



Computer Architecture

Project (1)

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Testbench Idea:

Code in MIPS assembly:

```
lw $t0, 0($zero)          //t0=16
lw $t1, 4($zero)           //t1=5
add $t2, $t1, $t0          //t2=21
sub $t2, $t2, $t0          //t2=5
sw $t2, 0($zero)           //data_mem[0:3]=5
beq $t2, $t2, 4             // if(t2==t2) go to 4

1; nop
2; nop
3; nop
4; add $t1, $t1, $t1        //t1=10
```

The code tried to include all of the functions needed without much dependency on each other because of debugging issues

Data Memory before Function

Add[0]	0	0	0	16
Add[1]	0	0	0	5

Testbench Outcome:

KERNEL: Time: 0, PC: 00000000, instruction: 8c080000, \$t0: 0, \$t1: 0, \$t2: 0, Mem[0:3]: 16, Mem[4:7]: 5

KERNEL: Time: 20000, PC: 00000004, instruction: 8c090004, \$t0: 16, \$t1: 0, \$t2: 0, Mem[0:3]: 16, Mem[4:7]: 5

KERNEL: Time: 40000, PC: 00000008, instruction: 01285020, \$t0: 16, \$t1: 5, \$t2: 0, Mem[0:3]: 16, Mem[4:7]: 5

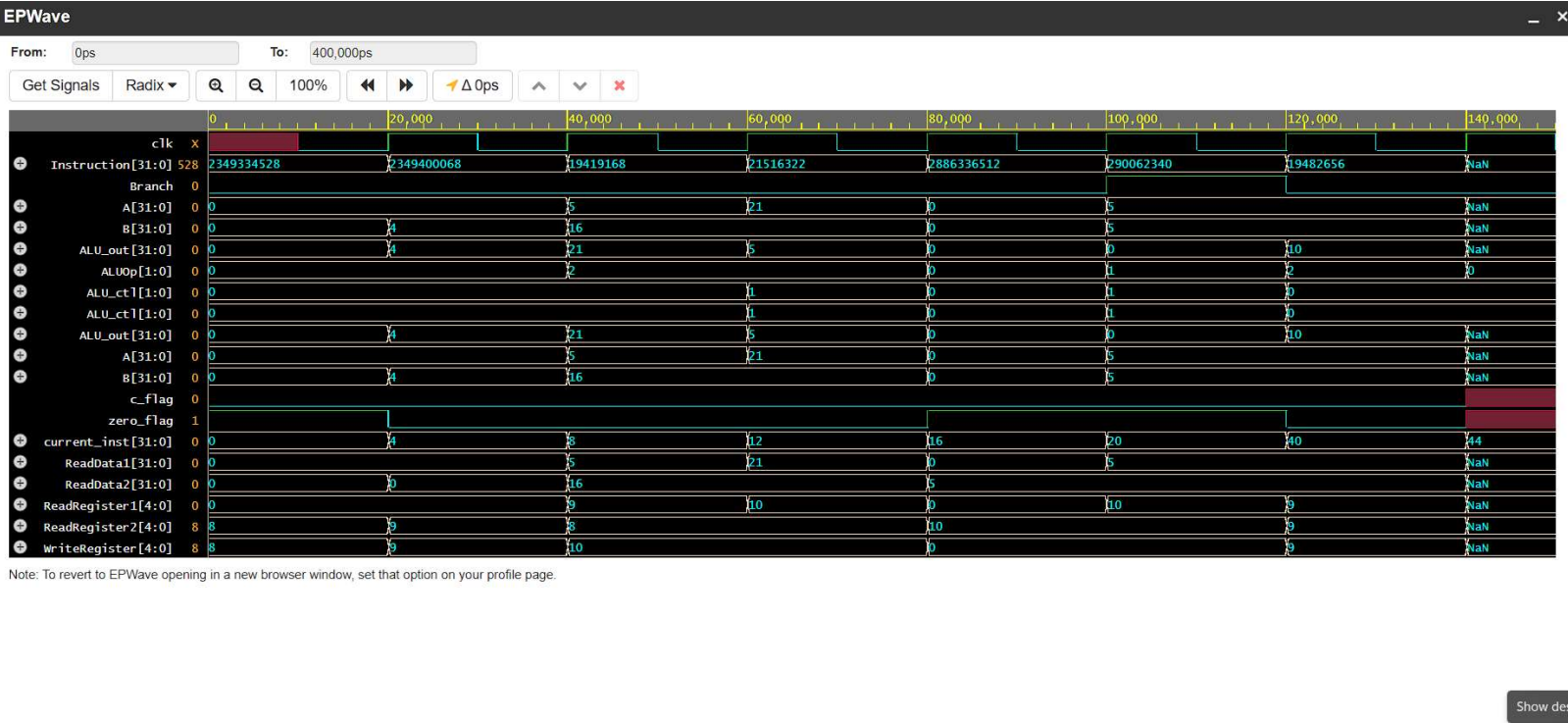
KERNEL: Time: 60000, PC: 0000000c, instruction: 01485022, \$t0: 16, \$t1: 5, \$t2: 21, Mem[0:3]: 16, Mem[4:7]: 5

KERNEL: Time: 80000, PC: 00000010, instruction: ac0a0000, \$t0: 16, \$t1: 5, \$t2: 5, Mem[0:3]: 5, Mem[4:7]: 5

KERNEL: Time: 100000, PC: 00000014, instruction: 114a0004, \$t0: 16, \$t1: 5, \$t2: 5, Mem[0:3]: 5, Mem[4:7]: 5

KERNEL: Time: 120000, PC: 00000028, instruction: 01294820, \$t0: 16, \$t1: 5, \$t2: 5, Mem[0:3]: 5, Mem[4:7]: 5

Testbench Outcome:



Data Memory After Function

Add[0]	0	0	0	5
Add[1]	0	0	0	5

APPENDIX:

Decoded to HEX:

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lw → 35
sw → 43
add → 0
sub → 0
beg → 4

100011 0000 01000 00 0
0x8C 0x08 0x00 0x00
0x8D 0x00 0x00 0x00

lw \$t1, 4(\$zero)

35 0 9 4

100011 0000 01000 00 0
0x8C 0x09 0x00 0x04
0x8D 0x00 0x00 0x04

add \$t2, \$t0, \$t1

0 8 3 10 0 32

0000 00 0100 0100 01010 0000 100000

0x01 0x09 0x50 0x20

sub \$t2, \$t2, \$t0

0 10 8 10 0 34

0000 00 01010 0100 0100 0000 100000

0x01 0x48 0x50 0x22

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sw \$t2, 0(\$zero)

43 0 10 0

101 01 00 00 0100 000000
0xAC 0x0A 0x00 0x00
0xAD 0x40 0x00 0x00

beg \$t2, \$t2, 4

4 10 10 4

00 0100 01010 01010 0 0100

0x11 0x4A 0x00 0x04

add \$t1, \$t1, \$t1

0 2 9 9 0 22

0000 00 01001 01001 01010 0000 10 0000

0x01 0x29 0x45 0x20

Data Memory:

DATE

0	0	0	0	16 ₁₆	= 16
4	0	0	0	5 ₁₆	=

↓ after funct

0	0	0	0	5	
4	0	0	0	5	