# Register File

## Description of IO

## Summary of Circuit Functionality

## Writing Data to a Register

## Reading Data from a Register

## Program Counter

# ALU

## Description of IO

## Summary of Circuit Functionality

## Selection of ALU Operation

## Addition of Two Operands

## Subtraction of Two Operands

## AND of Two Operands

## OR of Two Operands

## NOT of Two Operands

## Shift Left Operation

## Shift Right Operation

## Negative Bit Detection

## Zero Result Detection

# Instruction Decode

## Instruction Type Table

## Description of IO

## Summary of Circuit Functionality

## Parsing the 16-bit instruction

## Determining the OpCode

## Determining the Rd output

# Sign Extend

## Description of IO

## Summary of Circuit Functionality

## Branch Multiplexer

# RAM

## Description of IO

## Summary of Circuit Functionality

## Writing to RAM

## Reading from RAM

# ROM

## Description of IO

## Summary of Circuit Functionality

## Reading from ROM

# PSW

## Description of IO

## Summary of Circuit Functionality

## Choosing PSW Register’s Input Data

# Control

## Description of IO

## Summary of Circuit Functionality

## Determining the OpCode

## Determining RegWrite

## Determining MemtoReg

## Determining MemWrite

## Determining ALUOp

## Determining Instruction Type

## Outputting remaining control signals

# Exception Handling

## Detecting a program check violation (PCV)

## Detecting Program Timeout

## Resolving exceptions

# Optimization

## Reworking RegWrite, MemWrite, and MemtoReg Logic

## Calculating RAM Address

## Use of the tunnel object in Logisim

# Appendix

## Final Circuit Overview