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Un



not\_c.v



```
module not_c(a,y);
```

```
    input a;
```

```
    output y;
```

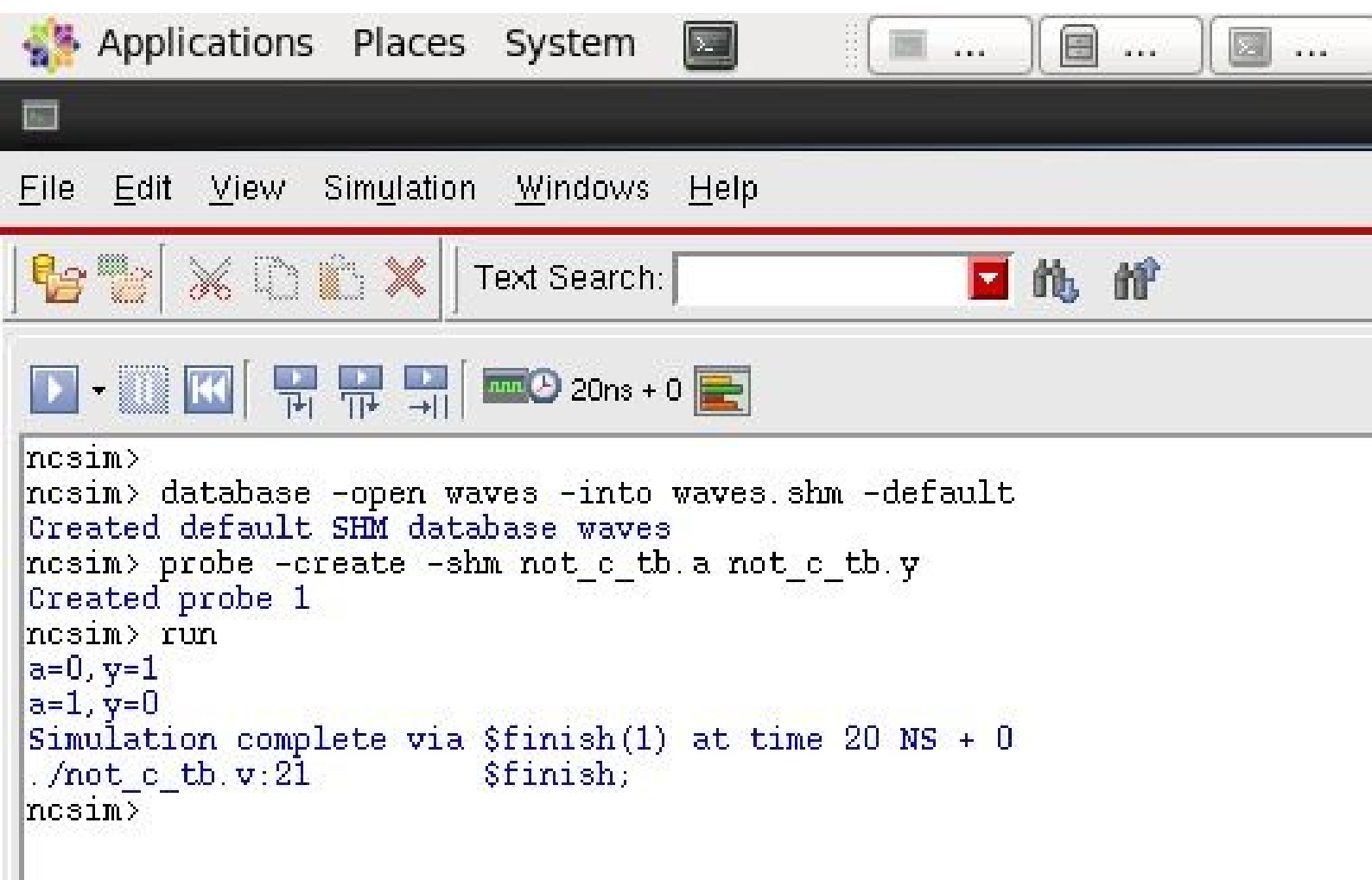
```
    supply1 vdd;
```

```
    supply0 vss;
```

```
    pmos P1(y,vdd,a);
```

```
    nmos N1(y,vss,a);
```

```
endmodule
```





