ECE 4273 VLSI design

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Project Draft

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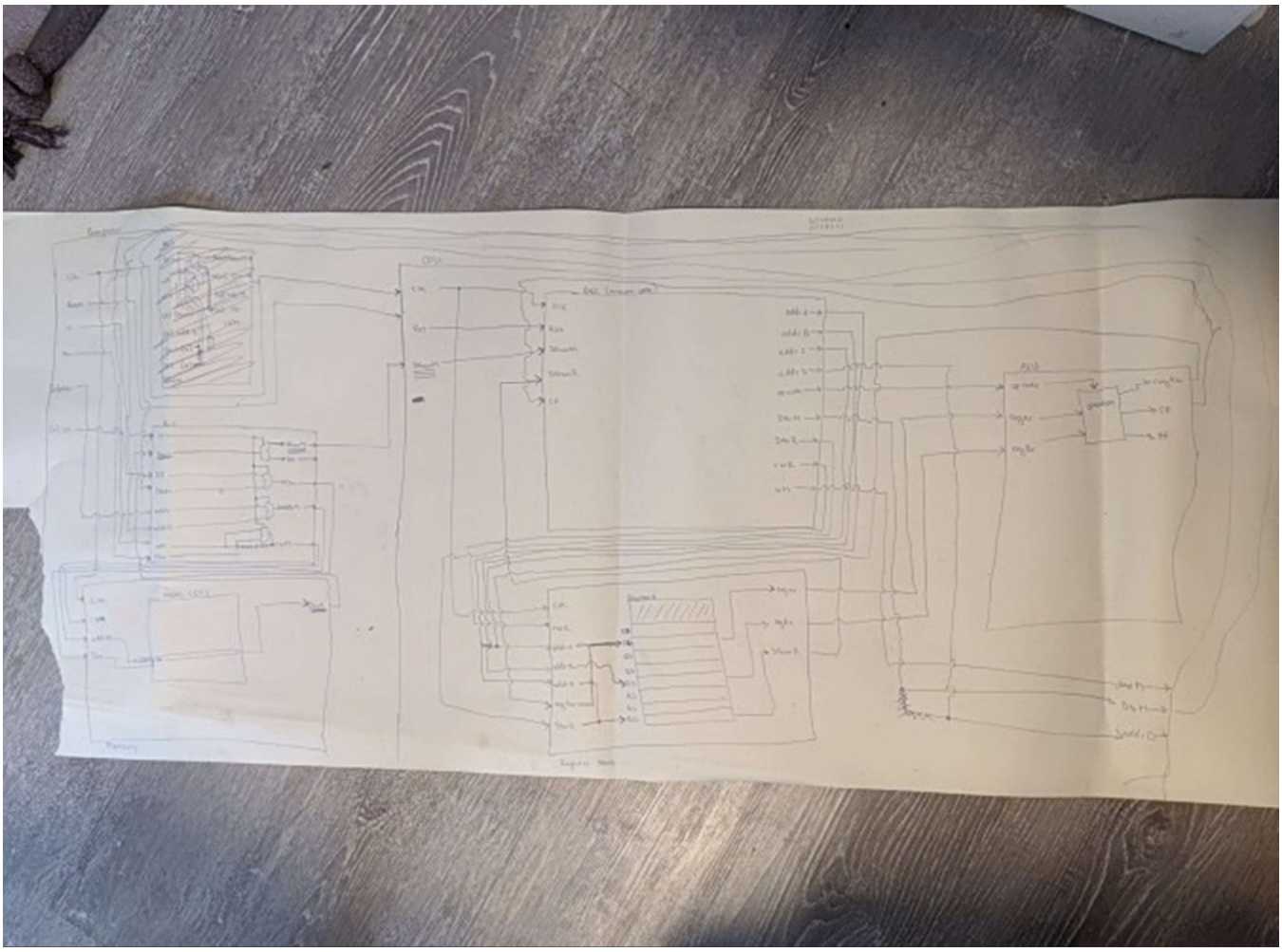
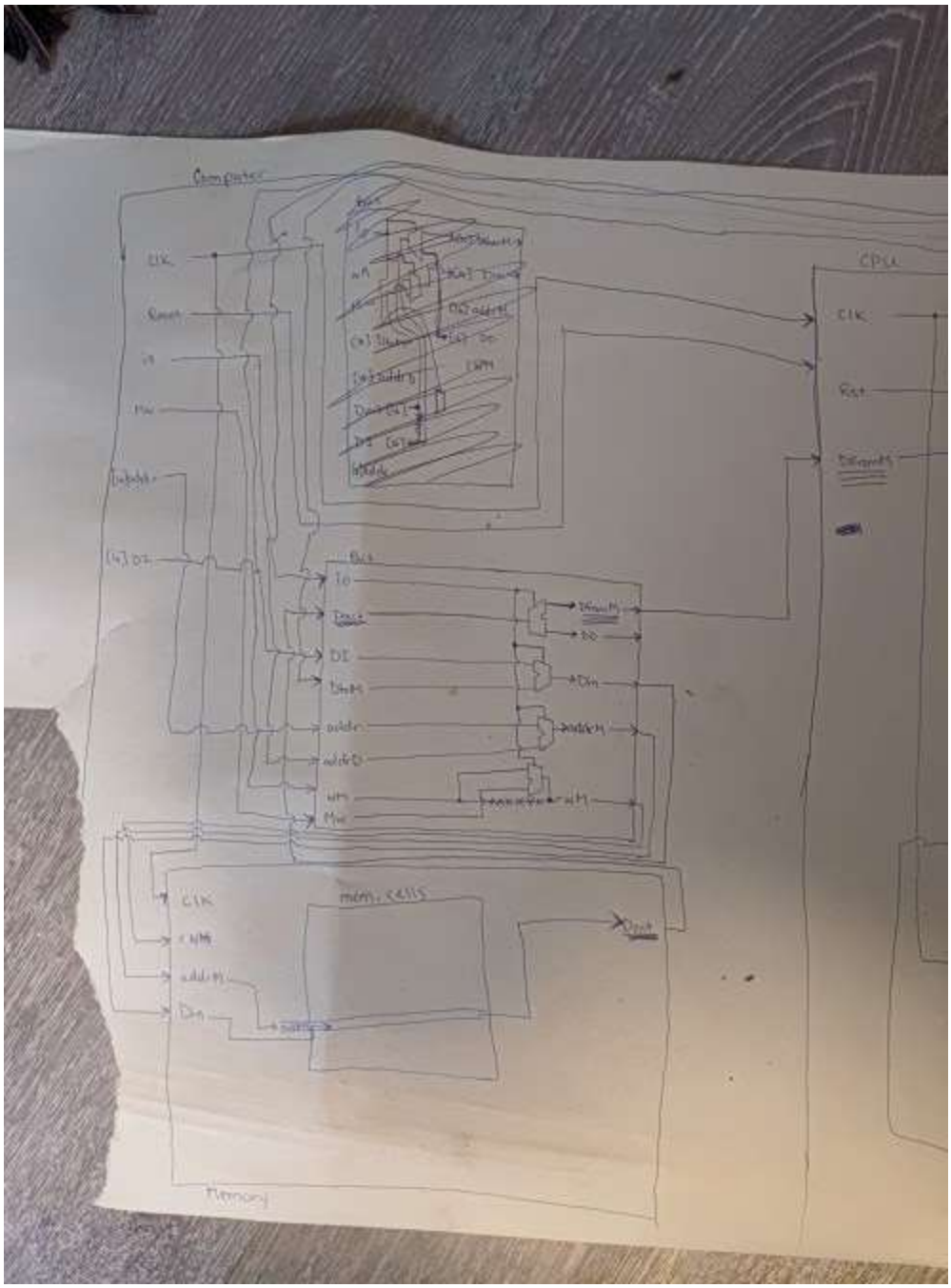
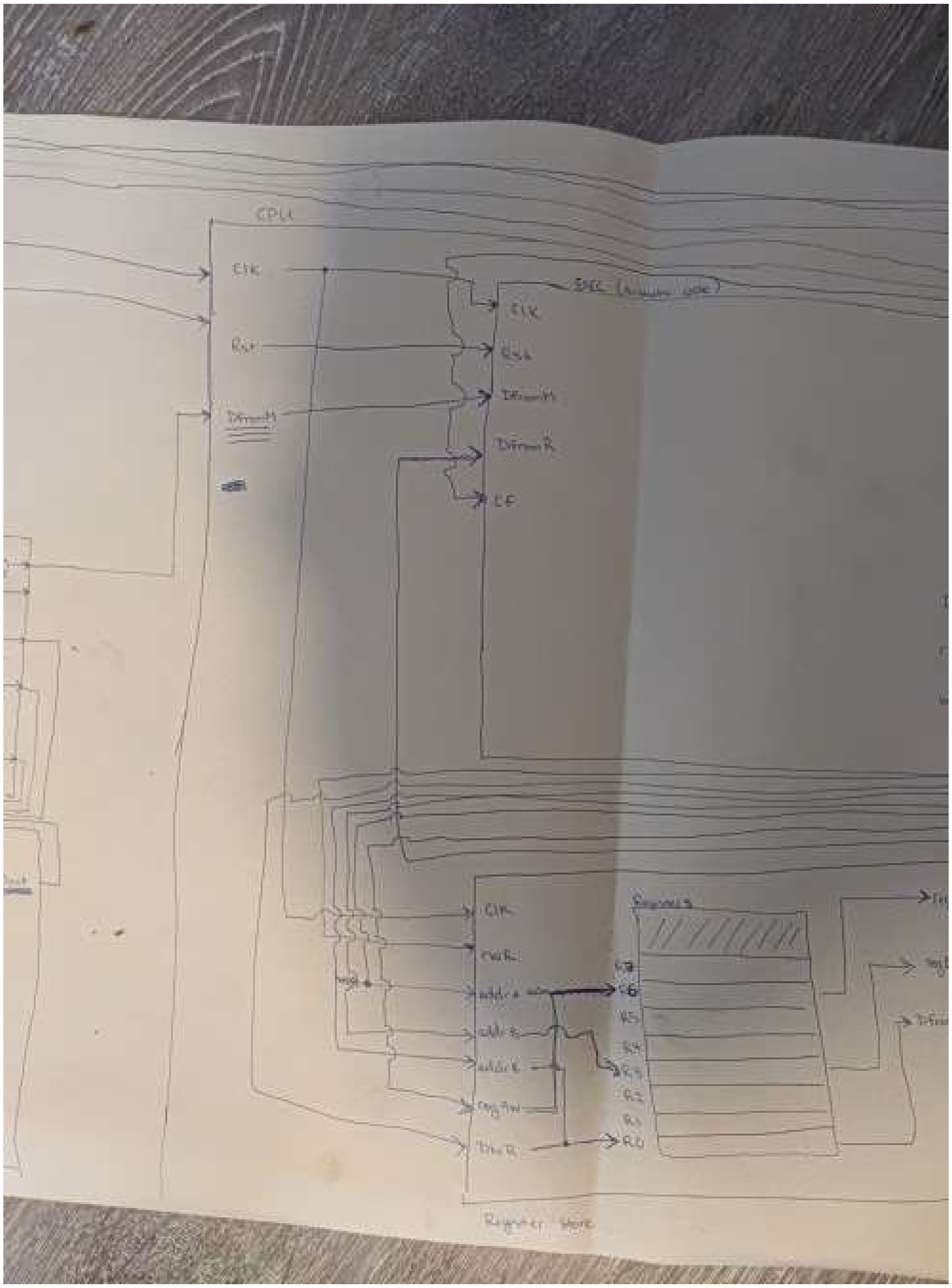
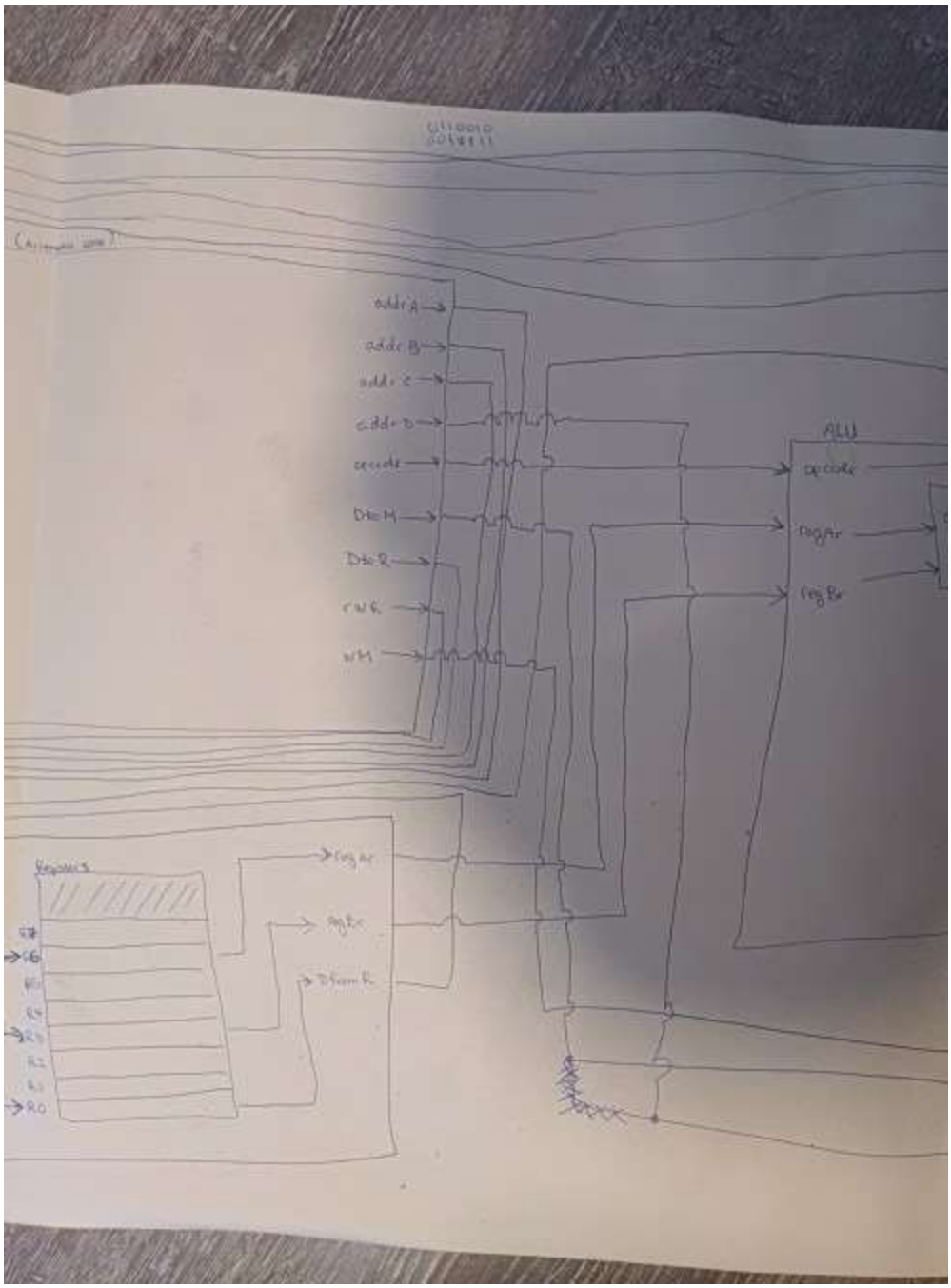
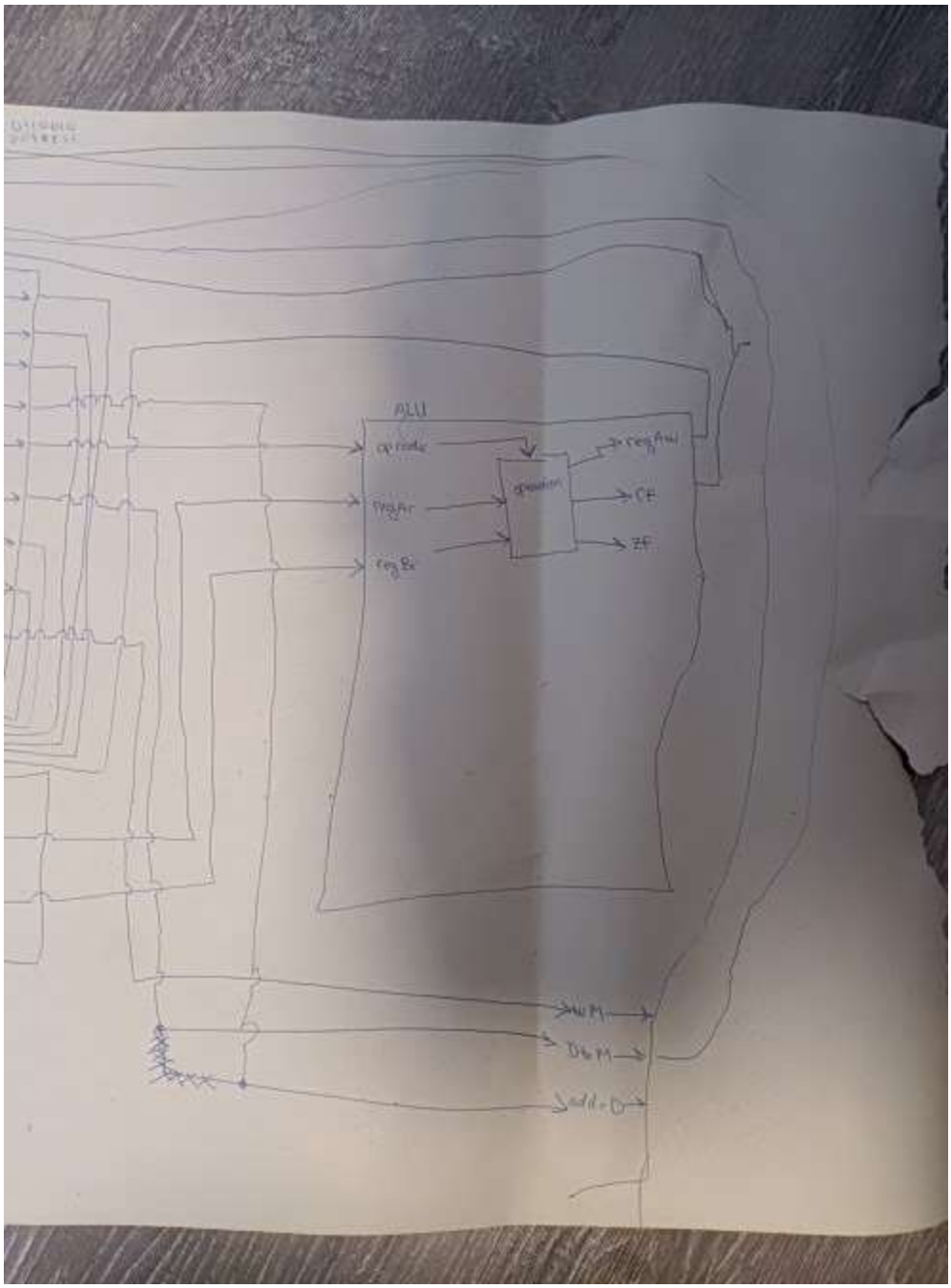
The following image(s) is a draft block diagram of the 16-bit microcomputer architecture:




CPU
CLK
DI
DO
mem. cells
Memory


CPU
Clk
Rst
DFromM
Clk
Rst
DFromM
DFromR
CF
Clk
rwR
addrA
addrB
addrC
DtoR
Registers
R0
Register store


addr A
addr B
addr C
addr D
opcode
DtoM
DtoR
rWR
wM
ALU
opcode
regAr
regBr
Registers
regAr
regBr
DfromR
R7
R6
R5
R4
R3
R2
R1
R0


ALU
opcode
regAr
regBr
operation
regAw
CF
ZF
WM
DtoM
Wd-D

The following Verilog code is the initial draft of a 16-bit microcomputer. The implementation is not complete as the code does not perform as expected and some debugging is still required.

