Name (Pin Yin): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_



**QUPT EE310 2020 Fall Quiz 4a**

**(15min, 20pts)**

1. (2pts) What type of information is stored in the instruction register (IR)?

An 8-bit opcode and an 8-bit operand that can either be an address or a value.

The opcode is the computer instruction that is to be carried out.

1. (1pts) What type of information is stored in a program counter (PC)?

contains the memory address of the (current/next) instruction

1. (1pts) What type of information is stored in an accumulator (AC)?

The Accumulator (AC) stores the results of the ALU when loaded and feeds those results back to the ALU as an input.



1. (2pts) Draw a serial-in and serial-out register and explain how it works.

The serial in/serial out register accepts input to the LSB of the register (D input) and gives an output from the Q port of the MSB. During each clock cycle, each bit’s value is moved to the next higher bit from LSB to MSB and finally output via the MSB.



1. (14pts) Read the following System Verilog program for an IR register and finish the truth table below



*module ir (input logic clk, reset, load\_iru, load\_irl,*

*input logic [7:0] opcodedata\_in,*

*input logic signed [7:0] data\_in,*

*output logic [7:0] opcode\_out,*

*output logic signed [7:0] add\_val\_out);*

*always\_ff @(posedge clk,posedge reset)*

*if (reset)*

*begin*

*opcode\_out <= 8’h00;*

*add\_val\_out <= 8’h00;*

*end*

*else if (load\_iru & ~load\_irl) opcode\_out <= opcodedata\_in;*

*else if (~load\_iru & load\_irl) add\_val\_out <= data\_in;*

*endmodule*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| clk | reset | load\_iru\_in | load\_irl\_in | data\_in | opcode\_out | add\_val\_out |
| X | 1 | X | X | XX | 00 | 00 |
| 1st | 0 | 0 | 1 | 6F | 00 | 6F |
| 2nd | 0 | 1 | 0 | AB | AB | 6F |
| 3rd | 0 | 1 | 1 | 1F | AB | 6F |
| 4th | 0 | 0 | 0 | C9 | AB | 6F |
| 5th | 0 | 1 | 0 | 6A | 6A | 6F |
| NOT | 0 | 0 | 1 | 77 | 6A | 6F |

Name (Pin Yin): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**CQUPT EE310 2020 Fall Quiz 4b**

**(15min, 20pts)**

1. (2pts) What type of information is stored in the instruction register (IR)?

An 8-bit opcode and an 8-bit operand that can either be an address or a value.

The opcode is the computer instruction that is to be carried out.

1. (1pts) What type of information is stored in an instruction register (PC)?

contains the memory address of the (current/next) instruction

1. (1pts) What type of information is stored in an accumulator (AC)?

The Accumulator (AC) stores the results of the ALU when loaded and feeds those results back to the ALU as an input.



1. (2pts) Draw a 4-bit parallel-in and parallel-out register and explain how it works.

A 4-bit parallel-in and parallel out register loads each individual bit for input and outputs each individual bit upon receipt of a clock signal.



1. (14pts) Read the following System Verilog program for a PC register and finish the truth table below

*module pc (input logic clk, rst, cnt, ld,*

*input logic [7:0] add\_val\_in,*

*output logic [7:0] pc\_out);*

*logic [7:0] pc\_pre;*

*always\_ff @(clk, rst)*

*begin*

*if (rst) pc\_pre <= 8’h00;*

*else if (ld) pc\_pre <= add\_val\_in; // ld will get evaluated before cnt*

*else if (cnt) pc\_pre <= pc\_pre + 1;// cnt will not happen if ld is true also*

*end*

*assign pc\_out = pc\_pre;*

*endmodule*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clk | reset | ld | cnt | add\_val\_in | pc\_out |
| X | 1 | X | X | XX | 00 |
| 1st | 0 | 1 | 0 | EE | EE |
| 2nd | 0 | 0 | 1 | 3C | EF |
| 3rd | 0 | 1 | 0 | 61 | 61 |
| 4th | 0 | 0 | 1 | AB | 62 |
| 5th | 0 | 1 | 1 | 26 | 26 |
| NOT | 0 | 0 | 1 | 45 | 27 |