

به نام خدا

پروژه اول
طراحی کامپیوتری
سیستم های دیجیتال
پاییز 1401

فاطمه شاه حسینی 810199440

محیا نفیسی 810198524

فایل های وریدلگ:

```
`timescale 1ns/1ns
module Controller (
    set,
    calc
);
    input set;
    output reg calc;
    always@(set)begin
        calc = 1'b0;
        if(set == 1'b1)
            calc = 1'b1;
        end
endmodule
```

```
`timescale 1ns/1ns
module DataPath (
    in,
    out,
    calc,
    set
);
    parameter memsize = 25;

    input calc, set;
    input [memsize-1:0]in;
    output [memsize-1:0]out;

    Reg25 permutation_reg(in, out, calc, set);
endmodule
```

```
`timescale 1ns/1ns
`define EOF 32'hFFFF_FFFF

module TB ();

    reg [24:0] Mem [0:63];
    reg [24:0]line;
    wire [24:0]mem;

    reg set = 1'b1;
    wire calc;

    reg [8*11:0]inFileName = "0.in";
    reg [8*12:0]outFileName = "0.out";

    integer test, i, outFile, testCounts=3, k;

    DataPath db(line, mem, calc, set);
    Controller cu(set, calc);

    initial begin
        for (k = 0; k < testCounts; k = k+1) begin
            $sformat(inFileName, "%0d.in", k);
            $sformat(outFileName, "%0d.out", k);
            $readmemb(inFileName,Mem);
            test = $fopen(inFileName, "r");
            outFile = $fopen(outFileName, "w");

            for(i = 0; i < 64; i = i+1) begin
                line = Mem[i];
                #5 set = 1'b1;
                #5;
                $fwriteb(outFile, mem);
                $fdisplay(outFile, "");
            end
            #5 set = 1'b0;
            end
            $fclose(test);
            $fclose(outFile);
        end
        #1000;
        $stop;
    end
endmodule
```

```
`timescale 1ns/1ns
module Reg25 (
    in,
    out,
    calc,
    set
);
    parameter memsize = 25;

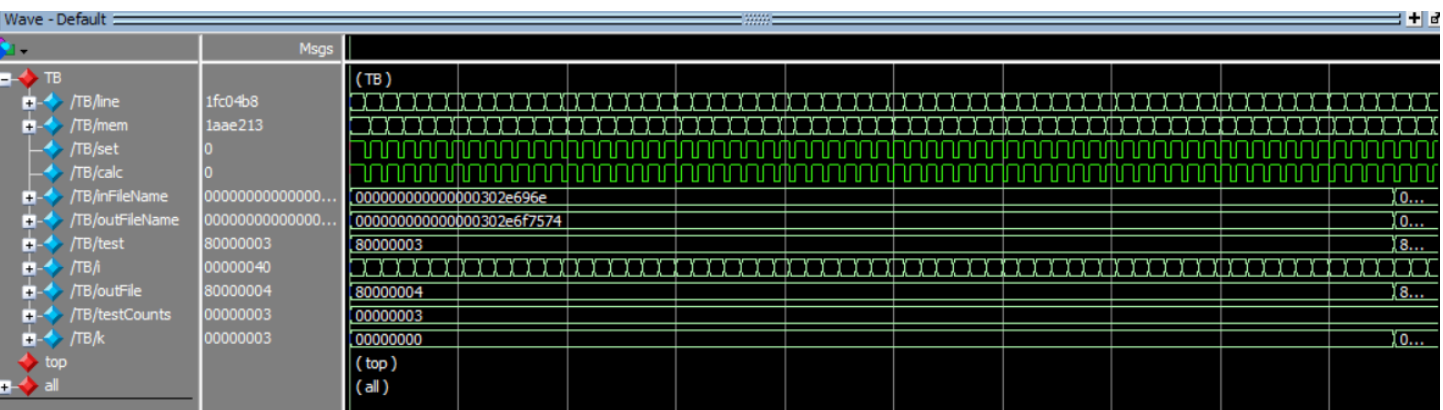
    input calc, set;
    input [memsize-1:0]in;
    output [memsize-1:0]out;

    reg [memsize-1:0]mem;

    always @(posedge set)
        mem = in;

    always @(posedge calc) begin
        mem[10] <= mem[0];
        mem[11] <= mem[6];
        mem[12] <= mem[12];
        mem[13] <= mem[18];
        mem[14] <= mem[24];
        mem[20] <= mem[1];
        mem[21] <= mem[7];
        mem[22] <= mem[13];
        mem[23] <= mem[19];
        mem[5] <= mem[2];
        mem[6] <= mem[8];
        mem[7] <= mem[14];
        mem[24] <= mem[20];
        mem[15] <= mem[3];
        mem[16] <= mem[9];
        mem[8] <= mem[15];
        mem[9] <= mem[21];
        mem[0] <= mem[4];
        mem[17] <= mem[10];
        mem[18] <= mem[16];
        mem[19] <= mem[22];
        mem[1] <= mem[5];
        mem[2] <= mem[11];
        mem[3] <= mem[17];
        mem[4] <= mem[23];
    end
end
```