```
`define reg_ADD 1
`define reg_SUB 2
`define reg_AND 3
`define reg_OR 4
`define reg_XOR 5

`define addr_ADD 6
`define addr_SUB 7
`define addr_AND 8
`define addr_OR 9
`define addr_XOR 10

`define JZ 11
`define LOAD 12
`define STORE 13

module ALU (
    input [3:0] opcode,
    input [15:0] regAr, regBr, op2,
    output reg [15:0] regAw,
    output reg CF, ZF
);
    always @(opcode, regAr, regBr, op2)
    begin
        case (opcode)
            `reg_ADD: {CF, regAw} = regAr + regBr;
            `reg_SUB: {CF, regAw} = regAr - regBr;
            `reg_AND: {CF, regAw} = regAr & regBr;
            `reg_OR: {CF, regAw} = regAr | regBr;
            `reg_XOR: {CF, regAw} = regAr ^ regBr;
            `addr_ADD: {CF, regAw} = regAr + op2;
            `addr_SUB: {CF, regAw} = regAr - op2;
            `addr_AND: {CF, regAw} = regAr & op2;
            `addr_OR: {CF, regAw} = regAr | op2;
            `addr_XOR: {CF, regAw} = regAr ^ op2;
        endcase

        ZF <= (regAw == 16'b0) ? 1 : 0;
    end

endmodule

module REGS (
    input clk, rwR,
    input [3:0] addrA, addrB, addrC,
    input [15:0] regAw, DtoR,
    output [15:0] regAr, regBr, DfromR
);

    reg [15:0] RegFile [7:0]; //8 16 bit registers

    assign regAr = RegFile[addrA];
    assign regBr = RegFile[addrB];
    assign DfromR = RegFile[addrC];

    always @(posedge clk)
    begin
        if (rwR) begin
```

```
            RegFile[addrA]=regAw;
            RegFile[addrC]=DtoR;
        end
    end
endmodule

module EXEC (
    input clk, R, CF,
    input [15:0] DfromM, DfromR,
    output reg [15:0] addrD, DtoM, DtoR,
    output reg [15:0] op2,
    output reg [3:0] addrA, addrB, addrC, opcode,
    output reg rwR, wM
);

    localparam fetch = 0;
    localparam decode = 1;
    localparam execute = 2;
    localparam increment_PC = 3;
    localparam next = 4;

    reg [15:0] IR, PC;
    reg [2:0] S;
    reg rwRM;

    always @(posedge clk)
    begin
        if(R) begin
            S = fetch;
            rwR = 0;
            wM = 0;
            opcode = 4'b0;

            addrD = 16'b0;
            PC = 16'b0;
        end else begin
            case (S)
                fetch:
                begin
                    IR = DfromM;
                    rwR = 0;
                    wM = 0;
                    S = decode;
                    opcode = 4'b0;
                end
                decode:
                begin
                    S = execute;
                    case (IR[15:12])
                        `reg_ADD, //fallthrough
                        `reg_SUB, //fallthrough
                        `reg_AND, //fallthrough
                        `reg_OR, //fallthrough
                        `reg_XOR:
                        begin
                            addrA = IR[11:8];
                            addrB = IR[7:4];
                            rwR = 0;
                            wM = 0;
                        end
                        `addr_ADD, //fallthrough
                        `addr_SUB, //fallthrough
                        `addr_AND, //fallthrough
                        `addr_OR, //fallthrough
```

```
        `addr_XOR:
        begin
            addrA = IR[11:8];
            if(IR[7:0] == 8'b0) begin
                //immediate value will follow
                addrD = PC+1; //get the next line for the immediate
            end else begin
                addrD = {8'b0, IR[7:0]};
            end
            rwR = 0;
            wM = 0;
        end
        `JZ:
        begin
            addrC = IR[11:8];
            rwR = 0;
            wM = 0;
        end
        `LOAD, //fallthrough
        `STORE:
        begin
            addrC = IR[11:8];
            addrD = {8'b0, IR[7:0]};
            rwR = 0;
            wM = 0;
        end
    endcase
end
execute:
begin
    S = increment_PC;
    case(IR[15:12])
        `reg_ADD, //fallthrough
        `reg_SUB, //fallthrough
        `reg_AND, //fallthrough
        `reg_OR, //fallthrough
        `reg_XOR:
        begin
            op2 = 0;
            rwR = 0;
            wM = 0;
        end
        `addr_ADD, //fallthrough
        `addr_SUB, //fallthrough
        `addr_AND, //fallthrough
        `addr_OR, //fallthrough
        `addr_XOR:
        begin
            op2 = DfromM;
            rwR = 0;
            wM = 0;
        end
        `JZ:
        begin
            if(DfromR == 16'b0) begin
                PC = PC + IR[7:0];
            end
        end
        `LOAD:
        begin
            DtoR = DfromM;
            rwR = 1;
            wM = 0;
        end
```

```
                        `STORE:
                        begin
                            DtoM = DfromR;
                            rwR = 0;
                            wM = 1;
                        end
                    endcase
                end
                increment_PC:
                begin
                    S = next;
                    opcode = IR[15:12];
                    PC = PC + 1;
                    case (IR[15:12])
                        `reg_ADD, //fallthrough
                        `reg_SUB, //fallthrough
                        `reg_AND, //fallthrough
                        `reg_OR, //fallthrough
                        `reg_XOR, //fallthrough
                        `addr_ADD, //fallthrough
                        `addr_SUB, //fallthrough
                        `addr_AND, //fallthrough
                        `addr_OR, //fallthrough
                        `addr_XOR:
                        begin
                            rwR=1;
                            wM=0;
                        end
                        `LOAD:
                        begin
                            rwR=0;
                            wM=0;
                        end
                        `STORE:
                        begin
                            rwR=0;
                            wM=1;
                        end
                        `JZ:
                        begin
                            rwR=0;
                            wM=0;
                        end
                    endcase
                end
                next:
                begin
                    S = fetch;
                    addrD = PC;
                    wM = 0;
                    rwR = 0;
                end
            endcase
        end
    end
endmodule

module CPU (
    input clk, R,
    input [15:0] DfromM,
    output wM,
    output [15:0] DtoM, addrD
);
```

```
    wire [15:0] op2;
    wire [3:0] addrA, addrB, addrC, opcode;
    wire [15:0] regAr, regBr, regAw, DtoR, DfromR;
    wire rwR, CF, ZF;

    EXEC ex (
                .clk(clk),
                .R(R),
                .opcode(opcode),
                .CF(CF),
                .addrD(addrD),
                .DfromM(DfromM),
                .DtoM(DtoM),
                .op2(op2),
                .addrA(addrA),
                .addrB(addrB),
                .addrC(addrC),
                .DtoR(DtoR),
                .DfromR(DfromR),
                .rwR(rwR),
                .wM(wM)
            );

    ALU alu1 (
                .opcode(opcode),
                .regAr(regAr),
                .regBr(regBr),
                .op2(op2),
                .regAw(regAw),
                .CF(CF),
                .ZF(ZF)
            );

    REGS rg (
                .clk(clk),
                .rwR(rwR),
                .addrA(addrA),
                .regAr(regAr),
                .regAw(regAw),
                .addrB(addrB),
                .regBr(regBr),
                .addrC(addrC),
                .DfromR(DfromR),
                .DtoR(DtoR)
            );
endmodule

module MEM (
    clk, rwM, addrM, Din, Dout
);
    parameter address_space = 16;
    parameter width = 16;

    input wire clk;
    input wire rwM;
    input wire [address_space-1:0] addrM;
    input wire [width-1:0] Din;
    output wire [width-1:0] Dout;

    reg [width-1:0] mem [(2**address_space)-1:0];

    assign Dout = mem[addrM];

    always @(posedge clk)
```

```
    begin
        if (rwM) begin
           mem[addrM]=Din;
        end
    end
endmodule

module BUS (
    input io, wM, Mw,
    input [15:0] DtoM, addrD, Dout, DI, addr,
    output reg [15:0] DfromM, Din, addrM, DO,
    output reg rwM
);

    always @(io or DtoM or addrD or Dout or DI or addr or wM or Mw)
    begin
        if (io) begin
            DO = Dout;
            Din = DI;
            addrM = addr;
            rwM = Mw;
        end else begin
            DfromM = Dout;
            Din = DtoM;
            addrM = addrD;
            rwM = wM;
        end
    end
endmodule

module comp001 (
    input wire clk, R, Mw,
    input io,
    input wire [15:0] addr, DI,
    output wire [15:0] DO
);

    wire wM, rwM;
    wire [15:0] DfromM, DtoM, addrD, Din, Dout, addrM;

    CPU cpu001 (
                .clk(clk),
                .R(R),
                .DfromM(DfromM),
                .addrD(addrD),
                .wM(wM),
                .DtoM(DtoM)
            );

    MEM mem001 (
                .clk(clk),
                .Din(Din),
                .Dout(Dout),
                .addrM(addrM),
                .rwM(rwM)
            );

    BUS bus001 (
                .io(io),
                .DfromM(DfromM),
                .DtoM(DtoM),
                .addrD(addrD),
                .Din(Din),
                .Dout(Dout),
```

```
                .addrM(addrM),
                .DO(DO),
                .DI(DI),
                .addr(addr),
                .wM(wM),
                .Mw(Mw),
                .rwM(rwM)
            );
Endmodule
```

The following Verilog code is the initial draft of the test bench required to simulate the 16-bit microcomputer:

```
module comp001_comptest_v_tf();

    integer i;

    parameter prog_start = 300;

    // Inputs
    reg clk;
    reg R;
    reg io;
    reg Mw;
