

NMK20603

Computer Architecture

Describing Combinational Logic (cont.)

Codes so far:

- ✓ dmux21, dmux21_tb
- ✓ dmux41, dmux41_tb
- ✓ add_1b, add_1b_tb
- ✓ add_4b, add_4b_tb

Homework?

⇒ sub_1b, sub_1b_tb

⇒ sub_4b, sub_4b_tb

Completing ALU components

...

⇒ arithmetic ✓

⇒ logic ?

Describe:

and_4b

```
module and_4b (iA, iB, oY);  
input [3:0] iA, iB;  
output [3:0] oY;  
wire [3:0] oY;  
assign oY = iA & iB;  
endmodule
```


Describe:

and_4b_tb

```

module and_4b_tb ();
reg[3:0] dA,dB;
wire[3:0] mY;
integer loop,ecnt;
initial begin
    ecnt = 0;
    for (loop=0;loop<256;loop=loop+1) begin
        {dA,dB} = loop;
        #5;
        if (mY!==(dA&dB)) begin
            ecnt = ecnt + 1;
        end
        #5;
    end
    if (ecnt==0) begin
        $display("-- Module and_4b verified!");
    end
    else begin
        $display("*** Module and_4b with error(s)! (%d)",ecnt);
    end
    $stop;
end
and_4b dut (dA,dB,mY);
endmodule

```

Practice:

⇒ or_4b

⇒ or_4b_tb

Simple 4-bit ALU (add/sub/and/or)

Common ports
for all?

...

⇒ 2 x input data

⇒ 1 x output data



All n-bits wide!

Sketch it!

- Can we describe it?

Describe:

alu_4b

Describe:

alu_4b_tb

Core:ALU

⇒ Done!

Practice: (optional)

⇒ 8-function alu

✓ add, addc, sub, subb

✓ and, or, xor, cpl

⇒ what's needed?