# VE370 Project 2

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July 14, 2021

## 1 Objective

This project aims at writing a pipiline stage processor of Risc-V in Verilog.

## 2 Tested Code

```
00100093        //  addi    x1  x0  1
00200113        //  addi    x2  x0  2
00300193        //  addi    x3  x0  3
00400213        //  addi    x4  x0  4
002080b3        //  add x1  x1  x2
003080b3        //  add x1  x1  x3
004080b3        //  add x1  x1  x4
00500293        //  addi    x5  x0  5
00600313        //  addi    x6  x0  6
00700393        //  addi    x7  x0  7
00800413        //  addi    x8  x0  8
00900493        //  addi    x9  x0  9
00a00513        //  addi    x10 x0  10
00b00593        //  addi    x11 x0  11
00c00613        //  addi    x12 x0  12
00d00693        //  addi    x13 x0  13
00e00713        //  addi    x14 x0  14
00f00793        //  addi    x15 x0  15
01000813        //  addi    x16 x0  16
01100893        //  addi    x17 x0  17
01200913        //  addi    x18 x0  18
01300993        //  addi    x19 x0  19
01400a13        //  addi    x20 x0  20
01500a93        //  addi    x21 x0  21
01600b13        //  addi    x22 x0  22
01700b93        //  addi    x23 x0  23
407302b3        //  sub x5  x6  x7
0062ffb3        //  and x31 x5  x6
0055e533        //  or  x10 x11 x5
fff37f13        //  andi    x30 x6  4095
0045a023        //  sw  x4  0(x11)
```

```
0005a603          //  lw   x12 0(x11)
00760833          //  add  x16 x12 x7
00b82023          //  sw   x11 0(x16)
00082903          //  lw   x18 0(x16)
007908b3          //  add  x17 x18 x7
0049a223          //  sw   x4  4(x19)
00000013          //  nop
00000013          //  nop
0049aa03          //  lw   x20 4(x19)
014ba223          //  sw   x20 4(x23)
00000013          //  nop
00000013          //  nop
004bad83          //  lw   x27 4(x23)
004baa83          //  lw   x21 4(x23)
013aa223          //  sw   x19 4(x21)
004aac83          //  lw   x25 4(x21)
017b0c33          //  add  x24 x22 x23
00000013          //  nop
00000013          //  nop
```

## 3 Results

```
close_sim
INFO: [Simtcl 6-16] Simulation closed
launch_simulation
INFO: [Vivado 12-5682] Launching behavioral simulation in 'D:/
   Study/SJTU/Junior/2021SU/VE370/Project/p2/Group_impl/
   Group_impl.sim/sim_1/behav/xsim'
INFO: [SIM-utils-51] Simulation object is 'sim_1'
INFO: [SIM-utils-54] Inspecting design source files for '
   testbench' in fileset 'sim_1'...
INFO: [USF-XSim-97] Finding global include files...
INFO: [USF-XSim-100] Fetching design files from 'sources_1'...(
   this may take a while)...
INFO: [USF-XSim-101] Fetching design files from 'sim_1'...
INFO: [USF-XSim-2] XSim::Compile design
INFO: [USF-XSim-61] Executing 'COMPILE and ANALYZE' step in 'D:/
   Study/SJTU/Junior/2021SU/VE370/Project/p2/Group_impl/
   Group_impl.sim/sim_1/behav/xsim'
"xvlog --incr --relax -prj testbench_vlog.prj"
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/EX_MEM.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module EX_MEM
INFO: [VRFC 10-311] analyzing module EX_MEM_control
INFO: [VRFC 10-311] analyzing module EX_MEM_imme
INFO: [VRFC 10-311] analyzing module EX_MEM_pc
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/ForwardingUnit.v"
```

```
   into library xil_defaultlib
INFO: [VRFC 10-311] analyzing module ForwardingUnit
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/ID_EX.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module ID_EX
INFO: [VRFC 10-311] analyzing module ID_EX_control
INFO: [VRFC 10-311] analyzing module ID_EX_imme
INFO: [VRFC 10-311] analyzing module ID_EX_pc
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/IF_ID.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module IF_ID
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/MEM_WB.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module MEM_WB
INFO: [VRFC 10-311] analyzing module MEM_WB_control
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/alu.v" into library
   xil_defaultlib
INFO: [VRFC 10-311] analyzing module alu
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/alu_control.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module alu_control
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/control.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module control
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/data_memory.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module data_memory
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/
   HazardControlDetection.v" into library xil_defaultlib
INFO: [VRFC 10-311] analyzing module hazardControlDetection
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/
   immediate_generator.v" into library xil_defaultlib
INFO: [VRFC 10-311] analyzing module immediate_generator
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/instru_memory.v"
   into library xil_defaultlib
INFO: [VRFC 10-311] analyzing module instru_memory
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/register.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module register
```

```
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/next_pc.v" into
   library xil_defaultlib
INFO: [VRFC 10-311] analyzing module next_pc
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/program_counter.v"
   into library xil_defaultlib
INFO: [VRFC 10-311] analyzing module program_counter
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/mux.v" into library
   xil_defaultlib
INFO: [VRFC 10-311] analyzing module one_64bit_mux
INFO: [VRFC 10-311] analyzing module two_64bit_mux
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/group/src/main.v" into library
    xil_defaultlib
INFO: [VRFC 10-311] analyzing module alu_control
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'alu_control' [D:/Study/SJTU/Junior/2021SU/VE370/
   Project/p2/group/src/alu_control.v:3]
INFO: [VRFC 10-311] analyzing module alu
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'alu' [D:/Study/SJTU/Junior/2021SU/VE370/Project/p2/
   group/src/alu.v:3]
INFO: [VRFC 10-311] analyzing module control
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'control' [D:/Study/SJTU/Junior/2021SU/VE370/Project/
   p2/group/src/control.v:3]
INFO: [VRFC 10-311] analyzing module data_memory
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'data_memory' [D:/Study/SJTU/Junior/2021SU/VE370/
   Project/p2/group/src/data_memory.v:3]
INFO: [VRFC 10-311] analyzing module immediate_generator
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'immediate_generator' [D:/Study/SJTU/Junior/2021SU/
   VE370/Project/p2/group/src/immediate_generator.v:3]
INFO: [VRFC 10-311] analyzing module instru_memory
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'instru_memory' [D:/Study/SJTU/Junior/2021SU/VE370/
   Project/p2/group/src/instru_memory.v:3]
INFO: [VRFC 10-311] analyzing module next_pc
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'next_pc' [D:/Study/SJTU/Junior/2021SU/VE370/Project/
   p2/group/src/next_pc.v:3]
INFO: [VRFC 10-311] analyzing module program_counter
WARNING: [VRFC 10-3609] overwriting previous definition of
   module 'program_counter' [D:/Study/SJTU/Junior/2021SU/VE370/
   Project/p2/group/src/program_counter.v:3]
INFO: [VRFC 10-311] analyzing module register
WARNING: [VRFC 10-3609] overwriting previous definition of
```

```
    module 'register' [D:/Study/SJTU/Junior/2021SU/VE370/Project/
    p2/group/src/register.v:3]
INFO: [VRFC 10-311] analyzing module IF_ID
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'IF_ID' [D:/Study/SJTU/Junior/2021SU/VE370/Project/p2/
    group/src/IF_ID.v:3]
INFO: [VRFC 10-311] analyzing module ID_EX
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'ID_EX' [D:/Study/SJTU/Junior/2021SU/VE370/Project/p2/
    group/src/ID_EX.v:3]
INFO: [VRFC 10-311] analyzing module ID_EX_control
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'ID_EX_control' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/ID_EX.v:51]
INFO: [VRFC 10-311] analyzing module ID_EX_imme
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'ID_EX_imme' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/ID_EX.v:110]
INFO: [VRFC 10-311] analyzing module ID_EX_pc
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'ID_EX_pc' [D:/Study/SJTU/Junior/2021SU/VE370/Project/
    p2/group/src/ID_EX.v:138]
INFO: [VRFC 10-311] analyzing module EX_MEM
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'EX_MEM' [D:/Study/SJTU/Junior/2021SU/VE370/Project/p2
    /group/src/EX_MEM.v:3]
INFO: [VRFC 10-311] analyzing module EX_MEM_control
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'EX_MEM_control' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/EX_MEM.v:44]
INFO: [VRFC 10-311] analyzing module EX_MEM_imme
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'EX_MEM_imme' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/EX_MEM.v:83]
INFO: [VRFC 10-311] analyzing module EX_MEM_pc
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'EX_MEM_pc' [D:/Study/SJTU/Junior/2021SU/VE370/Project
    /p2/group/src/EX_MEM.v:101]
INFO: [VRFC 10-311] analyzing module MEM_WB
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'MEM_WB' [D:/Study/SJTU/Junior/2021SU/VE370/Project/p2
    /group/src/MEM_WB.v:3]
INFO: [VRFC 10-311] analyzing module MEM_WB_control
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'MEM_WB_control' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/MEM_WB.v:30]
INFO: [VRFC 10-311] analyzing module one_64bit_mux
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'one_64bit_mux' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/mux.v:3]
```

```
INFO: [VRFC 10-311] analyzing module two_64bit_mux
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'two_64bit_mux' [D:/Study/SJTU/Junior/2021SU/VE370/
    Project/p2/group/src/mux.v:25]
INFO: [VRFC 10-311] analyzing module main
INFO: [VRFC 10-2263] Analyzing Verilog file "D:/Study/SJTU/
    Junior/2021SU/VE370/Project/p2/group/src/testbench.v" into
    library xil_defaultlib
INFO: [VRFC 10-311] analyzing module alu_control
INFO: [VRFC 10-311] analyzing module alu
INFO: [VRFC 10-311] analyzing module control
INFO: [VRFC 10-311] analyzing module data_memory
INFO: [VRFC 10-311] analyzing module immediate_generator
INFO: [VRFC 10-311] analyzing module instru_memory
INFO: [VRFC 10-311] analyzing module next_pc
INFO: [VRFC 10-311] analyzing module program_counter
INFO: [VRFC 10-311] analyzing module register
INFO: [VRFC 10-311] analyzing module IF_ID
INFO: [VRFC 10-311] analyzing module ID_EX
INFO: [VRFC 10-311] analyzing module ID_EX_control
INFO: [VRFC 10-311] analyzing module ID_EX_imme
INFO: [VRFC 10-311] analyzing module ID_EX_pc
INFO: [VRFC 10-311] analyzing module EX_MEM
INFO: [VRFC 10-311] analyzing module EX_MEM_control
INFO: [VRFC 10-311] analyzing module EX_MEM_imme
INFO: [VRFC 10-311] analyzing module EX_MEM_pc
INFO: [VRFC 10-311] analyzing module MEM_WB
INFO: [VRFC 10-311] analyzing module MEM_WB_control
INFO: [VRFC 10-311] analyzing module one_64bit_mux
INFO: [VRFC 10-311] analyzing module two_64bit_mux
INFO: [VRFC 10-311] analyzing module main
WARNING: [VRFC 10-3609] overwriting previous definition of
    module 'main' [D:/Study/SJTU/Junior/2021SU/VE370/Project/p2/
    group/src/main.v:18]
INFO: [VRFC 10-311] analyzing module testbench
run_program: Time (s): cpu = 00:00:00 ; elapsed = 00:00:05 .
    Memory (MB): peak = 1844.254 ; gain = 0.000
INFO: [USF-XSim-69] 'compile' step finished in '5' seconds
INFO: [USF-XSim-3] XSim::Elaborate design
INFO: [USF-XSim-61] Executing 'ELABORATE' step in 'D:/Study/SJTU
    /Junior/2021SU/VE370/Project/p2/Group_impl/Group_impl.sim/
    sim_1/behav/xsim'
"xelab -wto 4debe8d2cc774e4f82b6b4a336ea92a6 --incr --debug
    typical --relax --mt 2 -L xil_defaultlib -L unisims_ver -L
    unimacro_ver -L secureip --snapshot testbench_behav x
    il_defaultlib.testbench xil_defaultlib.glbl -log
    elaborate.log"
Vivado Simulator 2019.1
Copyright 1986-1999, 2001-2019 Xilinx, Inc. All Rights Reserved.
Running: E:/Softwares/Xilinx/Vivado/2019.1/bin/unwrapped/win64.o
```

```
   /xelab.exe -wto 4debe8d2cc774e4f82b6b4a336ea92a6 --incr --
   debug typical --relax --mt 2 -L xil_defaultlib -L unisims_ver
    -L unimacro_ver -L secureip --snapshot testbench_behav x
   il_defaultlib.testbench xil_defaultlib.glbl -log
   elaborate.log
Using 2 slave threads.
Starting static elaboration
Completed static elaboration
Starting simulation data flow analysis
Completed simulation data flow analysis
Time Resolution for simulation is 1ps
Compiling module xil_defaultlib.program_counter
Compiling module xil_defaultlib.instru_memory
Compiling module xil_defaultlib.IF_ID
Compiling module xil_defaultlib.control
Compiling module xil_defaultlib.alu_control
Compiling module xil_defaultlib.ID_EX_control
Compiling module xil_defaultlib.immediate_generator
Compiling module xil_defaultlib.ID_EX_imme
Compiling module xil_defaultlib.register
Compiling module xil_defaultlib.ID_EX
Compiling module xil_defaultlib.ID_EX_pc
Compiling module xil_defaultlib.two_64bit_mux
Compiling module xil_defaultlib.ForwardingUnit
Compiling module xil_defaultlib.alu
Compiling module xil_defaultlib.EX_MEM
Compiling module xil_defaultlib.EX_MEM_control
Compiling module xil_defaultlib.EX_MEM_imme
Compiling module xil_defaultlib.EX_MEM_pc
Compiling module xil_defaultlib.next_pc
Compiling module xil_defaultlib.one_64bit_mux
Compiling module xil_defaultlib.data_memory
Compiling module xil_defaultlib.MEM_WB
Compiling module xil_defaultlib.MEM_WB_control
Compiling module xil_defaultlib.hazardControlDetection
Compiling module xil_defaultlib.main
Compiling module xil_defaultlib.testbench
Compiling module xil_defaultlib.glbl
Built simulation snapshot testbench_behav
INFO: [USF-XSim-69] 'elaborate' step finished in '3' seconds
INFO: [USF-XSim-4] XSim::Simulate design
INFO: [USF-XSim-61] Executing 'SIMULATE' step in 'D:/Study/SJTU/
   Junior/2021SU/VE370/Project/p2/Group_impl/Group_impl.sim/
   sim_1/behav/xsim'
INFO: [USF-XSim-98] *** Running xsim
   with args "testbench_behav -key {Behavioral:sim_1:Functional:
      testbench} -tclbatch {testbench.tcl} -log {simulate.log}"
INFO: [USF-XSim-8] Loading simulator feature
Vivado Simulator 2019.1
Time resolution is 1 ps
```

```
source testbench.tcl
# set curr_wave [current_wave_config]
# if { [string length $curr_wave] == 0 } {
#   if { [llength [get_objects]] > 0} {
#     add_wave /
#     set_property needs_save false [current_wave_config]
#   } else {
#      send_msg_id Add_Wave-1 WARNING "No top level signals
    found. Simulator will start without a wave window. If you
    want to open a wave window go to 'File->New Waveform
    Configuration' or type 'create_wave_config' in the TCL
    console."
#   }
# }
# run 1000ns
instruction = 0x00000013
```