    reg [15:0] addr;
    reg [15:0] DI;

    // Outputs
    wire [15:0] DO;

    // Bidirs
    // Instantiate the UUT

    comp001 uut (
                .clk(clk),
                .R(R),
                .io(io),
                .Mw(Mw),
                .addr(addr),
                .DI(DI),
                .DO(DO)
    );

    initial begin
        $monitor ("time=%t, clk=%b, R=%b, io=%b, Mw=%b, addr=%b, DI=%b, D0=%b", $realtime, clk,
R, io, Mw, addr, DI, DO);
    end

    initial begin
        clk = 0;
        R = 0;
        io = 0;
        Mw = 0;
        addr = 16'b0;
        DI = 16'b0;
    end

    always
        #20 clk = ~clk;

    initial begin
```

```
R = 1;   // Reset high
io = 1;  // Store our program in memory
addr = prog_start;  // start at the beginning of program memory
#40; //full clock cycle

Mw = 1;

//*********************************************//
//           Set all registers to 0            //
//*********************************************//


DI = 16'b0;
addr = 20;

#40; //full clock cycle
addr = prog_start;
DI = 16'b1100000000010100; // LOAD r1, 00010100  -- r0 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100000100010100; // LOAD r1, 00010100  -- r1 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100001000010100; // LOAD r2, 00010100  -- r2 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100001100010100; // LOAD r3, 00010100  -- r3 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100010000010100; // LOAD r4, 00010100  -- r4 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100010100010100; // LOAD r5, 00010100  -- r5 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100011000010100; // LOAD r6, 00010100  -- r6 = 0

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100011100010100; // LOAD r7, 00010100  -- r7 = 0

//
//start program
//

//*********************************************//
//           Test immediate values             //
//                  &                          //
//             Populate registers              //
//                                             //
//            Store result of each             //
//           operation in memory for           //
//             verifying result                //
//*********************************************//
DI = 16'b0110000100000000; // ADD r1, 30
#40; //full clock cycle
addr = addr + 1;
DI = 30; // imm16
```

```
#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000100110010; // STORE r1, 00110010

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0110001000000000; // ADD r2, 50
#40; //full clock cycle
addr = addr + 1;
DI = 20; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101001000110011; // STORE r2, 00110011

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0110001100000000; // ADD r3, 1
#40; //full clock cycle
addr = addr + 1;
DI = 1; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101001100110100; // STORE r3, 00110100

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0110010000000000; // ADD r4, 25
#40; //full clock cycle
addr = addr + 1;
DI = 25; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101010000110101; // STORE r4, 00110101

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0111000100000000; // SUB r1, 16 -- r1 now should equal 14
#40; //full clock cycle
addr = addr + 1;
DI = 16; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000100110111; // STORE r1, 00110111

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1000001000000000; // AND r2, 30 -- r2 now should equal 18
#40; //full clock cycle
addr = addr + 1;
DI = 30; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101001000111000; // STORE r2, 00111000

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1001000100000000; // OR r3, 30 -- r3 should now be 31
#40; //full clock cycle
```

```
addr = addr + 1;
DI = 30; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101001100111001; // STORE r3, 00111001

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1010000100000000; // XOR r4, imm16 --r4 should now be 6
#40; //full clock cycle
addr = addr + 1;
DI = 31; // imm16

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101010000111010; // STORE r4, 00111010

#40; //full clock cycle
addr = addr + 1;

//*********************************************//
//           Test register values              //
//                                             //
//            Store result of each             //
//           operation in memory for           //
//             verifying result                //
//*********************************************//

DI = 16'b0001000010010ZZZZ; // ADD r1, r2  -- r1 should now be 32

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000100111011; // STORE r1, 00111011

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0010000010010ZZZZ; // SUB r1, r3 -- r1 should now be 1

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000100111100; // STORE r1, 00111100

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0011000010010ZZZZ; // AND r2, r4 -- r2 should now be 2

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101001000111101; // STORE r2, 00111101

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0100000010010ZZZZ; // OR r3, r1  -- r3 remains at 31

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101001100111110; // STORE r3, 00111110

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0101000010010ZZZZ; // XOR r4, r2  -- r4 should now be 27

#40; //full clock cycle
```

```
addr = addr + 1;
DI = 16'b1101010000111111; // STORE r4, 00111111

//*********************************************//
//           Test LOAD and STORE               //
//*********************************************//

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101010101000000; // STORE r5, 01000000 (to see the before value)

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000101000001; // STORE r1, 01000001    -- store r1 in memory
#40; //full clock cycle
addr = addr + 1;
DI = 16'b1100010101000001; // LOAD r5, 01000001     -- load it back, into r5

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101010101000010; // STORE r5, 01000010     -- verify result

//*********************************************//
//           Test opcode with addr8            //
//*********************************************//

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0110000100110010; // ADD r1, [00111100]

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000101000011; // STORE r1, 01000011

#40; //full clock cycle
addr = addr + 1;
DI = 16'b0111000100110011; // SUB r1, [00111101]

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000101000100; // STORE r1, 01000100

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1000000100110100; // AND r1, [00111110]

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000101000101; // STORE r1, 01000101

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1001000100110101; // OR r1, [00111111]

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1101000101000110; // STORE r1, 01000110

#40; //full clock cycle
addr = addr + 1;
DI = 16'b1010000100110111; // XOR r1, [00111011]

#40; //full clock cycle
addr = addr + 1;
```

```
        DI = 16'b1101000101000110; // STORE r1, 01000111

        #40; //full clock cycle
        addr = addr + 1;
        DI = 16'b1011000111110001; // JZ r1, address        Jump back 15 instructions

        /* Wait for last 15 instructions to repeat */
        for (i=0; i<15; i=i+1) begin
            #40;
        end

        Mw = 0;
        io = 0;
        R = 1;
        #40;
        R = 0;

        /* Wait for instructions to be executed by computer */
        for (i=0; i<60; i=i+1) begin
            #40;
        end

        io = 1;
        addr = prog_start;


        /* Read program from memory */
        for (i=0; i<60; i=i+1) begin
            #40 addr = addr + 1;
        end

        addr = 20;
        /* Read results of operations */
        for (i=0; i<30; i=i+1) begin
            #40 addr = addr + 1;
        end


        $finish;
        $stop;
    end
endmodule
```

The following is the current output from the simulated 16-bit microcomputer:

```
time=            0, clk=0, R=1, io=1, Mw=0, addr=0000000100101100, DI=0000000000000000, D0=xxxxxxxxxxxxxxxx
time=        20000, clk=1, R=1, io=1, Mw=0, addr=0000000100101100, DI=0000000000000000, D0=xxxxxxxxxxxxxxxx
time=        40000, clk=0, R=1, io=1, Mw=1, addr=0000000000010100, DI=0000000000000000, D0=xxxxxxxxxxxxxxxx
time=        60000, clk=1, R=1, io=1, Mw=1, addr=0000000000010100, DI=0000000000000000, D0=0000000000000000
time=        80000, clk=0, R=1, io=1, Mw=1, addr=0000000100101100, DI=1100000000010100, D0=xxxxxxxxxxxxxxxx
time=       100000, clk=1, R=1, io=1, Mw=1, addr=0000000100101100, DI=1100000000010100, D0=1100000000010100
time=       120000, clk=0, R=1, io=1, Mw=1, addr=0000000100101101, DI=1100000100010100, D0=xxxxxxxxxxxxxxxx
time=       140000, clk=1, R=1, io=1, Mw=1, addr=0000000100101101, DI=1100000100010100, D0=1100000100010100
time=       160000, clk=0, R=1, io=1, Mw=1, addr=0000000100101110, DI=1100001000010100, D0=xxxxxxxxxxxxxxxx
time=       180000, clk=1, R=1, io=1, Mw=1, addr=0000000100101110, DI=1100001000010100, D0=1100001000010100
time=       200000, clk=0, R=1, io=1, Mw=1, addr=0000000100101111, DI=1100001100010100, D0=xxxxxxxxxxxxxxxx
time=       220000, clk=1, R=1, io=1, Mw=1, addr=0000000100101111, DI=1100001100010100, D0=1100001100010100
time=       240000, clk=0, R=1, io=1, Mw=1, addr=0000000100110000, DI=1100010000010100, D0=xxxxxxxxxxxxxxxx
time=       260000, clk=1, R=1, io=1, Mw=1, addr=0000000100110000, DI=1100010000010100, D0=1100010000010100
time=       280000, clk=0, R=1, io=1, Mw=1, addr=0000000100110001, DI=1100010100010100, D0=xxxxxxxxxxxxxxxx
time=       300000, clk=1, R=1, io=1, Mw=1, addr=0000000100110001, DI=1100010100010100, D0=1100010100010100
