

# CISC360 - Project 3

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## Introduction

Project 3 required we expand even further upon our current Gemini implementations.

Part 1: A pipelining architecture within the CPU

- Consists of [Fetch|Decode|eXecute|Store] stages.
- Separate each stage into its own thread

Part 2: Branch prediction;

- Based on past results predict future branching within fetch stage

## Pipelining

The pipelining is separated into 4 running threads. In order to maintain simple cross platform support, making sure not having to mess with compiler flags, I went with the implementation of QThreads provided by the Qt library. Messages to update the GUI utilized the easy to use Qt provided with a SLOT and SIGNAL interface. The hardest part of this whole thing was getting the synchronization between the threads to happen correctly.

## Branch prediction

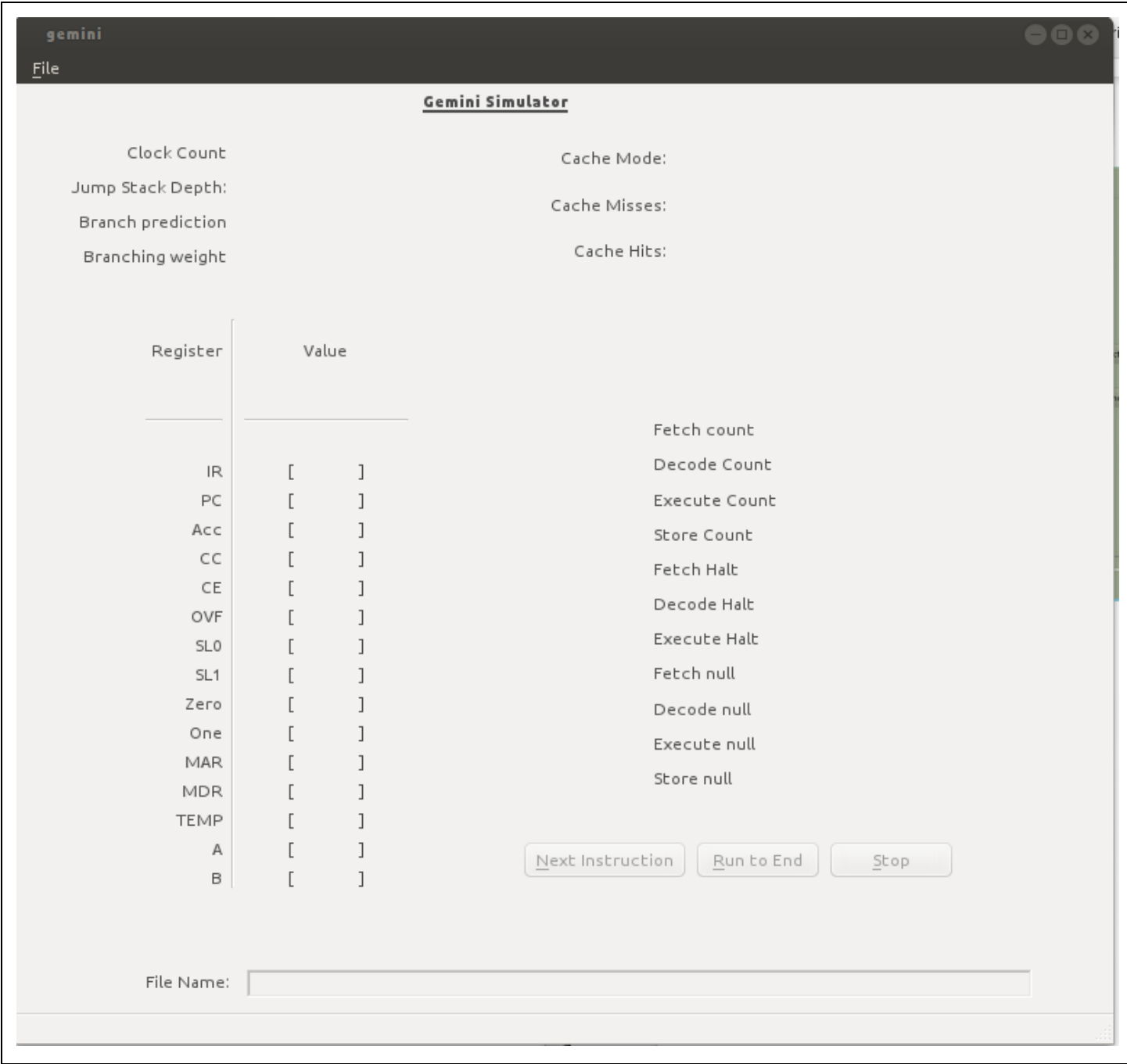
As an enhancement I performed the branch prediction. I do not have any immediate comments on the results of the implementation. The count on the **branch\_ways** var goes +1 for successful branch and -1 for unsuccessful prediction. The prediction portion will then evaluate if **branch\_ways** is less than 0, which it will then use a path taken, or greater than 1 which it will then keep the next instruction.