---

```
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00100093
```

---

```
Time:              0, CLK = 1, PC = 0x00000000
[x0] = 0x0000000000000000
[x1] = 0x0000000000000000
[x2] = 0x0000000000000000
[x3] = 0x0000000000000000
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
```

```
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000001
instruction = 0x00200113
```

---

```
Time:              20, CLK = 1, PC = 0x00000004
[x0] = 0x0000000000000000
[x1] = 0x0000000000000000
[x2] = 0x0000000000000000
[x3] = 0x0000000000000000
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000002
instruction = 0x00300193
```

---

```
Time:              40, CLK = 1, PC = 0x00000008
[x0] = 0x0000000000000000
[x1] = 0x0000000000000000
[x2] = 0x0000000000000000
[x3] = 0x0000000000000000
```

```
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000003
instruction = 0x00400213
--------------------------------------------------------------------------------
Time:              60, CLK = 1, PC = 0x0000000c
[x0] = 0x0000000000000000
[x1] = 0x0000000000000000
[x2] = 0x0000000000000000
[x3] = 0x0000000000000000
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
```

```
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x002080b3
--------------------------------------------------------------------------------
Time:              80, CLK = 1, PC = 0x00000010
[x0] = 0x0000000000000000
[x1] = 0x0000000000000001
[x2] = 0x0000000000000000
[x3] = 0x0000000000000000
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
```

```
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x003080b3
```

---

```
Time:           100, CLK = 1, PC = 0x00000014
[x0] = 0x0000000000000000
[x1] = 0x0000000000000001
[x2] = 0x0000000000000002
[x3] = 0x0000000000000000
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x004080b3
```

---

```
Time:           120, CLK = 1, PC = 0x00000018
[x0] = 0x0000000000000000
[x1] = 0x0000000000000001
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000000
[x5] = 0x0000000000000000
```

```
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00500293
--------------------------------------------------------------------------------
Time:            140, CLK = 1, PC = 0x0000001c
[x0] = 0x0000000000000000
[x1] = 0x0000000000000001
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
```

```
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000005
instruction = 0x00600313
```

---

```
Time:            160, CLK = 1, PC = 0x00000020
[x0] = 0x0000000000000000
[x1] = 0x0000000000000003
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
```

```
ALUcontrol: 0x2
immediate: 0x0000000000000006
instruction = 0x00700393
```

---

```
Time:            180, CLK = 1, PC = 0x00000024
[x0] = 0x0000000000000000
[x1] = 0x0000000000000006
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000007
instruction = 0x00800413
```

---

```
Time:            200, CLK = 1, PC = 0x00000028
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000000
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
```

```
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000008
instruction = 0x00900493
--------------------------------------------------------------------------------
Time:            220, CLK = 1, PC = 0x0000002c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000000
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
```

```
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000009
instruction = 0x00a00513
```

---

```
Time:            240, CLK = 1, PC = 0x00000030
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000000
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x000000000000000a
```

```
instruction = 0x00b00593
--------------------------------------------------------------------------------
Time:           260, CLK = 1, PC = 0x00000034
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000000
[x9] = 0x0000000000000000
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x000000000000000b
instruction = 0x00c00613
--------------------------------------------------------------------------------
Time:           280, CLK = 1, PC = 0x00000038
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000000
```

```
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x000000000000000c
instruction = 0x00d00693
```