time=       320000, clk=0, R=1, io=1, Mw=1, addr=0000000100110010, DI=1100011000010100, D0=xxxxxxxxxxxxxxxx
time=       340000, clk=1, R=1, io=1, Mw=1, addr=0000000100110010, DI=1100011000010100, D0=1100011000010100
time=       360000, clk=0, R=1, io=1, Mw=1, addr=0000000100110011, DI=0110000100000000, D0=xxxxxxxxxxxxxxxx
time=       380000, clk=1, R=1, io=1, Mw=1, addr=0000000100110011, DI=0110000100000000, D0=0110000100000000
time=       400000, clk=0, R=1, io=1, Mw=1, addr=0000000100110100, DI=0000000000011110, D0=xxxxxxxxxxxxxxxx
time=       420000, clk=1, R=1, io=1, Mw=1, addr=0000000100110100, DI=0000000000011110, D0=0000000000011110
time=       440000, clk=0, R=1, io=1, Mw=1, addr=0000000100110101, DI=1101000100110010, D0=xxxxxxxxxxxxxxxx
time=       460000, clk=1, R=1, io=1, Mw=1, addr=0000000100110101, DI=1101000100110010, D0=1101000100110010
time=       480000, clk=0, R=1, io=1, Mw=1, addr=0000000100110110, DI=0110001000000000, D0=xxxxxxxxxxxxxxxx
time=       500000, clk=1, R=1, io=1, Mw=1, addr=0000000100110110, DI=0110001000000000, D0=0110001000000000
time=       520000, clk=0, R=1, io=1, Mw=1, addr=0000000100110111, DI=0000000000010100, D0=xxxxxxxxxxxxxxxx
time=       540000, clk=1, R=1, io=1, Mw=1, addr=0000000100110111, DI=0000000000010100, D0=0000000000010100
time=       560000, clk=0, R=1, io=1, Mw=1, addr=0000000100111000, DI=1101001000110011, D0=xxxxxxxxxxxxxxxx
time=       580000, clk=1, R=1, io=1, Mw=1, addr=0000000100111000, DI=1101001000110011, D0=1101001000110011
time=       600000, clk=0, R=1, io=1, Mw=1, addr=0000000100111001, DI=0110001100000000, D0=xxxxxxxxxxxxxxxx
time=       620000, clk=1, R=1, io=1, Mw=1, addr=0000000100111001, DI=0110001100000000, D0=0110001100000000
time=       640000, clk=0, R=1, io=1, Mw=1, addr=0000000100111010, DI=0000000000000001, D0=xxxxxxxxxxxxxxxx
time=       660000, clk=1, R=1, io=1, Mw=1, addr=0000000100111010, DI=0000000000000001, D0=0000000000000001
time=       680000, clk=0, R=1, io=1, Mw=1, addr=0000000100111011, DI=1101001100110100, D0=xxxxxxxxxxxxxxxx
time=       700000, clk=1, R=1, io=1, Mw=1, addr=0000000100111011, DI=1101001100110100, D0=1101001100110100
time=       720000, clk=0, R=1, io=1, Mw=1, addr=0000000100111100, DI=0110010000000000, D0=xxxxxxxxxxxxxxxx
time=       740000, clk=1, R=1, io=1, Mw=1, addr=0000000100111100, DI=0110010000000000, D0=0110010000000000
time=       760000, clk=0, R=1, io=1, Mw=1, addr=0000000100111101, DI=0000000000011001, D0=xxxxxxxxxxxxxxxx
time=       780000, clk=1, R=1, io=1, Mw=1, addr=0000000100111101, DI=0000000000011001, D0=0000000000011001
time=       800000, clk=0, R=1, io=1, Mw=1, addr=0000000100111110, DI=1101010000110101, D0=xxxxxxxxxxxxxxxx
time=       820000, clk=1, R=1, io=1, Mw=1, addr=0000000100111110, DI=1101010000110101, D0=1101010000110101
time=       840000, clk=0, R=1, io=1, Mw=1, addr=0000000100111111, DI=0111000100000000, D0=xxxxxxxxxxxxxxxx
time=       860000, clk=1, R=1, io=1, Mw=1, addr=0000000100111111, DI=0111000100000000, D0=0111000100000000
time=       880000, clk=0, R=1, io=1, Mw=1, addr=0000000101000000, DI=0000000000010000, D0=xxxxxxxxxxxxxxxx
time=       900000, clk=1, R=1, io=1, Mw=1, addr=0000000101000000, DI=0000000000010000, D0=0000000000010000
time=       920000, clk=0, R=1, io=1, Mw=1, addr=0000000101000001, DI=1101000100110111, D0=xxxxxxxxxxxxxxxx
time=       940000, clk=1, R=1, io=1, Mw=1, addr=0000000101000001, DI=1101000100110111, D0=1101000100110111
time=       960000, clk=0, R=1, io=1, Mw=1, addr=0000000101000010, DI=1000001000000000, D0=xxxxxxxxxxxxxxxx
time=       980000, clk=1, R=1, io=1, Mw=1, addr=0000000101000010, DI=1000001000000000, D0=1000001000000000
time=      1000000, clk=0, R=1, io=1, Mw=1, addr=0000000101000011, DI=0000000000011110, D0=xxxxxxxxxxxxxxxx
time=      1020000, clk=1, R=1, io=1, Mw=1, addr=0000000101000011, DI=0000000000011110, D0=0000000000011110
time=      1040000, clk=0, R=1, io=1, Mw=1, addr=0000000101000100, DI=1101001000111000, D0=xxxxxxxxxxxxxxxx
time=      1060000, clk=1, R=1, io=1, Mw=1, addr=0000000101000100, DI=1101001000111000, D0=1101001000111000
time=      1080000, clk=0, R=1, io=1, Mw=1, addr=0000000101000101, DI=1001000100000000, D0=xxxxxxxxxxxxxxxx
time=      1100000, clk=1, R=1, io=1, Mw=1, addr=0000000101000101, DI=1001000100000000, D0=1001000100000000
time=      1120000, clk=0, R=1, io=1, Mw=1, addr=0000000101000110, DI=0000000000011110, D0=xxxxxxxxxxxxxxxx
time=      1140000, clk=1, R=1, io=1, Mw=1, addr=0000000101000110, DI=0000000000011110, D0=0000000000011110
time=      1160000, clk=0, R=1, io=1, Mw=1, addr=0000000101000111, DI=1101001100111001, D0=xxxxxxxxxxxxxxxx
time=      1180000, clk=1, R=1, io=1, Mw=1, addr=0000000101000111, DI=1101001100111001, D0=1101001100111001
time=      1200000, clk=0, R=1, io=1, Mw=1, addr=0000000101001000, DI=1010000100000000, D0=xxxxxxxxxxxxxxxx
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time=      1220000, clk=1, R=1, io=1, Mw=1, addr=0000000101001000, DI=1010000100000000, D0=1010000100000000
time=      1240000, clk=0, R=1, io=1, Mw=1, addr=0000000101001001, DI=0000000000011111, D0=xxxxxxxxxxxxxxxx
time=      1260000, clk=1, R=1, io=1, Mw=1, addr=0000000101001001, DI=0000000000011111, D0=0000000000011111
time=      1280000, clk=0, R=1, io=1, Mw=1, addr=0000000101001010, DI=1101010000111010, D0=xxxxxxxxxxxxxxxx
time=      1300000, clk=1, R=1, io=1, Mw=1, addr=0000000101001010, DI=1101010000111010, D0=1101010000111010
time=      1320000, clk=0, R=1, io=1, Mw=1, addr=0000000101001011, DI=0001000010010zzzz, D0=xxxxxxxxxxxxxxxx
time=      1340000, clk=1, R=1, io=1, Mw=1, addr=0000000101001011, DI=0001000010010zzzz, D0=0001000010010zzzz
time=      1360000, clk=0, R=1, io=1, Mw=1, addr=0000000101001100, DI=1101000100111011, D0=xxxxxxxxxxxxxxxx
time=      1380000, clk=1, R=1, io=1, Mw=1, addr=0000000101001100, DI=1101000100111011, D0=1101000100111011
time=      1400000, clk=0, R=1, io=1, Mw=1, addr=0000000101001101, DI=0010000010010zzzz, D0=xxxxxxxxxxxxxxxx
time=      1420000, clk=1, R=1, io=1, Mw=1, addr=0000000101001101, DI=0010000010010zzzz, D0=0010000010010zzzz
time=      1440000, clk=0, R=1, io=1, Mw=1, addr=0000000101001110, DI=1101000100111100, D0=xxxxxxxxxxxxxxxx
time=      1460000, clk=1, R=1, io=1, Mw=1, addr=0000000101001110, DI=1101000100111100, D0=1101000100111100
time=      1480000, clk=0, R=1, io=1, Mw=1, addr=0000000101001111, DI=0011000010010zzzz, D0=xxxxxxxxxxxxxxxx
time=      1500000, clk=1, R=1, io=1, Mw=1, addr=0000000101001111, DI=0011000010010zzzz, D0=0011000010010zzzz
time=      1520000, clk=0, R=1, io=1, Mw=1, addr=0000000101010000, DI=1101001000111101, D0=xxxxxxxxxxxxxxxx
time=      1540000, clk=1, R=1, io=1, Mw=1, addr=0000000101010000, DI=1101001000111101, D0=1101001000111101
time=      1560000, clk=0, R=1, io=1, Mw=1, addr=0000000101010001, DI=0100000010010zzzz, D0=xxxxxxxxxxxxxxxx
time=      1580000, clk=1, R=1, io=1, Mw=1, addr=0000000101010001, DI=0100000010010zzzz, D0=0100000010010zzzz
time=      1600000, clk=0, R=1, io=1, Mw=1, addr=0000000101010010, DI=1101001100111110, D0=xxxxxxxxxxxxxxxx
time=      1620000, clk=1, R=1, io=1, Mw=1, addr=0000000101010010, DI=1101001100111110, D0=1101001100111110
time=      1640000, clk=0, R=1, io=1, Mw=1, addr=0000000101010011, DI=0101000010010zzzz, D0=xxxxxxxxxxxxxxxx
time=      1660000, clk=1, R=1, io=1, Mw=1, addr=0000000101010011, DI=0101000010010zzzz, D0=0101000010010zzzz
time=      1680000, clk=0, R=1, io=1, Mw=1, addr=0000000101010100, DI=1101010000111111, D0=xxxxxxxxxxxxxxxx
time=      1700000, clk=1, R=1, io=1, Mw=1, addr=0000000101010100, DI=1101010000111111, D0=1101010000111111
time=      1720000, clk=0, R=1, io=1, Mw=1, addr=0000000101010101, DI=1101010101000000, D0=xxxxxxxxxxxxxxxx
time=      1740000, clk=1, R=1, io=1, Mw=1, addr=0000000101010101, DI=1101010101000000, D0=1101010101000000
time=      1760000, clk=0, R=1, io=1, Mw=1, addr=0000000101010110, DI=1101000101000001, D0=xxxxxxxxxxxxxxxx
time=      1780000, clk=1, R=1, io=1, Mw=1, addr=0000000101010110, DI=1101000101000001, D0=1101000101000001
time=      1800000, clk=0, R=1, io=1, Mw=1, addr=0000000101010111, DI=1100010101000001, D0=xxxxxxxxxxxxxxxx
time=      1820000, clk=1, R=1, io=1, Mw=1, addr=0000000101010111, DI=1100010101000001, D0=1100010101000001
time=      1840000, clk=0, R=1, io=1, Mw=1, addr=0000000101011000, DI=1101010101000010, D0=xxxxxxxxxxxxxxxx
time=      1860000, clk=1, R=1, io=1, Mw=1, addr=0000000101011000, DI=1101010101000010, D0=1101010101000010
time=      1880000, clk=0, R=1, io=1, Mw=1, addr=0000000101011001, DI=0110000100110010, D0=xxxxxxxxxxxxxxxx
time=      1900000, clk=1, R=1, io=1, Mw=1, addr=0000000101011001, DI=0110000100110010, D0=0110000100110010
time=      1920000, clk=0, R=1, io=1, Mw=1, addr=0000000101011010, DI=1101000101000011, D0=xxxxxxxxxxxxxxxx
time=      1940000, clk=1, R=1, io=1, Mw=1, addr=0000000101011010, DI=1101000101000011, D0=1101000101000011
time=      1960000, clk=0, R=1, io=1, Mw=1, addr=0000000101011011, DI=0111000100110011, D0=xxxxxxxxxxxxxxxx
time=      1980000, clk=1, R=1, io=1, Mw=1, addr=0000000101011011, DI=0111000100110011, D0=0111000100110011
time=      2000000, clk=0, R=1, io=1, Mw=1, addr=0000000101011100, DI=1101000101000100, D0=xxxxxxxxxxxxxxxx
time=      2020000, clk=1, R=1, io=1, Mw=1, addr=0000000101011100, DI=1101000101000100, D0=1101000101000100
time=      2040000, clk=0, R=1, io=1, Mw=1, addr=0000000101011101, DI=1000000100110100, D0=xxxxxxxxxxxxxxxx
time=      2060000, clk=1, R=1, io=1, Mw=1, addr=0000000101011101, DI=1000000100110100, D0=1000000100110100
time=      2080000, clk=0, R=1, io=1, Mw=1, addr=0000000101011110, DI=1101000101000101, D0=xxxxxxxxxxxxxxxx
time=      2100000, clk=1, R=1, io=1, Mw=1, addr=0000000101011110, DI=1101000101000101, D0=1101000101000101