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not\_c\_tb.v ✕

```
module not_c_tb();

    reg a;
    wire y;

    not_c DUT(a,y);

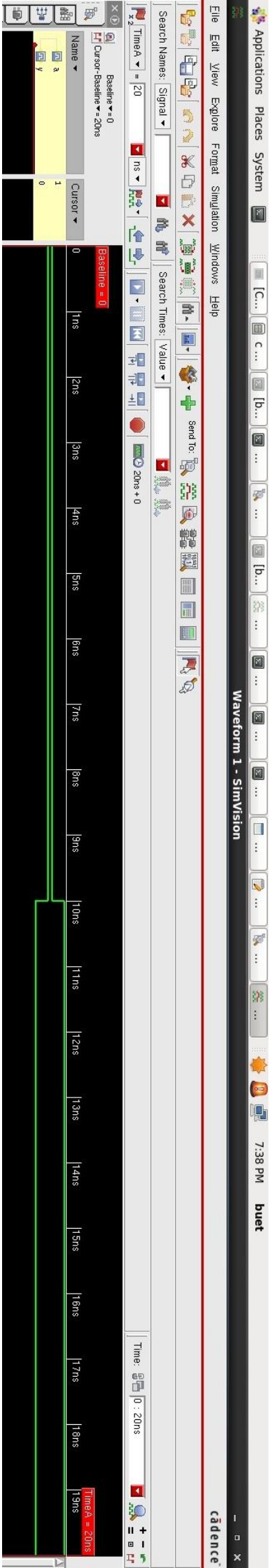
    initial
    begin

        $monitor("a=%b,y=%b",a,y);

    end

    initial
    begin

        #0;a=0;
        #10;a=1;
        #10;
        $finish;
    end
endmodule
```





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nand\_c.v



```
module nand_c(a,b,y);
```

```
    input a,b;
```

```
    output y;
```

```
    supply1 vdd;
```

```
    supply0 vss;
```

```
    wire w;
```

```
    pmos P1(y,vdd,a);
```

```
    pmos P2(y,vdd,b);
```

```
    nmos N1(w,vss,b);
```

```
    nmos N2(y,w,a);
```

```
endmodule
```

```
ncsim>
ncsim> database -open waves -into waves.shm -default
Created default SHM database waves
ncsim> probe -create -shm nand_c_tb.a nand_c_tb.b nand_c_tb.y
Created probe 1
ncsim> run
Time=          0, a=0, b=0, y=1
Time=         10, a=0, b=1, y=1
Time=         20, a=1, b=0, y=1
Time=         30, a=1, b=1, y=0
Simulation complete via $finish(1) at time 40 NS + 0
./nand_c_tb.v:20      $finish;
ncsim>
```

```
module nand_c_tb();

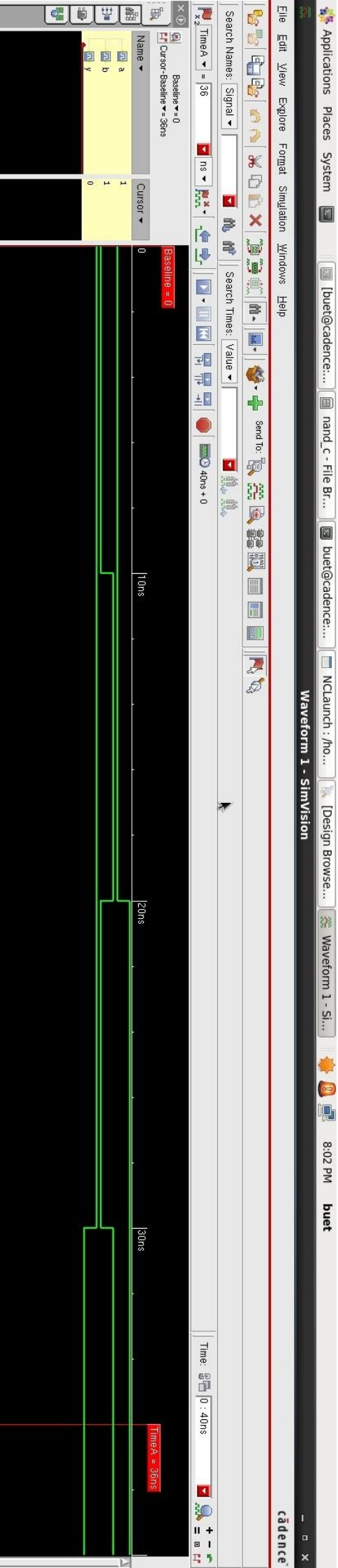
    reg a, b;
    wire y;

    nand_c NA1(a, b, y);

    initial
    begin
        $monitor("Time=%t,a=%b, b=%b, y=%b",$time, a, b, y);
    end

    initial
    begin
        #0; {a, b} = 2'd0;
        #10; {a, b} = 2'd1;
        #10; {a, b} = 2'd2;
        #10; {a, b} = 2'd3;
        #10;
        $finish;
    end

endmodule
```