---

```
Time:            300, CLK = 1, PC = 0x0000003c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x0000000000000000
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
```

```
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x000000000000000d
instruction = 0x00e00713
-----------------------------------------------------------------
Time:            320, CLK = 1, PC = 0x00000040
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x0000000000000000
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x000000000000000e
instruction = 0x00f00793
-----------------------------------------------------------------
```

```
Time:            340, CLK = 1, PC = 0x00000044
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x0000000000000000
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x000000000000000f
instruction = 0x01000813
-----------------------------------------------------------------
Time:            360, CLK = 1, PC = 0x00000048
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
```

```
[x12] = 0x000000000000000c
[x13] = 0x0000000000000000
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000010
instruction = 0x01100893
--------------------------------------------------------------------------------
Time:            380, CLK = 1, PC = 0x0000004c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x0000000000000000
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
```

```
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000011
instruction = 0x01200913
```

---

```
Time:           400, CLK = 1, PC = 0x00000050
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x0000000000000000
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000012
instruction = 0x01300993
```

---

```
Time:           420, CLK = 1, PC = 0x00000054
[x0] = 0x0000000000000000
```

```
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000000
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000013
instruction = 0x01400a13
--------------------------------------------------------------------------------
Time:            440, CLK = 1, PC = 0x00000058
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
```

```
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000000
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000014
instruction = 0x01500a93
--------------------------------------------------------------------------------
Time:            460, CLK = 1, PC = 0x0000005c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000000
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
```

```
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000015
instruction = 0x01600b13
--------------------------------------------------------------------------------
Time:           480, CLK = 1, PC = 0x00000060
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000000
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000016
instruction = 0x01700b93
--------------------------------------------------------------------------------
Time:           500, CLK = 1, PC = 0x00000064
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
```

```
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000000
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000017
instruction = 0x407302b3
--------------------------------------------------------------------------------
Time:            520, CLK = 1, PC = 0x00000068
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
```

```
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000000
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x6
immediate: 0x0000000000000000
instruction = 0x0062ffb3
--------------------------------------------------------------------------------
Time:            540, CLK = 1, PC = 0x0000006c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000000
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
```

```
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x0
immediate: 0x0000000000000000
instruction = 0x0055e533
```

---

```
Time:           560, CLK = 1, PC = 0x00000070
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000000
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x1
immediate: 0x0000000000000000
instruction = 0xfff37f13
```

---

```
Time:           580, CLK = 1, PC = 0x00000074
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
```

```
[x5] = 0x0000000000000005
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x0
immediate: 0xffffffffffffffff
instruction = 0x0045a023
--------------------------------------------------------------------------------
Time:            600, CLK = 1, PC = 0x00000078
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
```

```
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000000
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x0005a603
--------------------------------------------------------------------------------
Time:            620, CLK = 1, PC = 0x0000007c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0x000000000000000a
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
```

```
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00760833
--------------------------------------------------------------------------------
Time:            640, CLK = 1, PC = 0x00000080
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000000
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00b82023
--------------------------------------------------------------------------------
Time:            660, CLK = 1, PC = 0x00000084
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
```

```
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
--------------------------------------------------------------------------------
Time:            680, CLK = 1, PC = 0x00000084
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x000000000000000c
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
```

```
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00082903
--------------------------------------------------------------------------------
Time:            700, CLK = 1, PC = 0x00000088
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
```

```
instruction = 0x007908b3
--------------------------------------------------------------------------------
Time:           720, CLK = 1, PC = 0x0000008c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x0000000000000010
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x0049a223
--------------------------------------------------------------------------------
Time:           740, CLK = 1, PC = 0x00000090
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
```

```
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
--------------------------------------------------------------------------------
Time:            760, CLK = 1, PC = 0x00000090
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000011
[x18] = 0x0000000000000012
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
```

```
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x00000013
```

---

```
Time:           780, CLK = 1, PC = 0x00000094
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000011
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

---

```
Time:           800, CLK = 1, PC = 0x00000098
```

```
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000011
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x0049aa03
--------------------------------------------------------------------------------
Time:            820, CLK = 1, PC = 0x0000009c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
```

```
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x014ba223
--------------------------------------------------------------------------------
Time:            840, CLK = 1, PC = 0x000000a0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
```

```
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:            860, CLK = 1, PC = 0x000000a4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:            880, CLK = 1, PC = 0x000000a8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
```

```
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000014
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x004bad83
--------------------------------------------------------------------------------
Time:            900, CLK = 1, PC = 0x000000ac
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
```

```
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x004baa83
--------------------------------------------------------------------------------
Time:           920, CLK = 1, PC = 0x000000b0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
```

```
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x013aa223
```

---

```
Time:           940, CLK = 1, PC = 0x000000b4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x004aac83
```

---

```
Time:           960, CLK = 1, PC = 0x000000b8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
```

```
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000000
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000004
instruction = 0x017b0c33
-------------------------------------------------------------------------
Time:            980, CLK = 1, PC = 0x000000bc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
```

```
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000015
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
INFO: [USF-XSim-96] XSim completed. Design snapshot '
   testbench_behav' loaded.
INFO: [USF-XSim-97] XSim simulation ran for 1000ns
launch_simulation: Time (s): cpu = 00:00:03 ; elapsed = 00:00:11
    . Memory (MB): peak = 1844.254 ; gain = 0.000
run all
--------------------------------------------------------------------------------
Time:          1000, CLK = 1, PC = 0x000000c0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
```

```
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1020, CLK = 1, PC = 0x000000c4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1040, CLK = 1, PC = 0x000000c8
```

```
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x0000000000000000
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1060, CLK = 1, PC = 0x000000cc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
```

```
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1080, CLK = 1, PC = 0x000000d0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
```

```
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1100, CLK = 1, PC = 0x000000d4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1120, CLK = 1, PC = 0x000000d8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
```

```
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1140, CLK = 1, PC = 0x000000dc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
```

```
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1160, CLK = 1, PC = 0x000000e0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
```

```
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1180, CLK = 1, PC = 0x000000e4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1200, CLK = 1, PC = 0x000000e8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
```

```
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1220, CLK = 1, PC = 0x000000ec
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
```

```
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1240, CLK = 1, PC = 0x000000f0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
```

```
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1260, CLK = 1, PC = 0x000000f4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1280, CLK = 1, PC = 0x000000f8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
```

```
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1300, CLK = 1, PC = 0x000000fc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
```

```
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1320, CLK = 1, PC = 0x00000100
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
```

```
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1340, CLK = 1, PC = 0x00000104
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1360, CLK = 1, PC = 0x00000108
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
```

```
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1380, CLK = 1, PC = 0x0000010c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
```

```
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1400, CLK = 1, PC = 0x00000110
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
```

```
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1420, CLK = 1, PC = 0x00000114
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1440, CLK = 1, PC = 0x00000118
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
```

```
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1460, CLK = 1, PC = 0x0000011c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
```

```
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1480, CLK = 1, PC = 0x00000120
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
```

```
Time:          1500, CLK = 1, PC = 0x00000124
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1520, CLK = 1, PC = 0x00000128
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
```

```
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1540, CLK = 1, PC = 0x0000012c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
```

```
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1560, CLK = 1, PC = 0x00000130
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1580, CLK = 1, PC = 0x00000134
[x0] = 0x0000000000000000
```

```
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1600, CLK = 1, PC = 0x00000138
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
```

```
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1620, CLK = 1, PC = 0x0000013c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
```

```
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1640, CLK = 1, PC = 0x00000140
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1660, CLK = 1, PC = 0x00000144
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
```

```
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1680, CLK = 1, PC = 0x00000148
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
```

```
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1700, CLK = 1, PC = 0x0000014c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
```

```
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

---

```
Time:          1720, CLK = 1, PC = 0x00000150
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

---

```
Time:          1740, CLK = 1, PC = 0x00000154
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
```

```
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1760, CLK = 1, PC = 0x00000158
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
```

```
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1780, CLK = 1, PC = 0x0000015c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
```

```
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1800, CLK = 1, PC = 0x00000160
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1820, CLK = 1, PC = 0x00000164
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
```

```
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1840, CLK = 1, PC = 0x00000168
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
```

```
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1860, CLK = 1, PC = 0x0000016c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
```

```
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1880, CLK = 1, PC = 0x00000170
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1900, CLK = 1, PC = 0x00000174
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
```

```
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1920, CLK = 1, PC = 0x00000178
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
```

```
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1940, CLK = 1, PC = 0x0000017c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

```
--------------------------------------------------------------------------------
Time:          1960, CLK = 1, PC = 0x00000180
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          1980, CLK = 1, PC = 0x00000184
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
```

```
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
```

---

```
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

---

```
Time:          2000, CLK = 1, PC = 0x00000188
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
```

```
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2020, CLK = 1, PC = 0x0000018c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
```

```
Time:           2040, CLK = 1, PC = 0x00000190
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
-----------------------------------------------------------------------
Time:           2060, CLK = 1, PC = 0x00000194
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
```

```
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2080, CLK = 1, PC = 0x00000198
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
```

```
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2100, CLK = 1, PC = 0x0000019c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2120, CLK = 1, PC = 0x000001a0
[x0] = 0x0000000000000000
```

```
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2140, CLK = 1, PC = 0x000001a4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
```

```
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2160, CLK = 1, PC = 0x000001a8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
```

```
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2180, CLK = 1, PC = 0x000001ac
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2200, CLK = 1, PC = 0x000001b0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
```