time=      2120000, clk=0, R=1, io=1, Mw=1, addr=0000000101011111, DI=1001000100110101, D0=xxxxxxxxxxxxxxxx
time=      2140000, clk=1, R=1, io=1, Mw=1, addr=0000000101011111, DI=1001000100110101, D0=1001000100110101
time=      2160000, clk=0, R=1, io=1, Mw=1, addr=0000000101100000, DI=1101000101000110, D0=xxxxxxxxxxxxxxxx
time=      2180000, clk=1, R=1, io=1, Mw=1, addr=0000000101100000, DI=1101000101000110, D0=1101000101000110
time=      2200000, clk=0, R=1, io=1, Mw=1, addr=0000000101100001, DI=1010000100110111, D0=xxxxxxxxxxxxxxxx
time=      2220000, clk=1, R=1, io=1, Mw=1, addr=0000000101100001, DI=1010000100110111, D0=1010000100110111
time=      2240000, clk=0, R=1, io=1, Mw=1, addr=0000000101100010, DI=1101000101000110, D0=xxxxxxxxxxxxxxxx
time=      2260000, clk=1, R=1, io=1, Mw=1, addr=0000000101100010, DI=1101000101000110, D0=1101000101000110
time=      2280000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      2300000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2320000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2340000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2360000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2380000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2400000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2420000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2440000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2460000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2480000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
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time=      2500000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2520000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2540000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2560000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2580000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2600000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2620000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2640000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2660000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2680000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2700000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2720000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2740000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2760000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2780000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2800000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2820000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2840000, clk=0, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2860000, clk=1, R=1, io=1, Mw=1, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2880000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2900000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2920000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2940000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2960000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      2980000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3000000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3020000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3040000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3060000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3080000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3100000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3120000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3140000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3160000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3180000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3200000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3220000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3240000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3260000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3280000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3300000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3320000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3340000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3360000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3380000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3400000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3420000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3440000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3460000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3480000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3500000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3520000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3540000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3560000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3580000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3600000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3620000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3640000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3660000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3680000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3700000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3720000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3740000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3760000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
```

```
time=      3780000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3800000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3820000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3840000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3860000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3880000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3900000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3920000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3940000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3960000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      3980000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4000000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4020000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4040000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4060000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4080000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4100000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4120000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4140000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4160000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4180000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4200000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4220000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4240000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4260000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4280000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4300000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4320000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4340000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4360000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4380000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4400000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4420000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4440000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4460000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4480000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4500000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4520000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4540000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4560000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4580000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4600000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4620000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4640000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4660000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4680000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4700000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4720000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4740000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4760000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4780000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4800000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4820000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4840000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4860000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4880000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4900000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4920000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4940000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4960000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      4980000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5000000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5020000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5040000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
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time=      5060000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5080000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5100000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5120000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5140000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5160000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5180000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5200000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5220000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5240000, clk=0, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5260000, clk=1, R=0, io=0, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      5280000, clk=0, R=0, io=1, Mw=0, addr=0000000100101100, DI=1011000111110001, D0=1100000000010100