## GUI Enhancements

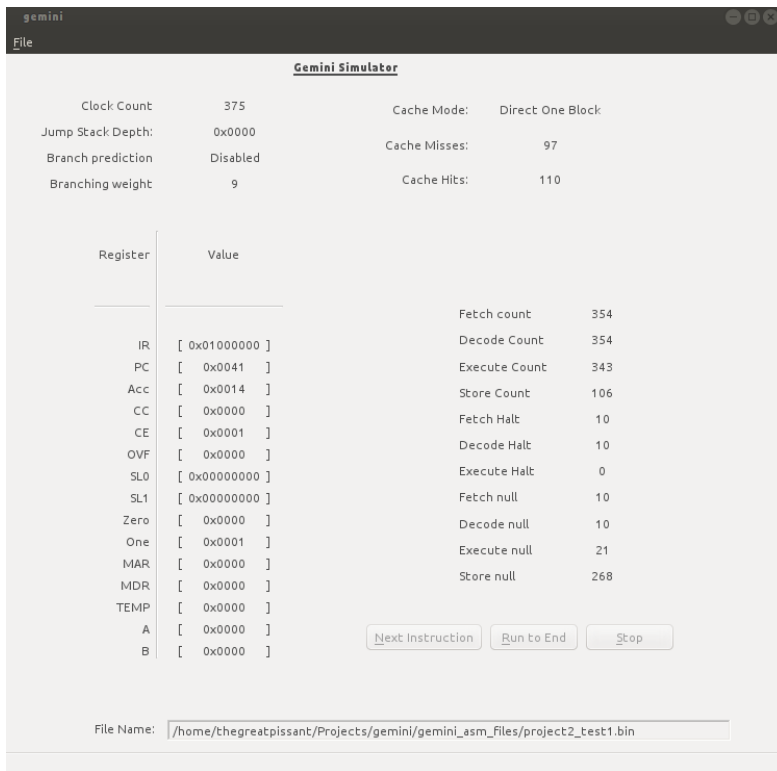
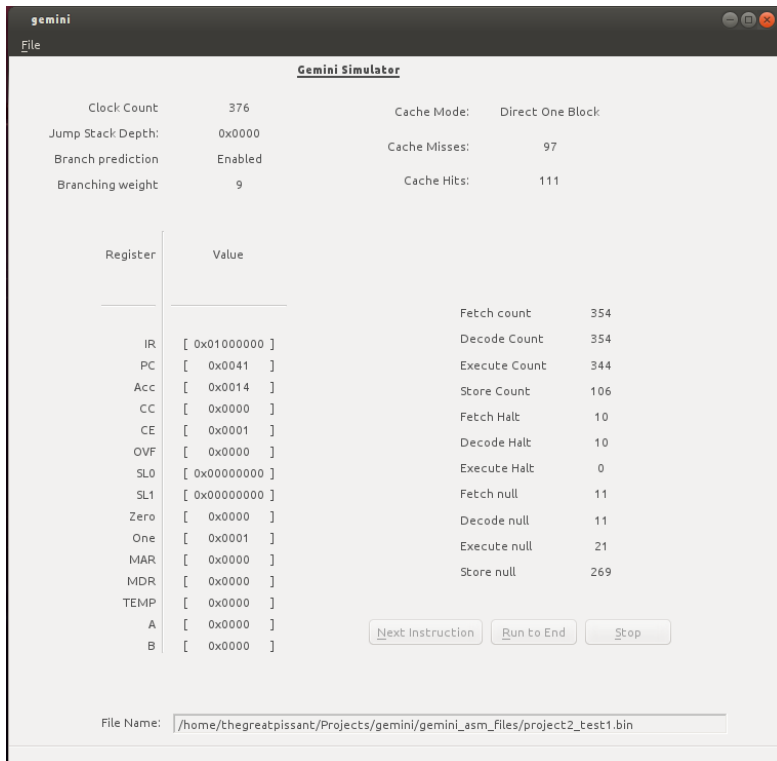
The '**Run to End**' button is now tied to a QTimer object that will emit SIGNALS to the gemini gui for executing the next instruction button. This allows for a stop button as well that will stop execution of the timer and allow for the user to restart at any time.