```
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2220, CLK = 1, PC = 0x000001b4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
```

```
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2240, CLK = 1, PC = 0x000001b8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
```

```
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
-----------------------------------------------------------------
Time:          2260, CLK = 1, PC = 0x000001bc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
-----------------------------------------------------------------
Time:          2280, CLK = 1, PC = 0x000001c0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
```

```
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:           2300, CLK = 1, PC = 0x000001c4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
```

```
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
-----------------------------------------------------------------
Time:          2320, CLK = 1, PC = 0x000001c8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
```

```
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2340, CLK = 1, PC = 0x000001cc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2360, CLK = 1, PC = 0x000001d0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
```

```
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2380, CLK = 1, PC = 0x000001d4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
```

```
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:           2400, CLK = 1, PC = 0x000001d8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
```

```
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2420, CLK = 1, PC = 0x000001dc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2440, CLK = 1, PC = 0x000001e0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
```

```
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2460, CLK = 1, PC = 0x000001e4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
```

```
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

---

```
Time:          2480, CLK = 1, PC = 0x000001e8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
```

```
--------------------------------------------------------------------------------
Time:           2500, CLK = 1, PC = 0x000001ec
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:           2520, CLK = 1, PC = 0x000001f0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
```

```
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2540, CLK = 1, PC = 0x000001f4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
```

```
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2560, CLK = 1, PC = 0x000001f8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0x00000013
--------------------------------------------------------------------------------
Time:          2580, CLK = 1, PC = 0x000001fc
```

```
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2600, CLK = 1, PC = 0x00000200
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
```

```
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          2620, CLK = 1, PC = 0x00000204
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
```

```
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:           2640, CLK = 1, PC = 0x00000208
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:           2660, CLK = 1, PC = 0x0000020c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
```

```
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           2680, CLK = 1, PC = 0x00000210
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
```

```
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2700, CLK = 1, PC = 0x00000214
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
```

```
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2720, CLK = 1, PC = 0x00000218
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2740, CLK = 1, PC = 0x0000021c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
```

```
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          2760, CLK = 1, PC = 0x00000220
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
```

```
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           2780, CLK = 1, PC = 0x00000224
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
```

```
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2800, CLK = 1, PC = 0x00000228
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2820, CLK = 1, PC = 0x0000022c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
```

```
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          2840, CLK = 1, PC = 0x00000230
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
```

```
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          2860, CLK = 1, PC = 0x00000234
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
```

```
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:           2880, CLK = 1, PC = 0x00000238
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:           2900, CLK = 1, PC = 0x0000023c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
```

```
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          2920, CLK = 1, PC = 0x00000240
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
```

```
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          2940, CLK = 1, PC = 0x00000244
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
```

```
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          2960, CLK = 1, PC = 0x00000248
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          2980, CLK = 1, PC = 0x0000024c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
```

```
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3000, CLK = 1, PC = 0x00000250
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
```

```
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3020, CLK = 1, PC = 0x00000254
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
```

```
Time:           3040, CLK = 1, PC = 0x00000258
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:           3060, CLK = 1, PC = 0x0000025c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
```

```
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3080, CLK = 1, PC = 0x00000260
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
```

```
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3100, CLK = 1, PC = 0x00000264
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3120, CLK = 1, PC = 0x00000268
[x0] = 0x0000000000000000
```

```
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3140, CLK = 1, PC = 0x0000026c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
```

```
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-------------------------------------------------------------------------------
Time:           3160, CLK = 1, PC = 0x00000270
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
```

```
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3180, CLK = 1, PC = 0x00000274
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3200, CLK = 1, PC = 0x00000278
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
```

```
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3220, CLK = 1, PC = 0x0000027c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
```

```
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3240, CLK = 1, PC = 0x00000280
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
```

```
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3260, CLK = 1, PC = 0x00000284
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3280, CLK = 1, PC = 0x00000288
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
```

```
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           3300, CLK = 1, PC = 0x0000028c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
```

```
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3320, CLK = 1, PC = 0x00000290
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
```

```
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3340, CLK = 1, PC = 0x00000294
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3360, CLK = 1, PC = 0x00000298
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
```

```
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3380, CLK = 1, PC = 0x0000029c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
```

```
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3400, CLK = 1, PC = 0x000002a0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
```

```
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3420, CLK = 1, PC = 0x000002a4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3440, CLK = 1, PC = 0x000002a8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
```

```
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3460, CLK = 1, PC = 0x000002ac
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
```

```
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3480, CLK = 1, PC = 0x000002b0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
```

```
--------------------------------------------------------------------------------
Time:           3500, CLK = 1, PC = 0x000002b4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           3520, CLK = 1, PC = 0x000002b8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
```

```
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3540, CLK = 1, PC = 0x000002bc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
```

```
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3560, CLK = 1, PC = 0x000002c0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3580, CLK = 1, PC = 0x000002c4
```

```
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3600, CLK = 1, PC = 0x000002c8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
```

```
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3620, CLK = 1, PC = 0x000002cc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
```

```
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3640, CLK = 1, PC = 0x000002d0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3660, CLK = 1, PC = 0x000002d4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
```

```
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3680, CLK = 1, PC = 0x000002d8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
```

```
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-------------------------------------------------------------------------------
Time:          3700, CLK = 1, PC = 0x000002dc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
```

```
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3720, CLK = 1, PC = 0x000002e0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3740, CLK = 1, PC = 0x000002e4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
```

```
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3760, CLK = 1, PC = 0x000002e8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
```

```
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           3780, CLK = 1, PC = 0x000002ec
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
```

```
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3800, CLK = 1, PC = 0x000002f0
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3820, CLK = 1, PC = 0x000002f4
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
```

```
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------------
Time:          3840, CLK = 1, PC = 0x000002f8
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
```

```
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3860, CLK = 1, PC = 0x000002fc
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
```

```
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           3880, CLK = 1, PC = 0x00000300
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:           3900, CLK = 1, PC = 0x00000304
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
```

```
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3920, CLK = 1, PC = 0x00000308
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
```

```
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
-----------------------------------------------------------------
Time:          3940, CLK = 1, PC = 0x0000030c
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
```

```
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3960, CLK = 1, PC = 0x00000310
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
ALUcontrol: 0x2
immediate: 0x0000000000000000
instruction = 0xxxxxxxxx
--------------------------------------------------------------------------------
Time:          3980, CLK = 1, PC = 0x00000314
[x0] = 0x0000000000000000
[x1] = 0x000000000000000a
[x2] = 0x0000000000000002
[x3] = 0x0000000000000003
[x4] = 0x0000000000000004
[x5] = 0xffffffffffffffff
[x6] = 0x0000000000000006
[x7] = 0x0000000000000007
[x8] = 0x0000000000000008
[x9] = 0x0000000000000009
```

```
[x10] = 0xffffffffffffffff
[x11] = 0x000000000000000b
[x12] = 0x0000000000000004
[x13] = 0x000000000000000d
[x14] = 0x000000000000000e
[x15] = 0x000000000000000f
[x16] = 0x000000000000000b
[x17] = 0x0000000000000012
[x18] = 0x000000000000000b
[x19] = 0x0000000000000013
[x20] = 0x0000000000000004
[x21] = 0x0000000000000004
[x22] = 0x0000000000000016
[x23] = 0x0000000000000017
[x24] = 0x000000000000002d
[x25] = 0x0000000000000000
[x26] = 0x0000000000000000
[x27] = 0x0000000000000004
[x28] = 0x0000000000000000
[x29] = 0x0000000000000000
[x30] = 0x0000000000000006
[x31] = 0x0000000000000006
$stop called at time : 4 us : File "D:/Study/SJTU/Junior/2021SU/
    VE370/Project/p2/group/src/testbench.v" Line 21
```