time=      5300000, clk=1, R=0, io=1, Mw=0, addr=0000000100101100, DI=1011000111110001, D0=1100000000010100
time=      5320000, clk=0, R=0, io=1, Mw=0, addr=0000000100101101, DI=1011000111110001, D0=1100000100010100
time=      5340000, clk=1, R=0, io=1, Mw=0, addr=0000000100101101, DI=1011000111110001, D0=1100000100010100
time=      5360000, clk=0, R=0, io=1, Mw=0, addr=0000000100101110, DI=1011000111110001, D0=1100001000010100
time=      5380000, clk=1, R=0, io=1, Mw=0, addr=0000000100101110, DI=1011000111110001, D0=1100001000010100
time=      5400000, clk=0, R=0, io=1, Mw=0, addr=0000000100101111, DI=1011000111110001, D0=1100001100010100
time=      5420000, clk=1, R=0, io=1, Mw=0, addr=0000000100101111, DI=1011000111110001, D0=1100001100010100
time=      5440000, clk=0, R=0, io=1, Mw=0, addr=0000000100110000, DI=1011000111110001, D0=1100010000010100
time=      5460000, clk=1, R=0, io=1, Mw=0, addr=0000000100110000, DI=1011000111110001, D0=1100010000010100
time=      5480000, clk=0, R=0, io=1, Mw=0, addr=0000000100110001, DI=1011000111110001, D0=1100010100010100
time=      5500000, clk=1, R=0, io=1, Mw=0, addr=0000000100110001, DI=1011000111110001, D0=1100010100010100
time=      5520000, clk=0, R=0, io=1, Mw=0, addr=0000000100110010, DI=1011000111110001, D0=1100011000010100
time=      5540000, clk=1, R=0, io=1, Mw=0, addr=0000000100110010, DI=1011000111110001, D0=1100011000010100
time=      5560000, clk=0, R=0, io=1, Mw=0, addr=0000000100110011, DI=1011000111110001, D0=0110000100000000
time=      5580000, clk=1, R=0, io=1, Mw=0, addr=0000000100110011, DI=1011000111110001, D0=0110000100000000
time=      5600000, clk=0, R=0, io=1, Mw=0, addr=0000000100110100, DI=1011000111110001, D0=0000000000011110
time=      5620000, clk=1, R=0, io=1, Mw=0, addr=0000000100110100, DI=1011000111110001, D0=0000000000011110
time=      5640000, clk=0, R=0, io=1, Mw=0, addr=0000000100110101, DI=1011000111110001, D0=1101000100110010
time=      5660000, clk=1, R=0, io=1, Mw=0, addr=0000000100110101, DI=1011000111110001, D0=1101000100110010
time=      5680000, clk=0, R=0, io=1, Mw=0, addr=0000000100110110, DI=1011000111110001, D0=0110001000000000
time=      5700000, clk=1, R=0, io=1, Mw=0, addr=0000000100110110, DI=1011000111110001, D0=0110001000000000
time=      5720000, clk=0, R=0, io=1, Mw=0, addr=0000000100110111, DI=1011000111110001, D0=0000000000010100
time=      5740000, clk=1, R=0, io=1, Mw=0, addr=0000000100110111, DI=1011000111110001, D0=0000000000010100
time=      5760000, clk=0, R=0, io=1, Mw=0, addr=0000000100111000, DI=1011000111110001, D0=1101001000110011
time=      5780000, clk=1, R=0, io=1, Mw=0, addr=0000000100111000, DI=1011000111110001, D0=1101001000110011
time=      5800000, clk=0, R=0, io=1, Mw=0, addr=0000000100111001, DI=1011000111110001, D0=0110001100000000
time=      5820000, clk=1, R=0, io=1, Mw=0, addr=0000000100111001, DI=1011000111110001, D0=0110001100000000
time=      5840000, clk=0, R=0, io=1, Mw=0, addr=0000000100111010, DI=1011000111110001, D0=0000000000000001
time=      5860000, clk=1, R=0, io=1, Mw=0, addr=0000000100111010, DI=1011000111110001, D0=0000000000000001
time=      5880000, clk=0, R=0, io=1, Mw=0, addr=0000000100111011, DI=1011000111110001, D0=1101001100110100
time=      5900000, clk=1, R=0, io=1, Mw=0, addr=0000000100111011, DI=1011000111110001, D0=1101001100110100
time=      5920000, clk=0, R=0, io=1, Mw=0, addr=0000000100111100, DI=1011000111110001, D0=0110010000000000
time=      5940000, clk=1, R=0, io=1, Mw=0, addr=0000000100111100, DI=1011000111110001, D0=0110010000000000
time=      5960000, clk=0, R=0, io=1, Mw=0, addr=0000000100111101, DI=1011000111110001, D0=0000000000011001
time=      5980000, clk=1, R=0, io=1, Mw=0, addr=0000000100111101, DI=1011000111110001, D0=0000000000011001
time=      6000000, clk=0, R=0, io=1, Mw=0, addr=0000000100111110, DI=1011000111110001, D0=1101010000110101
time=      6020000, clk=1, R=0, io=1, Mw=0, addr=0000000100111110, DI=1011000111110001, D0=1101010000110101
time=      6040000, clk=0, R=0, io=1, Mw=0, addr=0000000100111111, DI=1011000111110001, D0=0111000100000000
time=      6060000, clk=1, R=0, io=1, Mw=0, addr=0000000100111111, DI=1011000111110001, D0=0111000100000000
time=      6080000, clk=0, R=0, io=1, Mw=0, addr=0000000101000000, DI=1011000111110001, D0=0000000000010000
time=      6100000, clk=1, R=0, io=1, Mw=0, addr=0000000101000000, DI=1011000111110001, D0=0000000000010000
time=      6120000, clk=0, R=0, io=1, Mw=0, addr=0000000101000001, DI=1011000111110001, D0=1101000100110111
time=      6140000, clk=1, R=0, io=1, Mw=0, addr=0000000101000001, DI=1011000111110001, D0=1101000100110111
time=      6160000, clk=0, R=0, io=1, Mw=0, addr=0000000101000010, DI=1011000111110001, D0=1000001000000000
time=      6180000, clk=1, R=0, io=1, Mw=0, addr=0000000101000010, DI=1011000111110001, D0=1000001000000000
time=      6200000, clk=0, R=0, io=1, Mw=0, addr=0000000101000011, DI=1011000111110001, D0=0000000000011110
time=      6220000, clk=1, R=0, io=1, Mw=0, addr=0000000101000011, DI=1011000111110001, D0=0000000000011110
time=      6240000, clk=0, R=0, io=1, Mw=0, addr=0000000101000100, DI=1011000111110001, D0=1101001000111000
time=      6260000, clk=1, R=0, io=1, Mw=0, addr=0000000101000100, DI=1011000111110001, D0=1101001000111000
time=      6280000, clk=0, R=0, io=1, Mw=0, addr=0000000101000101, DI=1011000111110001, D0=1001000100000000
time=      6300000, clk=1, R=0, io=1, Mw=0, addr=0000000101000101, DI=1011000111110001, D0=1001000100000000
time=      6320000, clk=0, R=0, io=1, Mw=0, addr=0000000101000110, DI=1011000111110001, D0=0000000000011110
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time=      6340000, clk=1, R=0, io=1, Mw=0, addr=0000000101000110, DI=1011000111110001, D0=0000000000011110
time=      6360000, clk=0, R=0, io=1, Mw=0, addr=0000000101000111, DI=1011000111110001, D0=1101001100111001
time=      6380000, clk=1, R=0, io=1, Mw=0, addr=0000000101000111, DI=1011000111110001, D0=1101001100111001
time=      6400000, clk=0, R=0, io=1, Mw=0, addr=0000000101001000, DI=1011000111110001, D0=1010000100000000
time=      6420000, clk=1, R=0, io=1, Mw=0, addr=0000000101001000, DI=1011000111110001, D0=1010000100000000
time=      6440000, clk=0, R=0, io=1, Mw=0, addr=0000000101001001, DI=1011000111110001, D0=0000000000011111
time=      6460000, clk=1, R=0, io=1, Mw=0, addr=0000000101001001, DI=1011000111110001, D0=0000000000011111
time=      6480000, clk=0, R=0, io=1, Mw=0, addr=0000000101001010, DI=1011000111110001, D0=1101010000111010
time=      6500000, clk=1, R=0, io=1, Mw=0, addr=0000000101001010, DI=1011000111110001, D0=1101010000111010
time=      6520000, clk=0, R=0, io=1, Mw=0, addr=0000000101001011, DI=1011000111110001, D0=000100010010zzzz
time=      6540000, clk=1, R=0, io=1, Mw=0, addr=0000000101001011, DI=1011000111110001, D0=000100010010zzzz
time=      6560000, clk=0, R=0, io=1, Mw=0, addr=0000000101001100, DI=1011000111110001, D0=1101000100111011
time=      6580000, clk=1, R=0, io=1, Mw=0, addr=0000000101001100, DI=1011000111110001, D0=1101000100111011
time=      6600000, clk=0, R=0, io=1, Mw=0, addr=0000000101001101, DI=1011000111110001, D0=0010000100010zzzz
time=      6620000, clk=1, R=0, io=1, Mw=0, addr=0000000101001101, DI=1011000111110001, D0=0010000100010zzzz
time=      6640000, clk=0, R=0, io=1, Mw=0, addr=0000000101001110, DI=1011000111110001, D0=1101000100111100
time=      6660000, clk=1, R=0, io=1, Mw=0, addr=0000000101001110, DI=1011000111110001, D0=1101000100111100
time=      6680000, clk=0, R=0, io=1, Mw=0, addr=0000000101001111, DI=1011000111110001, D0=0011000100010zzzz
time=      6700000, clk=1, R=0, io=1, Mw=0, addr=0000000101001111, DI=1011000111110001, D0=0011000100010zzzz
time=      6720000, clk=0, R=0, io=1, Mw=0, addr=0000000101010000, DI=1011000111110001, D0=1101001000111101
time=      6740000, clk=1, R=0, io=1, Mw=0, addr=0000000101010000, DI=1011000111110001, D0=1101001000111101
time=      6760000, clk=0, R=0, io=1, Mw=0, addr=0000000101010001, DI=1011000111110001, D0=0100000100010zzzz
time=      6780000, clk=1, R=0, io=1, Mw=0, addr=0000000101010001, DI=1011000111110001, D0=0100000100010zzzz
time=      6800000, clk=0, R=0, io=1, Mw=0, addr=0000000101010010, DI=1011000111110001, D0=1101001100111110
time=      6820000, clk=1, R=0, io=1, Mw=0, addr=0000000101010010, DI=1011000111110001, D0=1101001100111110
time=      6840000, clk=0, R=0, io=1, Mw=0, addr=0000000101010011, DI=1011000111110001, D0=0101000100010zzzz
time=      6860000, clk=1, R=0, io=1, Mw=0, addr=0000000101010011, DI=1011000111110001, D0=0101000100010zzzz
time=      6880000, clk=0, R=0, io=1, Mw=0, addr=0000000101010100, DI=1011000111110001, D0=1101010000111111
time=      6900000, clk=1, R=0, io=1, Mw=0, addr=0000000101010100, DI=1011000111110001, D0=1101010000111111
time=      6920000, clk=0, R=0, io=1, Mw=0, addr=0000000101010101, DI=1011000111110001, D0=1101010101000000
time=      6940000, clk=1, R=0, io=1, Mw=0, addr=0000000101010101, DI=1011000111110001, D0=1101010101000000
time=      6960000, clk=0, R=0, io=1, Mw=0, addr=0000000101010110, DI=1011000111110001, D0=1101000101000001
time=      6980000, clk=1, R=0, io=1, Mw=0, addr=0000000101010110, DI=1011000111110001, D0=1101000101000001
time=      7000000, clk=0, R=0, io=1, Mw=0, addr=0000000101010111, DI=1011000111110001, D0=1100010101000001
time=      7020000, clk=1, R=0, io=1, Mw=0, addr=0000000101010111, DI=1011000111110001, D0=1100010101000001
time=      7040000, clk=0, R=0, io=1, Mw=0, addr=0000000101011000, DI=1011000111110001, D0=1101010101000010