Counts have been added to show each stage execution count, halt count, and null (nop) count.

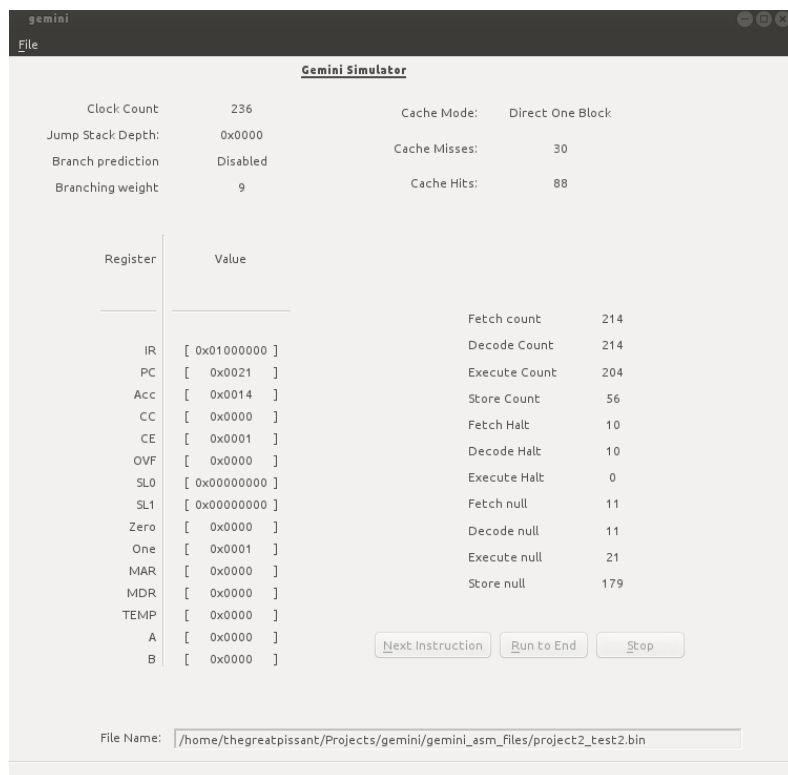
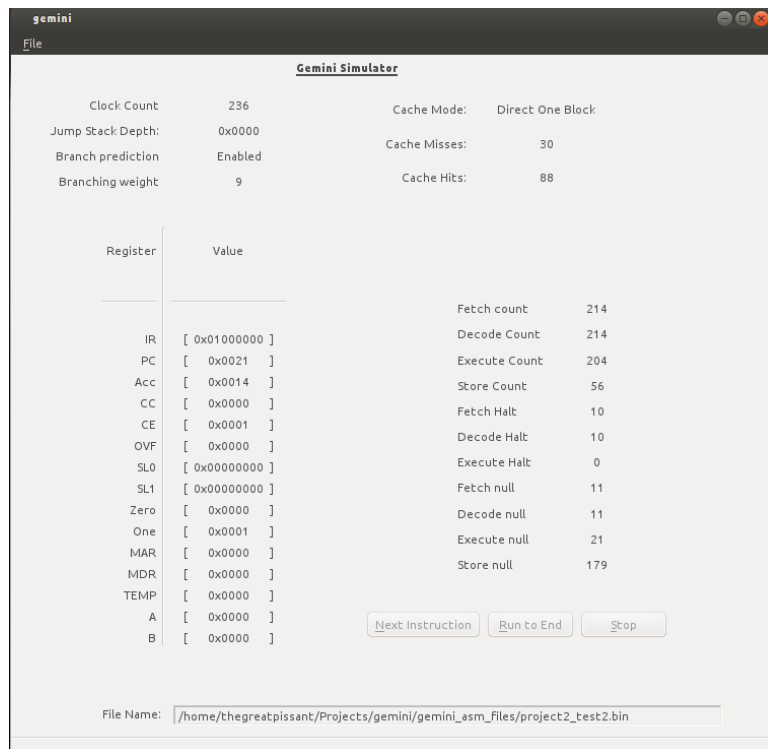
# Gemini simulator update GUI