## Appendix

### Main

```
`timescale 1ns / 1ps

`include "alu_control.v"
`include "alu.v"
`include "control.v"
`include "data_memory.v"
`include "immediate_generator.v"
`include "instru_memory.v"
`include "next_pc.v"
`include "program_counter.v"
`include "register.v"
`include "IF_ID.v"
`include "ID_EX.v"
`include "EX_MEM.v"
`include "MEM_WB.v"
`include "mux.v"

module main(input clk);

    wire [31:0] pc_in, pc_out,
```

```
                IF_ID_pc,
                ID_EX_pc,
                EX_MEM_pc;

    wire [6:0] im_funct7;
    wire [2:0] im_funct3;
    wire [6:0] im_opcode;

    wire [31:0] im_instru;
    wire [31:0] IF_ID_instru;

    wire c_Branch, c_MemRead, c_MemtoReg, c_MemWrite, c_ALUSrc,
       c_RegWrite, c_Jump,
          ID_EX_Branch, ID_EX_MemRead, ID_EX_MemtoReg,
             ID_EX_MemWrite, ID_EX_ALUSrc, ID_EX_RegWrite,
             ID_EX_Jump,
          EX_MEM_Branch, EX_MEM_MemRead, EX_MEM_MemtoReg,
             EX_MEM_MemWrite, EX_MEM_RegWrite, EX_MEM_Jump,
          MEM_WB_RegWrite, MEM_WB_MemtoReg, MEM_WB_MemRead;

    wire [1:0] c_ALUOp;

    wire [3:0] c_ALUcontrol;
    wire [3:0] ID_EX_ALUcontrol;

    wire [63:0] r_wbdata,
                mem_data,
                MEM_WB_mem_data,
                r_read1,
                r_read2,
                ID_EX_Read1,
                ID_EX_Read2,
                EX_MEM_Read2;

    wire [4:0] ID_EX_Rs1,
               ID_EX_Rs2,
               ID_EX_Rd,
               EX_MEM_Rd,
               MEM_WB_Rd;

    wire [63:0] ALUin1, ALUin2;

    wire [63:0] MemWriteData;

    wire c_zero,
         EX_MEM_zero;

    wire [63:0] alu_result,
                EX_MEM_alu_result,
                MEM_WB_alu_result;
```

```
    wire [63:0] imme,
                ID_EX_imme,
                EX_MEM_imme;

    wire [63:0] zeros;

    wire [1:0] ForwardA, ForwardB; // for ALU
    wire MemSrc; // for load-store
    wire IF_Flush, ID_EX_Flush;
    wire ID_branch, RegWrite, ID_jump, PCWrite, IF_ID_Write;

    // wire ID_equal;
    wire [4:0] IF_ID_Rs1, IF_ID_Rs2, EX_MEM_Rs2;

    assign zeros = 64'b0;

/* IF */
program_counter asset_pc(clk, pc_in, pc_out);

instru_memory asset_im(pc_out, im_instru);

IF_ID asset_if_id(clk, IF_Flush, IF_ID_Write, pc_out, im_instru,
    IF_ID_pc, im_funct7, im_funct3, im_opcode, IF_ID_instru);

/* ID */
control asset_control(im_opcode, c_Branch, c_MemRead, c_MemtoReg
    , c_ALUOp, c_MemWrite, c_ALUSrc, c_RegWrite, c_Jump);

alu_control asset_aluct(clk, c_ALUOp, im_funct7, im_funct3,
    c_ALUcontrol);

ID_EX_control asset_id_ex_ctrl(clk, ID_EX_Flush, c_Branch,
    c_MemRead, c_MemtoReg, c_MemWrite, c_ALUSrc, c_RegWrite,
    c_Jump, c_ALUcontrol,
ID_EX_Branch, ID_EX_MemRead, ID_EX_MemtoReg, ID_EX_MemWrite,
    ID_EX_ALUSrc, ID_EX_RegWrite, ID_EX_Jump, ID_EX_ALUcontrol);

immediate_generator asset_ig(clk, IF_ID_instru, im_opcode, imme)
    ;

ID_EX_imme asset_id_ex_imme(clk, ID_EX_Flush, imme, ID_EX_imme);

register asset_reg(clk, MEM_WB_RegWrite, c_Branch, c_Jump,
    IF_ID_pc, IF_ID_instru, MEM_WB_Rd, r_wbdata, r_read1, r_read2
    );

ID_EX asset_id_ex(clk, ID_EX_Flush, r_read1, r_read2,
    IF_ID_instru, ID_EX_Read1, ID_EX_Read2, ID_EX_Rs1, ID_EX_Rs2,
     ID_EX_Rd);
```

```
ID_EX_pc asset_ID_EX_pc(clk, ID_EX_Flush, IF_ID_pc, ID_EX_pc);

/* EX */

two_64bit_mux asset_alu_mux1(ForwardA, ID_EX_Read1, r_wbdata,
    EX_MEM_alu_result, zeros, ALUin1);

two_64bit_mux asset_alu_mux2(ForwardB, ID_EX_Read2, r_wbdata,
    EX_MEM_alu_result, zeros, ALUin2);

ForwardingUnit assert_forwarding_unit(ID_EX_Rs1, ID_EX_Rs2,
    EX_MEM_Rs2, EX_MEM_Rd, MEM_WB_Rd, EX_MEM_RegWrite,
    MEM_WB_RegWrite, EX_MEM_MemWrite, MEM_WB_MemRead, ForwardA,
    ForwardB, MemSrc);

alu asset_alu(ID_EX_ALUSrc, ID_EX_ALUcontrol, ALUin1, ALUin2,
    ID_EX_imme, c_zero, alu_result);

EX_MEM asset_ex_mem(clk, c_zero, alu_result, ID_EX_Read2,
    ID_EX_Rd, ID_EX_Rs2, EX_MEM_zero, EX_MEM_alu_result,
    EX_MEM_Read2, EX_MEM_Rd, EX_MEM_Rs2);

EX_MEM_control asset_ex_mem_ctrl(clk, ID_EX_Branch,
    ID_EX_MemRead, ID_EX_MemtoReg, ID_EX_MemWrite, ID_EX_RegWrite
    ,
ID_EX_Jump, EX_MEM_Branch, EX_MEM_MemRead, EX_MEM_MemtoReg,
    EX_MEM_MemWrite, EX_MEM_RegWrite, EX_MEM_Jump);

EX_MEM_imme asset_ex_mem_imme(clk, ID_EX_imme, EX_MEM_imme);

EX_MEM_pc asset_EX_MEM_pc(clk, ID_EX_pc, EX_MEM_pc);

/* MEM */
next_pc asset_next_pc(clk, EX_MEM_Jump, EX_MEM_Branch,
    EX_MEM_zero, PCWrite, pc_out, EX_MEM_alu_result, EX_MEM_imme,
     pc_in);

one_64bit_mux asset_mem_wb_memsrc_mux(MemSrc, EX_MEM_Read2,
    mem_data, MemWriteData);

data_memory asset_dm(clk, EX_MEM_MemWrite, EX_MEM_MemRead,
    EX_MEM_alu_result, MemWriteData, mem_data);

MEM_WB asset_mem_wb(clk, mem_data, EX_MEM_alu_result, EX_MEM_Rd,
     MEM_WB_mem_data, MEM_WB_alu_result, MEM_WB_Rd);

MEM_WB_control asset_mem_wb_ctrl(clk, EX_MEM_MemtoReg,
    EX_MEM_RegWrite, EX_MEM_MemRead, MEM_WB_MemtoReg,
    MEM_WB_RegWrite, MEM_WB_MemRead);
```

```
one_64bit_mux asset_mem_wb_mux(MEM_WB_MemtoReg,
    MEM_WB_alu_result, MEM_WB_mem_data, r_wbdata);

assign IF_ID_Rs1 = IF_ID_instru[19:15];
assign IF_ID_Rs2 = IF_ID_instru[24:20];

/* Hazard Detection Unit */
hazardControlDetection asset_hazardControlDetection(IF_ID_Rs1,
    IF_ID_Rs2, ID_EX_Rs2, EX_MEM_Rs2, ID_EX_Rd, EX_MEM_Rd,
    c_MemWrite,
ID_EX_MemRead, EX_MEM_MemRead, ID_EX_Branch, ID_EX_Jump, c_zero,
     ID_EX_RegWrite, PCWrite, IF_ID_Write, ID_EX_Flush, IF_Flush)
    ;

endmodule
```

**Hazard Detection Unit**

```
`timescale 1ns / 1ps

module hazardControlDetection(
    input [4:0] IF_ID_Rs1,
    input [4:0] IF_ID_Rs2,
    input [4:0] ID_EX_Rs2,
    input [4:0] EX_MEM_Rs2,
    input [4:0] ID_EX_Rd,
    input [4:0] EX_MEM_Rd,
    input IF_ID_MemWrite,
    input ID_EX_MemRead,
    input EX_MEM_MemRead,
    input ID_branch,
    input ID_jump,
    input c_zero,
    input ID_EX_RegWrite,
    output PCWrite,
    output IF_ID_Write,
    output ID_EX_Flush,
    output IF_Flush
);

wire PCHold; // if PCHold==1, hold PC and IF/ID

assign PCHold = ( (ID_EX_MemRead && ~IF_ID_MemWrite) && (
    ID_EX_Rd == IF_ID_Rs1 || ID_EX_Rd == IF_ID_Rs2) ) // lw
    hazard
            || ( (ID_branch) && (ID_EX_MemRead) && (ID_EX_Rd ==
                IF_ID_Rs1 || ID_EX_Rd == IF_ID_Rs2) ) // lw
                followed by branch
            || ( (ID_branch) && (EX_MEM_MemRead) && (EX_MEM_Rd
```

```
                == IF_ID_Rs1 || EX_MEM_Rd == IF_ID_Rs2) ) // lw
                followed by nop and then branch
            || ( (ID_branch) && (ID_EX_RegWrite) && (ID_EX_Rd !=
                5'b0) && (ID_EX_Rd == IF_ID_Rs1 || ID_EX_Rd ==
                IF_ID_Rs2) ) // R-format followed by branch
            || ( (ID_branch) && (ID_EX_RegWrite) && (ID_EX_Rd ==
                5'b0) && (ID_EX_Rd == IF_ID_Rs1 || ID_EX_Rd ==
                IF_ID_Rs2) ) ; // addi followed by branch
// note we leave out the case that R-format followed by a nop
   then a branch, because that is solved by forwarding path

assign PCWrite=~PCHold; // if PCWrite==0, don't write in new
   instruction, IM decode the current instruction again

assign IF_ID_Write=~PCHold; // if IF_ID_Write==0, IF/ID register
    keeps the current instruction

assign ID_EX_Flush=PCHold; // if ID_EX_Flush=1, all control
   signals in ID/EX are 0 (implemented in ID/EX register later)

assign IF_Flush = (PCHold==0) && ( (ID_jump) || (ID_branch &&
   c_zero) );

endmodule
```