:Waveform



: Run in Modelsim

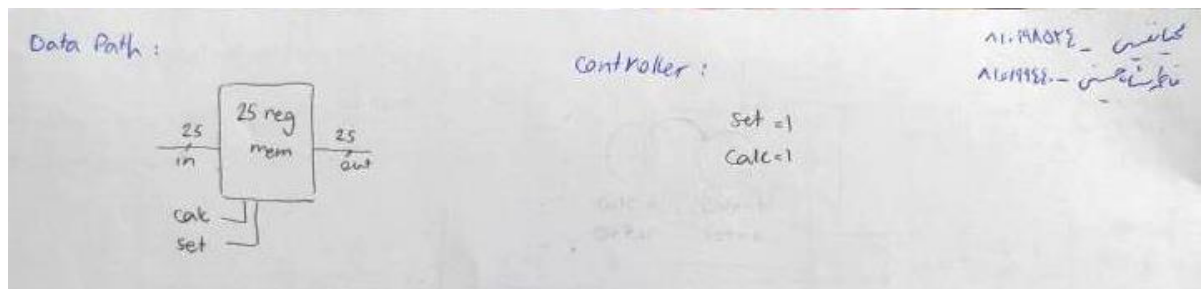
```

# -- Skipping module Reg25
#
# Top level modules:
#   Reg25
# End time: 00:01:57 on Dec 29,2022, Elapsed time: 0:00:00
# Errors: 0, Warnings: 0
# Model Technology ModelSim - Intel FPGA Edition vlog 2020.1 Compiler 2020.02 Feb 28 2020
# Start time: 00:01:57 on Dec 29,2022
# vlog -reportprogress 300 "+acc" -incr -source "+incdir+../src/inc" "+define+SIM" ./tb/TB.v
# -- Skipping module TB
#
# Top level modules:
#   TB
# End time: 00:01:57 on Dec 29,2022, Elapsed time: 0:00:00
# Errors: 0, Warnings: 0
# End time: 00:02:01 on Dec 29,2022, Elapsed time: 0:00:53
# Errors: 0, Warnings: 0
# vsim -voptargs="+acc" -debugDB TB
# Start time: 00:02:01 on Dec 29,2022
# Loading work.TB
# Loading work.DataPath
# Loading work.Reg25
# Loading work.Controller
# ** Note: (vsim-8716) Reusing existing debug database vsim.dbg.
# ** Note: (vsim-8716) No database found matching 1/TB/cont.tcl
do sim_top.tcl

VSIIM 59> do sim_top.tcl

```

Data Path and Controller



Test cases

0.out<<

The two files are identical

Editor ▾

Compare & merge

Clear

↔

Export as PDF

Original Text 📄

Changed Text 📄

52 1011000011110011001011010
53 1111011100011110100111110
54 1011101001101101000111111
55 1011101010100111010100001
56 1110000100011111100010100
57 1101110101111010011101101
58 1001101000011111000001110
59 0110000111011111000111001
60 0100001010011100101001110
61 1010111111010110001101000
62 0110110111110101000100000
63 0110100000110110101001101
64 0001111010100010000000010
65

52 1011000011110011001011010
53 1111011100011110100111110
54 1011101001101101000111111
55 1011101010100111010100001
56 1110000100011111100010100
57 1101110101111010011101101
58 1001101000011111000001110
59 0110000111011111000111001
60 0100001010011100101001110
61 1010111111010110001101000
62 0110110111110101000100000
63 0110100000110110101001101
64 0001111010100010000000010
65

1.out<<

The two files are identical

Editor ▾

Compare & merge

Clear

↔

Export as f

Original Text 📄

Changed Text 📄

52 1010111010011101010100001
53 0111100111111011110011001
54 0101000010111010011110001
55 1010001110011101000100111
56 0000001010001011100101000
57 1110000101010010111011111
58 0111110101011100100001101
59 01001001011001011110101101
60 1101000011010000010010100
61 0110011111000100010000001
62 1100111100011100010001000
63 0001011011101001010111101
64 1100011010001000111011100
65

52 1010111010011101010100001
53 0111100111111011110011001
54 0101000010111010011110001
55 1010001110011101000100111
56 0000001010001011100101000
57 1110000101010010111011111
58 0111110101011100100001101
59 01001001011001011110101101
60 1101000011010000010010100
61 0110011111000100010000001
62 1100111100011100010001000
63 0001011011101001010111101
64 1100011010001000111011100
65

2.out <<

The two files are identical

Editor ▾

Compare & merge

Clear

↔

Export as P

Original Text 📄

Changed Text 📄

52 0000101010110011001111000
53 0010111111111001111010010
54 0000111011000010000001110
55 0101011001100010001000110
56 0011010100010110101011100
57 0011111000010010001100101
58 0110001000101000000001111
59 0001000001011010011111010
60 1101111000111111001010000
61 1000101011011110110100101
62 1110001110111001011111011
63 1100001101001000101100000
64 11010101110001000010011
65

52 0000101010110011001111000
53 0010111111111001111010010
54 0000111011000010000001110
55 0101011001100010001000110
56 0011010100010110101011100
57 0011111000010010001100101
58 0110001000101000000001111
59 0001000001011010011111010
60 1101111000111111001010000
61 1000101011011110110100101
62 1110001110111001011111011
63 1100001101001000101100000
64 11010101110001000010011
65