### Project2\_test1.s 4 Branch Prediction runs



### Project2\_test2.s 4 Branch Prediction runs



## Test\_1.s 4 Branch Prediction runs

gemi  
File

**Gemini Simulator**

Clock Count	288	Cache Mode:	Direct One Block
Jump Stack Depth:	0x0000	Cache Misses:	8
Branch prediction	Enabled	Cache Hits:	146
Branching weight	9		

Register	Value
IR	[ 0x00000000 ]
PC	[ 0x002a ]
Acc	[ 0xffff6 ]
CC	[ 0x0001 ]
CE	[ 0x0000 ]
OVF	[ 0x0000 ]
SL0	[ 0x00000000 ]
SL1	[ 0x00000000 ]
Zero	[ 0x0000 ]
One	[ 0x0001 ]
MAR	[ 0x0000 ]
MDR	[ 0x0000 ]
TEMP	[ 0x0000 ]
A	[ 0x0000 ]
B	[ 0x0000 ]

Fetch count	229
Decode Count	229
Execute Count	217
Store Count	48
Fetch Halt	57
Decode Halt	57
Execute Halt	0
Fetch null	1
Decode null	1
Execute null	14
Store null	239

Next Instruction Run to End Stop

File Name: /home/cheatpissant/Projects/gemini/gemini\_asm\_files/Test\_1.bin

gemi  
File

**Gemini Simulator**

Clock Count	289	Cache Mode:	Direct One Block
Jump Stack Depth:	0x0000	Cache Misses:	8
Branch prediction	Disabled	Cache Hits:	146
Branching weight	9		

Register	Value
IR	[ 0x00000000 ]
PC	[ 0x002a ]
Acc	[ 0xffff6 ]
CC	[ 0x0001 ]
CE	[ 0x0000 ]
OVF	[ 0x0000 ]
SL0	[ 0x00000000 ]
SL1	[ 0x00000000 ]
Zero	[ 0x0000 ]
One	[ 0x0001 ]
MAR	[ 0x0000 ]
MDR	[ 0x0000 ]
TEMP	[ 0x0000 ]
A	[ 0x0000 ]
B	[ 0x0000 ]

Fetch count	229
Decode Count	229
Execute Count	218
Store Count	49
Fetch Halt	57
Decode Halt	57
Execute Halt	0
Fetch null	2
Decode null	2
Execute null	14
Store null	239

Next Instruction Run to End Stop

File Name: /home/cheatpissant/Projects/gemini/gemini\_asm\_files/Test\_1.bin

sethi\_sethl.s runs

geminigeminigemini

File

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