**IF_ID**

```
`timescale 1ns / 1ps

module IF_ID(
    input clock,
    input IF_flush,
    input IF_ID_Write,
    input [31:0] pc,
    input [31:0] in,
    output reg [31:0] pc_next,
    output reg [6:0]  funct7, // [31-25]
    output reg [2:0]  funct3, // [14-12]
    output reg [6:0]  opcode, // [6-0]
    output reg [31:0] instru  // [31-0]
);

initial
begin
    pc_next <= 0;
    instru <= 0;
    funct7 <= 0;
    funct3 <= 0;
    opcode <= 0;
end
```

```
always @(posedge clock)
begin
    if (IF_flush == 1) begin
        pc_next <= 0;
        instru <= 0;
        funct7 <= 0;
        funct3 <= 0;
        opcode <= 0;
    end else if (IF_ID_Write == 1) begin
        pc_next <= pc;
        instru <= in;
        funct7 <= in[31:25];
        funct3 <= in[14:12];
        opcode <= in[6:0];
    end else begin
        pc_next <= pc_next;
        instru <= instru;
        funct7 <= funct7;
        funct3 <= funct3;
        opcode <= opcode;
    end

    // $display("funct7 = 0x%H", funct7);
    // $display("funct3 = 0x%H", funct3);
    // $display("opcode = 0x%H", opcode);
end

endmodule
```

**ID_EX**

```
`timescale 1ns / 1ps

module ID_EX(
    input clock,
    input ID_flush,
    input [63:0] ReadDataIn1,
    input [63:0] ReadDataIn2,
    input [31:0] instru,
    output reg [63:0] ReadDataOut1,
    output reg [63:0] ReadDataOut2,
    output reg [4:0] Rs1,
    output reg [4:0] Rs2,
    output reg [4:0] Rd
);

initial
begin
    ReadDataOut1 = 0;
```

```
    ReadDataOut2 = 0;
    Rs1 = 0;
    Rs2 = 0;
    Rd = 0;
end

always @(posedge clock)
begin
    if (ID_flush == 1) begin
        ReadDataOut1 = 0;
        ReadDataOut2 = 0;
        Rs1 = 0;
        Rs2 = 0;
        Rd = 0;
    end else begin
        ReadDataOut1 = ReadDataIn1;
        ReadDataOut2 = ReadDataIn2;
        Rs1 = instru[19:15];
        Rs2 = instru[24:20];
        Rd = instru[11:7];
    end

    // $display("ID_flush = 0x%H", ID_flush);
    // $display("ReadDataOut1 = 0x%H", ReadDataOut1);
    // $display("ReadDataOut2 = 0x%H", ReadDataOut2);
    // $display("Rs1 = 0x%H", Rs1);
    // $display("Rs2 = 0x%H", Rs2);
    // $display("Rd = 0x%H", Rd);
end

endmodule

module ID_EX_control(
    input clock,
    input ID_flush,
    input i_Branch,
    input i_MemRead,
    input i_MemtoReg,
    input i_MemWrite,
    input i_ALUSrc,
    input i_RegWrite,
    input i_Jump,
    input [3:0] i_ALUcontrol,
    output reg o_Branch,
    output reg o_MemRead,
    output reg o_MemtoReg,
    output reg o_MemWrite,
    output reg o_ALUSrc,
    output reg o_RegWrite,
    output reg o_Jump,
```

```
    output reg [3:0] o_ALUcontrol
);

    initial
    begin
        o_Branch = 0;
        o_MemRead = 0;
        o_MemtoReg = 0;
        o_MemWrite = 0;
        o_ALUSrc = 0;
        o_RegWrite = 0;
        o_Jump = 0;
        o_ALUcontrol = 0;
    end

    always @(posedge clock)
    begin
        if (ID_flush == 0) begin
            o_Branch = i_Branch;
            o_MemRead = i_MemRead;
            o_MemtoReg = i_MemtoReg;
            o_MemWrite = i_MemWrite;
            o_ALUSrc = i_ALUSrc;
            o_RegWrite = i_RegWrite;
            o_Jump = i_Jump;
            o_ALUcontrol = i_ALUcontrol;
        end else begin
            o_Branch = 0;
            o_MemRead = 0;
            o_MemtoReg = 0;
            o_MemWrite = 0;
            o_ALUSrc = 0;
            o_RegWrite = 0;
            o_Jump = 0;
            o_ALUcontrol = 0;
        end
    end

endmodule


module ID_EX_imme(
    input clock,
    input ID_flush,
    input [63:0] immediate,
    output reg [63:0] immediate_out
);

    initial
    begin
```

```
        immediate_out = 0;
    end

    always @(posedge clock)
    begin
        if (ID_flush == 0) begin
            immediate_out = immediate;
        end else begin
            immediate_out = 0;
        end

        // $display("ID_flush: 0x%H", ID_flush);
        // $display("immediate: 0x%H", immediate);
        // $display("immediate_out: 0x%H", immediate_out);
    end

endmodule


module ID_EX_pc(
    input clock,
    input ID_flush,
    input [31:0] pc,
    output reg [31:0] pc_next
);

initial
begin
    pc_next = 0;
end

always @(posedge clock)
begin
    if (ID_flush == 0) begin
        pc_next = pc;
    end else begin
        pc_next = 0;
    end
end

endmodule
```

**EX_MEM**

```
`timescale 1ns / 1ps

module EX_MEM(
    input clock,
    input Zero,
    input [63:0] ALUresultIn,
```

```
    input [63:0] ReadData2In,
    input [4:0] RegisterRd,
    input [4:0] RegisterRs2,
    output reg ZeroOut,
    output reg [63:0] ALUresultOut,
    output reg [63:0] ReadData2Out,
    output reg [4:0] Rd,
    output reg [4:0] Rs2
);

initial
begin
    ZeroOut <= 0;
    ALUresultOut <= 0;
    ReadData2Out <= 0;
    Rd <= 0;
    Rs2 <= 0;
end

always @(posedge clock)
begin
    ZeroOut <= Zero;
    ALUresultOut <= ALUresultIn;
    ReadData2Out <= ReadData2In;
    Rd <= RegisterRd;
    Rs2 <= RegisterRs2;

    // $display("Zero = 0x%H", ZeroOut);
    // $display("ALUresult = 0x%H", ALUresultOut);
    // $display("ReadData2 = 0x%H", ReadData2Out);
    // $display("Rd = 0x%H", Rd);
    // $display("RegisterRs2 = 0x%H", Rs2);
end

endmodule


module EX_MEM_control(
    input clock,
    input i_Branch,
    input i_MemRead,
    input i_MemtoReg,
    input i_MemWrite,
    input i_RegWrite,
    input i_Jump,
    output reg o_Branch,
    output reg o_MemRead,
    output reg o_MemtoReg,
    output reg o_MemWrite,
    output reg o_RegWrite,
```

```
    output reg o_Jump
);

initial
begin
    o_Branch <= 0;
    o_MemRead <= 0;
    o_MemtoReg <= 0;
    o_MemWrite <= 0;
    o_RegWrite <= 0;
    o_Jump <= 0;
end

always @(posedge clock)
begin
    o_Branch <= i_Branch;
    o_MemRead <= i_MemRead;
    o_MemtoReg <= i_MemtoReg;
    o_MemWrite <= i_MemWrite;
    o_RegWrite <= i_RegWrite;
    o_Jump <= i_Jump;
end

endmodule


module EX_MEM_imme(
    input clock,
    input [63:0] immediate,
    output reg [63:0] immediate_out
);

initial
begin
    immediate_out <= 0;
end

always @(posedge clock)
begin
    immediate_out <= immediate;
end

endmodule

module EX_MEM_pc(
    input clock,
    input [31:0] pc,
    output reg [31:0] pc_next
);
```

```
initial
begin
    pc_next <= 0;
end

always @(posedge clock)
begin
    pc_next <= pc;
end

endmodule
```

**MEM_WB**

```
`timescale 1ns / 1ps
module MEM_WB(
    input clock,
    input [63:0] MemoryDataIn,
    input [63:0] AluResultIn,
    input [4:0] RegisterRd,
    output reg [63:0] MemoryDataOut,
    output reg [63:0] AluResultOut,
    output reg [4:0] Rd
);

initial
begin
    MemoryDataOut <= 0;
    AluResultOut <= 0;
    Rd <= 0;
end

always @(posedge clock)
begin
    MemoryDataOut = MemoryDataIn;
    AluResultOut = AluResultIn;
    Rd = RegisterRd;
end

endmodule


module MEM_WB_control(
    input clock,
    input i_MemtoReg,
    input i_RegWrite,
    input i_MemRead,
    output reg o_MemtoReg,
    output reg o_RegWrite,
    output reg o_MemRead
```

```
);

initial
begin
    o_MemtoReg <= 0;
    o_RegWrite <= 0;
    o_MemRead <= 0;
end

always @(posedge clock)
begin
    o_MemtoReg <= i_MemtoReg;
    o_RegWrite <= i_RegWrite;
    o_MemRead <= i_MemRead;

    // $display("MEM_WB_RegWrite: 0x%H", o_RegWrite);
    // $display("MEM_WB_MemRead: 0x%H", o_MemRead);
end

endmodule
```

**Common Register**

```
`timescale 1ns / 1ps

module common_reg(
    input clock,
    input in,
    output reg out
);

initial
begin
    out <= 0;
end

always @(posedge clock)
begin
    out <= in;
end
endmodule
```

