https://github.com/JNR-10/software-cpu>

How to Download, Compile, and Run the Program

Note: These instructions are for Linux/Mac

1. Download the Project

```
git clone https://github.com/JNR-10/software-cpu
cd software-cpu
```

2. Install Required Dependencies

WSL:

```
sudo apt-get install -y jq
sudo apt-get install -y dos2unix
```

Mac:

```
brew install jq
brew install dos2unix
```

3. Run the One-Command Demo

```
chmod +x demo.sh
dos2unix ./scripts/*.sh
dos2unix ./demo.sh
./demo.sh
```

Running the demo will:

- Build the entire project
- Run unit tests
- Generate CPU execution traces

-
- Launch the interactive web-based trace viewer
 - Automatically open your browser to visualize CPU execution

4. Manual Build Commands

```
make all          # Build everything
make test        # Run unit tests
make clean       # Clean build artifacts
```

5. Running and Debugging Programs

Assemble a program

```
dos2unix ./bin/software-cpu assemble src/programs/fibonacci.asm build/fib.bin
./bin/software-cpu assemble src/programs/fibonacci.asm build/fib.bin
```

Run a program

```
dos2unix ./bin/software-cpu run build/fib.bin
./bin/software-cpu run build/fib.bin
```

Interactive debugging mode

```
dos2unix ./bin/software-cpu debug build/fib.bin
./bin/software-cpu debug build/fib.bin
```

6. Quick Program Testing

Integration test

```
dos2unix ./scripts/run_general.sh tests/assembly/test_integration.asm
./scripts/run_general.sh tests/assembly/test_integration.asm
```

Fibonacci example

dos2unix ./scripts/run_general.sh src/programs/fibonacci.asm

./scripts/run_general.sh src/programs/fibonacci.asm

Full instruction set test

dos2unix ./scripts/run_general.sh tests/assembly/test_phase4b.asm

./scripts/run_general.sh tests/assembly/test_phase4b.asm

7. Trace Generation and Viewer

Generate execution trace

dos2unix ./scripts/run_general_with_trace.sh src/programs/fibonacci.asm fib_trace.json

./scripts/run_general_with_trace.sh src/programs/fibonacci.asm fib_trace.json

You can view the trace in 2 places:

1. The command line
2. build/traces/programname_time.json

Team Member Contributions

- **Charles Im:** Automation, trace schema, and visualization.
- **Jainil Narendrakumar Rana:** Assembler, emulator (register, memory, ALU, CPU).
- **Mohit Manoj Barade:** ISA implementation, Memory Mapping, Unit tests, and UI.
- **Shrivaikunth Krishnakumar:** CPU Architecture Design, ISA design, assembler definition implementation
- **All helped with debugging, Report writing, and Demo Video Prep**