time=      7060000, clk=1, R=0, io=1, Mw=0, addr=0000000101011000, DI=1011000111110001, D0=1101010101000010
time=      7080000, clk=0, R=0, io=1, Mw=0, addr=0000000101011001, DI=1011000111110001, D0=0110000100110010
time=      7100000, clk=1, R=0, io=1, Mw=0, addr=0000000101011001, DI=1011000111110001, D0=0110000100110010
time=      7120000, clk=0, R=0, io=1, Mw=0, addr=0000000101011010, DI=1011000111110001, D0=1101000101000011
time=      7140000, clk=1, R=0, io=1, Mw=0, addr=0000000101011010, DI=1011000111110001, D0=1101000101000011
time=      7160000, clk=0, R=0, io=1, Mw=0, addr=0000000101011011, DI=1011000111110001, D0=0111000100110011
time=      7180000, clk=1, R=0, io=1, Mw=0, addr=0000000101011011, DI=1011000111110001, D0=0111000100110011
time=      7200000, clk=0, R=0, io=1, Mw=0, addr=0000000101011100, DI=1011000111110001, D0=1101000101000100
time=      7220000, clk=1, R=0, io=1, Mw=0, addr=0000000101011100, DI=1011000111110001, D0=1101000101000100
time=      7240000, clk=0, R=0, io=1, Mw=0, addr=0000000101011101, DI=1011000111110001, D0=1000000100110100
time=      7260000, clk=1, R=0, io=1, Mw=0, addr=0000000101011101, DI=1011000111110001, D0=1000000100110100
time=      7280000, clk=0, R=0, io=1, Mw=0, addr=0000000101011110, DI=1011000111110001, D0=1101000101000101
time=      7300000, clk=1, R=0, io=1, Mw=0, addr=0000000101011110, DI=1011000111110001, D0=1101000101000101
time=      7320000, clk=0, R=0, io=1, Mw=0, addr=0000000101011111, DI=1011000111110001, D0=1001000100110101
time=      7340000, clk=1, R=0, io=1, Mw=0, addr=0000000101011111, DI=1011000111110001, D0=1001000100110101
time=      7360000, clk=0, R=0, io=1, Mw=0, addr=0000000101100000, DI=1011000111110001, D0=1101000101000110
time=      7380000, clk=1, R=0, io=1, Mw=0, addr=0000000101100000, DI=1011000111110001, D0=1101000101000110
time=      7400000, clk=0, R=0, io=1, Mw=0, addr=0000000101100001, DI=1011000111110001, D0=1010000100110111
time=      7420000, clk=1, R=0, io=1, Mw=0, addr=0000000101100001, DI=1011000111110001, D0=1010000100110111
time=      7440000, clk=0, R=0, io=1, Mw=0, addr=0000000101100010, DI=1011000111110001, D0=1101000101000110
time=      7460000, clk=1, R=0, io=1, Mw=0, addr=0000000101100010, DI=1011000111110001, D0=1101000101000110
time=      7480000, clk=0, R=0, io=1, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      7500000, clk=1, R=0, io=1, Mw=0, addr=0000000101100011, DI=1011000111110001, D0=1011000111110001
time=      7520000, clk=0, R=0, io=1, Mw=0, addr=0000000101100100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7540000, clk=1, R=0, io=1, Mw=0, addr=0000000101100100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7560000, clk=0, R=0, io=1, Mw=0, addr=0000000101100101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7580000, clk=1, R=0, io=1, Mw=0, addr=0000000101100101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7600000, clk=0, R=0, io=1, Mw=0, addr=0000000101100110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
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time=      7620000, clk=1, R=0, io=1, Mw=0, addr=0000000101100110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7640000, clk=0, R=0, io=1, Mw=0, addr=0000000101100111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7660000, clk=1, R=0, io=1, Mw=0, addr=0000000101100111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7680000, clk=0, R=0, io=1, Mw=0, addr=0000000000010100, DI=1011000111110001, D0=0000000000000000
time=      7700000, clk=1, R=0, io=1, Mw=0, addr=0000000000010100, DI=1011000111110001, D0=0000000000000000
time=      7720000, clk=0, R=0, io=1, Mw=0, addr=0000000000010101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7740000, clk=1, R=0, io=1, Mw=0, addr=0000000000010101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7760000, clk=0, R=0, io=1, Mw=0, addr=0000000000010110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7780000, clk=1, R=0, io=1, Mw=0, addr=0000000000010110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7800000, clk=0, R=0, io=1, Mw=0, addr=0000000000010111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7820000, clk=1, R=0, io=1, Mw=0, addr=0000000000010111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7840000, clk=0, R=0, io=1, Mw=0, addr=0000000000011000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7860000, clk=1, R=0, io=1, Mw=0, addr=0000000000011000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7880000, clk=0, R=0, io=1, Mw=0, addr=0000000000011001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7900000, clk=1, R=0, io=1, Mw=0, addr=0000000000011001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7920000, clk=0, R=0, io=1, Mw=0, addr=0000000000011010, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7940000, clk=1, R=0, io=1, Mw=0, addr=0000000000011010, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7960000, clk=0, R=0, io=1, Mw=0, addr=0000000000011011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      7980000, clk=1, R=0, io=1, Mw=0, addr=0000000000011011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8000000, clk=0, R=0, io=1, Mw=0, addr=0000000000011100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8020000, clk=1, R=0, io=1, Mw=0, addr=0000000000011100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8040000, clk=0, R=0, io=1, Mw=0, addr=0000000000011101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8060000, clk=1, R=0, io=1, Mw=0, addr=0000000000011101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8080000, clk=0, R=0, io=1, Mw=0, addr=0000000000011110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8100000, clk=1, R=0, io=1, Mw=0, addr=0000000000011110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8120000, clk=0, R=0, io=1, Mw=0, addr=0000000000011111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8140000, clk=1, R=0, io=1, Mw=0, addr=0000000000011111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8160000, clk=0, R=0, io=1, Mw=0, addr=0000000000100000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8180000, clk=1, R=0, io=1, Mw=0, addr=0000000000100000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8200000, clk=0, R=0, io=1, Mw=0, addr=0000000000100001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8220000, clk=1, R=0, io=1, Mw=0, addr=0000000000100001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8240000, clk=0, R=0, io=1, Mw=0, addr=0000000000100010, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8260000, clk=1, R=0, io=1, Mw=0, addr=0000000000100010, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8280000, clk=0, R=0, io=1, Mw=0, addr=0000000000100011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8300000, clk=1, R=0, io=1, Mw=0, addr=0000000000100011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8320000, clk=0, R=0, io=1, Mw=0, addr=0000000000100100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8340000, clk=1, R=0, io=1, Mw=0, addr=0000000000100100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8360000, clk=0, R=0, io=1, Mw=0, addr=0000000000100101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8380000, clk=1, R=0, io=1, Mw=0, addr=0000000000100101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8400000, clk=0, R=0, io=1, Mw=0, addr=0000000000100110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8420000, clk=1, R=0, io=1, Mw=0, addr=0000000000100110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8440000, clk=0, R=0, io=1, Mw=0, addr=0000000000100111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8460000, clk=1, R=0, io=1, Mw=0, addr=0000000000100111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8480000, clk=0, R=0, io=1, Mw=0, addr=0000000000101000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8500000, clk=1, R=0, io=1, Mw=0, addr=0000000000101000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8520000, clk=0, R=0, io=1, Mw=0, addr=0000000000101001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8540000, clk=1, R=0, io=1, Mw=0, addr=0000000000101001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8560000, clk=0, R=0, io=1, Mw=0, addr=0000000000101010, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8580000, clk=1, R=0, io=1, Mw=0, addr=0000000000101010, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8600000, clk=0, R=0, io=1, Mw=0, addr=0000000000101011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8620000, clk=1, R=0, io=1, Mw=0, addr=0000000000101011, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8640000, clk=0, R=0, io=1, Mw=0, addr=0000000000101100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8660000, clk=1, R=0, io=1, Mw=0, addr=0000000000101100, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8680000, clk=0, R=0, io=1, Mw=0, addr=0000000000101101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8700000, clk=1, R=0, io=1, Mw=0, addr=0000000000101101, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8720000, clk=0, R=0, io=1, Mw=0, addr=0000000000101110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8740000, clk=1, R=0, io=1, Mw=0, addr=0000000000101110, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8760000, clk=0, R=0, io=1, Mw=0, addr=0000000000101111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8780000, clk=1, R=0, io=1, Mw=0, addr=0000000000101111, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8800000, clk=0, R=0, io=1, Mw=0, addr=0000000000110000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8820000, clk=1, R=0, io=1, Mw=0, addr=0000000000110000, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8840000, clk=0, R=0, io=1, Mw=0, addr=0000000000110001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
time=      8860000, clk=1, R=0, io=1, Mw=0, addr=0000000000110001, DI=1011000111110001, D0=xxxxxxxxxxxxxxxx
```