**Forwarding Unit**

```
`timescale 1ns / 1ps

module ForwardingUnit(
    input [4:0] ID_EX_Rs1,
    input [4:0] ID_EX_Rs2,
    input [4:0] EX_MEM_Rs2,
```

```
    input [4:0] EX_MEM_Rd,
    input [4:0] MEM_WB_Rd,
    input EX_MEM_RegWrite,
    input MEM_WB_RegWrite,
    input EX_MEM_MemWrite,
    input MEM_WB_MemRead,
    output reg [1:0] ForwardA, // for ALU
    output reg [1:0] ForwardB, // for ALU
    output reg MemSrc // for load-store
);

initial begin
    ForwardA <= 2'b00;
    ForwardB <= 2'b00;
    MemSrc <= 1'b0;
end

// ForwardA
always @(*) begin
    if (EX_MEM_RegWrite == 1 && EX_MEM_Rd != 0 && EX_MEM_Rd ==
       ID_EX_Rs1) ForwardA <= 2'b10;//EX
    else if (MEM_WB_RegWrite == 1 && MEM_WB_Rd != 0 && MEM_WB_Rd
        == ID_EX_Rs1) ForwardA <= 2'b01;//MEM
    else ForwardA <= 2'b00;
end

// ForwardB
always @(*) begin
    if (EX_MEM_RegWrite == 1 && EX_MEM_Rd != 0 && EX_MEM_Rd ==
       ID_EX_Rs2) ForwardB <= 2'b10;//EX
    else if (MEM_WB_RegWrite == 1 && MEM_WB_Rd != 0 && MEM_WB_Rd
        == ID_EX_Rs2) ForwardB <= 2'b01;//MEM
    else ForwardB <= 2'b00;
end

// MemSrc
always @(*) begin
    if (EX_MEM_MemWrite == 1 && MEM_WB_MemRead == 1 && (
       MEM_WB_Rd == EX_MEM_Rs2)) MemSrc <= 1'b1;
    else MemSrc <= 1'b0;
end

endmodule
```

**Control Unit**

```
`timescale 1ns / 1ps

module control(
  input [6:0] opcode,
```

```
  output reg Branch,
  output reg MemRead,
  output reg MemtoReg,
  output reg [1:0] ALUOp,
  output reg MemWrite,
  output reg ALUSrc,
  output reg RegWrite,
  output reg Jump
);

  initial begin
    Branch = 0;
    MemRead = 0;
    MemtoReg = 0;
    ALUOp = 2'b00;
    MemWrite = 0;
    ALUSrc = 0;
    RegWrite = 0;
    Jump = 0;
  end

  always @(*) begin
    case (opcode)
      7'b0110011: begin // R-type
        Branch = 0;
        MemRead = 0;
        MemtoReg = 0;
        ALUOp = 2'b10;
        MemWrite = 0;
        ALUSrc = 0;
        RegWrite = 1;
        Jump = 0;
      end
      7'b0000011: begin // Load
        Branch = 0;
        MemRead = 1;
        MemtoReg = 1;
        ALUOp = 2'b00;
        MemWrite = 0;
        ALUSrc = 1;
        RegWrite = 1;
        Jump = 0;
      end
      7'b0010011: begin // immediate
        Branch = 0;
        MemRead = 0;
        MemtoReg = 0;
        ALUOp = 2'b10;
        MemWrite = 0;
        ALUSrc = 1;
```

```
        RegWrite = 1;
        Jump = 0;
      end
      7'b0100011: begin // S-type
        Branch = 0;
        MemRead = 0;
        MemtoReg = 0;
        ALUOp = 2'b00;
        MemWrite = 1;
        ALUSrc = 1;
        RegWrite = 0;
        Jump = 0;
      end
      7'b1100111: begin // jalr
        Branch = 0;
        MemRead = 0;
        MemtoReg = 0;
        ALUOp = 2'b11;
        MemWrite = 0;
        ALUSrc = 1;
        RegWrite = 1;
        Jump = 1;
      end
      7'b1100011: begin // SB-type
        Branch = 1;
        MemRead = 0;
        MemtoReg = 0;
        ALUOp = 2'b01;
        MemWrite = 0;
        ALUSrc = 0;
        RegWrite = 0;
        Jump = 0;
      end
      7'b1101111: begin // UJ-type
        Branch = 1;
        MemRead = 0;
        MemtoReg = 0;
        ALUOp = 2'b11;
        MemWrite = 0;
        ALUSrc = 0;
        RegWrite = 1;
        Jump = 1;
      end
      default:
        ;
    endcase

    // $display("Branch = %H;MemRead = %H;MemtoReg = %H;ALUOp =
       %H;MemWrite = %H;ALUSrc = %H;RegWrite = %H;Jump = %H;",
        // Branch, MemRead, MemtoReg, ALUOp, MemWrite, ALUSrc,
```

```
            RegWrite, Jump);
  end

endmodule
```

**Mux**

```
`timescale 1ns / 1ps

module one_64bit_mux(
  input source,
  input [63:0] input0,
  input [63:0] input1,
  output reg [63:0] out
);

initial begin
    out <= 64'b0;
end

always @(*) begin
    case (source)
        1'b0:
            out = input0;
        1'b1:
            out = input1;
    endcase
end

endmodule

module two_64bit_mux(
  input [1:0] source,
  input [63:0] input0,
  input [63:0] input1,
  input [63:0] input2,
  input [63:0] input3,
  output reg [63:0] out
);

initial begin
    out <= 64'b0;
end

always @(*) begin
    case (source)
        2'b00:
            out = input0;
        2'b01:
            out = input1;
```

```
        2'b10:
            out = input2;
        2'b11:
            out = input3;
    endcase
end

endmodule
```

**ImmGen**

```
`timescale 1ns / 1ps

module immediate_generator(
  input clock,
  input [31:0] instru,
  input [6:0] opcode,
  output reg [63:0] immediate
);

  parameter NEG = 64'
     b1111111111111111111111111111111111111111111111111111111111111111
     ;

  initial begin
    immediate = 64'b0;
  end

  always @(negedge clock) begin
    case (opcode)
      7'b0000011: begin // Load
        if (instru[31] == 1) begin
          immediate = {NEG[51:0], instru[31:20]};
        end else begin
          immediate = {52'b0, instru[31:20]};
        end
      end
      7'b0010011: begin // immediate
        if (instru[31] == 1) begin
          immediate = {NEG[51:0], instru[31:20]};
        end else begin
          immediate = {52'b0, instru[31:20]};
        end
      end
      7'b0100011: begin // S-type
        if (instru[31] == 1) begin
          immediate = {NEG[51:0], instru[31:25], instru[11:7]};
        end else begin
          immediate = {52'b0, instru[31:25], instru[11:7]};
        end
```

```
      end
      7'b1100111: begin // jalr
        if (instru[31] == 1) begin
          immediate = {NEG[51:0], instru[31:20]};
        end else begin
          immediate = {52'b0, instru[31:20]};
        end
      end
      7'b1100011: begin // SB-type
        if (instru[31] == 1) begin
          immediate = {NEG[50:0], instru[31], instru[7], instru
              [30:25], instru[11:8], 1'b0};
        end else begin
          immediate = {51'b0, instru[31], instru[7], instru
              [30:25], instru[11:8], 1'b0};
        end
      end
      7'b1101111: begin // UJ-type
        if (instru[31] == 1) begin
          immediate = {NEG[42:0], instru[31], instru[19:12],
              instru[20], instru[30:21], 1'b0};
        end else begin
          immediate = {43'b0, instru[31], instru[19:12], instru
              [20], instru[30:21], 1'b0};
        end
      end
      default:
        immediate = 64'b0;
    endcase

    $display("immediate: 0x%H", immediate[63:0]);
  end

endmodule
```

**Registers**

```
`timescale 1ns / 1ps

module register(
  input clk,
  input RegWrite,
  input Branch,
  input Jump,
  input [31:0] pc,
  input [31:0] instru,
  input [4:0] rd,
  input [63:0] WriteData,
  output [63:0] ReadData1,
  output [63:0] ReadData2
```

```
);

  reg [63:0] RegData [31:0]; // register data

  // initialize the regester data
  integer i;
  initial begin
    for (i = 0; i < 32; i = i + 1) begin
      RegData[i] = 64'b0;
    end
  end

  assign ReadData1 = RegData[instru[19:15]];
  assign ReadData2 = RegData[instru[24:20]];

  always @(negedge clk) begin
    if (RegWrite == 1) begin
      if (Branch == 1 & Jump == 1 & instru[11:7] != 5'b0) begin
        RegData[instru[11:7]] = {32'b0, pc + 4};
      end else if (rd != 5'b0) begin
        RegData[rd] = WriteData;
      end
    end
  end

endmodule
```

**ALU Control**

```
`timescale 1ns / 1ps

module alu_control(
  input clock,
  input [1:0] ALUOp,
  input [6:0] funct7,
  input [2:0] funct3,
  output reg [3:0] ALUcontrol
);

  always @(negedge clock) begin
    case (ALUOp)
      2'b00: // add
        ALUcontrol = 4'b0010;
      2'b01: begin
        case (funct3)
          3'b000: // beq sub
            ALUcontrol = 4'b0110;
          3'b001: // bne
            ALUcontrol = 4'b0011;
          3'b100: // blt
```

```
            ALUcontrol = 4'b1000;
          3'b101: // bge
            ALUcontrol = 4'b0111;
          default: // ADD
            ALUcontrol = 4'b0010;
        endcase
      end
      2'b10: begin
        case (funct3)
          3'b000: begin // add
            case (funct7)
              7'b0000000: // add
                ALUcontrol = 4'b0010;
              7'b0100000: // sub
                ALUcontrol = 4'b0110;
              default: // add
                ALUcontrol = 4'b0010;
            endcase
          end
          3'b001: // sll
            ALUcontrol = 4'b0100;
          3'b010: // slt
            ALUcontrol = 4'b0111;
          3'b100: // or
            ALUcontrol = 4'b1001;
          3'b110: // or
            ALUcontrol = 4'b0001;
          3'b111: // and
            ALUcontrol = 4'b0000;
          default: begin
            case (funct7)
              7'b1101111: // add
                ALUcontrol = 4'b0010;
              default:
                ALUcontrol = ALUcontrol;
            endcase
          end
        endcase
      end
      2'b11: // ADD
        ALUcontrol = 4'b0010;
    endcase

    $display("ALUcontrol: 0x%H", ALUcontrol);
  end

endmodule
```

**ALU**

```
`timescale 1ns / 1ps

module alu(
  input ALUSrc,
  input [3:0] ALUcontrol,
  input [63:0] data1,
  input [63:0] read2,
  input [63:0] imme,
  output reg zero,
  output reg [63:0] ALUresult
);

  reg [63:0] data2;

  always @(*) begin
    if (ALUSrc == 0) begin
      data2 = read2;
    end else begin
      data2 = imme;
    end
  end

  always @(*) begin
    case (ALUcontrol)
      4'b0000: // AND
        ALUresult = data1 & data2;
      4'b0001: // OR
        ALUresult = data1 | data2;
      4'b0010: // ADD
        ALUresult = data1 + data2;
      4'b0011: // NEQ
        ALUresult = (data1 == data2) ? 1 : 0;
      4'b0100: // SLL
        ALUresult = data1 << data2;
      4'b0110: // SUB
        ALUresult = data1 - data2;
      4'b0111: // SLT
        ALUresult = (data1 < data2) ? 1 : 0;
      4'b1000: // SGE
        ALUresult = (data1 < data2) ? 0 : 1;
      4'b1001: // XOR
        ALUresult = data1 ^ data2;
      4'b1100: // NOR
        ALUresult = data1 |~ data2;
      default:
        ALUresult = 64'b0;
    endcase

    if (ALUresult == 0) begin
      zero = 1;
```

```
    end else begin
      zero = 0;
    end

    // $display("ALUSrc: 0x%H", ALUSrc);
    // $display("ALUcontrol: 0x%H", ALUcontrol);
    // $display("data1: 0x%H", data1);
    // $display("data2: 0x%H", data2);
    // $display("ALUresult: 0x%H", ALUresult);
    // $display("Zero: 0x%H", zero);
  end

endmodule
```

**InstructionMemory**

```
`timescale 1ns / 1ps

module instru_memory(
  input [31:0] addr,
  output reg [31:0] instru  // [31-0]
);

  parameter NOP = 32'b00000000000000000000000000010011;
  parameter SIZE = 128;
  reg [31:0] mem [SIZE - 1:0];

  // initially set instruction to nop
  integer n;
  initial begin
    for (n = 0; n < SIZE; n = n + 1) begin
      mem[n] = NOP;
    end
    $readmemh("D:/Study/SJTU/Junior/2021SU/VE370/Project/p2/
        group/test/case.txt", mem);
    //  $readmemh("E:/JI/3 JUNIOR/2021 summer/ve370/7-14
        hazardtest4.txt", mem);
    instru = NOP;
  end

  always @(addr) begin
    if (addr != -4) begin
      instru = mem[addr >> 2];
    end

    $display("instruction = 0x%H", instru);
  end

endmodule
```

**DataMemory**

```
`timescale 1ns / 1ps

module data_memory(
  input clk,
  input MemWrite,
  input MemRead,
  input [63:0] ALUresult,
  input [63:0] writeData,
  output reg [63:0] readData
);

  parameter NONE = 64'b0;
  parameter SIZE = 128;
  reg [63:0] mem [SIZE - 1:0];

  // initially set default data to 0
  integer i;
  initial begin
    for (i = 0; i < SIZE; i = i + 1) begin
      mem[i] = NONE;
    end
  end

  // Write back Data Memory
  always @(*) begin
    if (MemRead == 1) begin
      readData = mem[ALUresult];
    end
  end

  // Write memory
  always @(negedge clk) begin
    if (MemWrite == 1) begin
      mem[ALUresult] = writeData;
    end
  end

endmodule
```

**Next PC**

```
`timescale 1ns / 1ps

module next_pc(
  input clock,
  input Jump,
  input Branch,
  input Zero,
```

```
  input PCWrite,
  input [31:0] old,
  input [63:0] alu_result,
  input [63:0] immediate,
  output reg [31:0] next
);

  reg [31:0] new;
  reg [63:0] origin;
  reg [63:0] jump;

  initial begin
    next = 32'b0;
    origin = 64'b0;
  end

  always @(old) begin
    new = old + 4;
    origin = {32'b0, old[31:0]};
  end

  always @(immediate, origin) begin
    jump = origin + (immediate>>1);
  end

  always @(posedge clock) begin
    // assign next program counter value
    if (PCWrite == 1) begin
      if (Branch == 1 & (Zero == 1 | Jump == 1)) begin
        next = jump[31:0];
      end else begin
        next = new;
      end
      if (Jump == 1 & Branch == 0) begin
        next = alu_result[31:0];
      end
    end else begin
      next = next;
    end

    // $display("Jump = 0x%H", Jump);
    // $display("Branch = 0x%H", Branch);
    // $display("Zero = 0x%H", Zero);
    // $display("PCWrite = 0x%H", PCWrite);
    // $display("old = 0x%H", old);
    // $display("origin = 0x%H", origin);
    // $display("jump = 0x%H", jump);
    // $display("new = 0x%H", new);
    // $display("next = 0x%H", next);
  end
```

```
endmodule
```

**Program Counter**

```
`timescale 1ns / 1ps

module program_counter(
  input clk,
  input [31:0] in,
  output reg [31:0] out
);

  initial begin
    out = -4;
  end

  always @(negedge clk) begin
    out = in;
  end

endmodule
```

**TestBench**

```
`timescale 1ns / 1ps

`include "main.v"

module testbench;
  integer currTime;
  reg clk;

  main uut(
    .clk (clk)
  );

  initial begin
    #0
    clk = 0;
    currTime = -10;
    uut.asset_pc.out = -4;
    $display("
      ==========================================================
      ");

    #2000 $display("
      ==========================================================
      ");
    #2000 $stop;
```

```
  end

  always @(posedge clk) begin
    // indicating a posedge clk triggered
    $display("
      ------------------------------------------------------------------
    ");
    #1; // wait for writing back
    $display("Time: %d, CLK = %d, PC = 0x%H", currTime, clk, uut
      .asset_pc.out);
    $display("[x0] = 0x%H", uut.asset_reg.RegData[0]);
    $display("[x1] = 0x%H", uut.asset_reg.RegData[1]);
    $display("[x2] = 0x%H", uut.asset_reg.RegData[2]);
    $display("[x3] = 0x%H", uut.asset_reg.RegData[3]);
    $display("[x4] = 0x%H", uut.asset_reg.RegData[4]);
    $display("[x5] = 0x%H", uut.asset_reg.RegData[5]);
    $display("[x6] = 0x%H", uut.asset_reg.RegData[6]);
    $display("[x7] = 0x%H", uut.asset_reg.RegData[7]);
    $display("[x8] = 0x%H", uut.asset_reg.RegData[8]);
    $display("[x9] = 0x%H", uut.asset_reg.RegData[9]);
    $display("[x10] = 0x%H", uut.asset_reg.RegData[10]);
    $display("[x11] = 0x%H", uut.asset_reg.RegData[11]);
    $display("[x12] = 0x%H", uut.asset_reg.RegData[12]);
    $display("[x13] = 0x%H", uut.asset_reg.RegData[13]);
    $display("[x14] = 0x%H", uut.asset_reg.RegData[14]);
    $display("[x15] = 0x%H", uut.asset_reg.RegData[15]);
    $display("[x16] = 0x%H", uut.asset_reg.RegData[16]);
    $display("[x17] = 0x%H", uut.asset_reg.RegData[17]);
    $display("[x18] = 0x%H", uut.asset_reg.RegData[18]);
    $display("[x19] = 0x%H", uut.asset_reg.RegData[19]);
    $display("[x20] = 0x%H", uut.asset_reg.RegData[20]);
    $display("[x21] = 0x%H", uut.asset_reg.RegData[21]);
    $display("[x22] = 0x%H", uut.asset_reg.RegData[22]);
    $display("[x23] = 0x%H", uut.asset_reg.RegData[23]);
    $display("[x24] = 0x%H", uut.asset_reg.RegData[24]);
    $display("[x25] = 0x%H", uut.asset_reg.RegData[25]);
    $display("[x26] = 0x%H", uut.asset_reg.RegData[26]);
    $display("[x27] = 0x%H", uut.asset_reg.RegData[27]);
    $display("[x28] = 0x%H", uut.asset_reg.RegData[28]);
    $display("[x29] = 0x%H", uut.asset_reg.RegData[29]);
    $display("[x30] = 0x%H", uut.asset_reg.RegData[30]);
    $display("[x31] = 0x%H", uut.asset_reg.RegData[31]);
  end

  always #10 begin
    clk = ~clk;
    currTime = currTime + 10;
  end

endmodule
```