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and\_c.v ✕

```
module and_c(a,b,y);  
  
    input a,b;  
    output y;  
    wire w;  
  
    nand_c NA1(a,b,w);  
    not_c NOT1(w,y);  
  
endmodule
```

```
ncsim>
ncsim> database -open waves -into waves.shm -default
Created default SHM database waves
ncsim> probe -create -shm and_c_tb.a and_c_tb.b and_c_tb.y
Created probe 1
ncsim> run
Time=          0, a=0, b=0, y=0
Time=         10, a=0, b=1, y=0
Time=         20, a=1, b=0, y=0
Time=         30, a=1, b=1, y=1
Simulation complete via $finish(1) at time 40 NS + 0
./and_c_tb.v:20      $finish;
ncsim>
```

```
module and_c_tb();

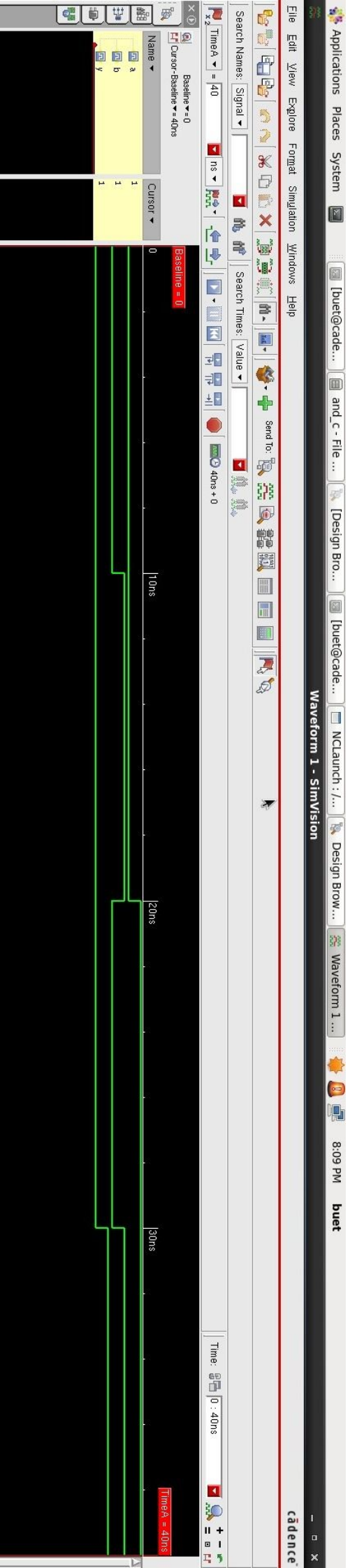
    reg a, b;
    wire y;

    and_c A1(a, b, y);

    initial
    begin
        $monitor("Time=%t,a=%b, b=%b, y=%b",$time, a, b, y);
    end

    initial
    begin
        #0; {a, b} = 2'd0;
        #10; {a, b} = 2'd1;
        #10; {a, b} = 2'd2;
        #10; {a, b} = 2'd3;
        #10;
        $finish;
    end

endmodule
```





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xnor\_c.v



```
module xnor_c(a,b,y);
```

```
    input a,b;
```

```
    output y;
```

```
    supply1 vdd;
```

```
    supply0 vss;
```

```
    wire [4:0]w;
```

```
    not_c NOT1(a,w[0]);
```

```
    not_c NOT2(b,w[1]);
```

```
    pmos P1(w[2],vdd,w[0]);
```

```
    pmos P2(w[2],vdd,b);
```

```
    pmos P3(y,w[2],w[1]);
```

```
    pmos P4(y,w[2],a);
```

```
    nmos N1(y,w[3],b);
```

```
    nmos N2(w[3],vss,w[0]);
```

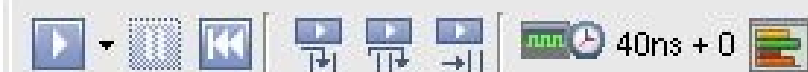
```
    nmos N3(y,w[4],w[1]);
```

```
    nmos N4(w[4],vss,a);
```

```
endmodule
```



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```
ncsim>
ncsim> database -open waves -into waves.shm -default
Created default SHM database waves
ncsim> probe -create -shm xnor_c_tb.a xnor_c_tb.b xnor_c_tb.y
Created probe 1
ncsim> run
Time=          0, a=0, b=0, y=1
Time=         10, a=0, b=1, y=0
Time=         20, a=1, b=0, y=0
Time=         30, a=1, b=1, y=1
Simulation complete via $finish(1) at time 40 NS + 0
./xnor_c_tb.v:20      $finish;
ncsim> |
```

xnor\_c\_tb.v

```
module xnor_c_tb();

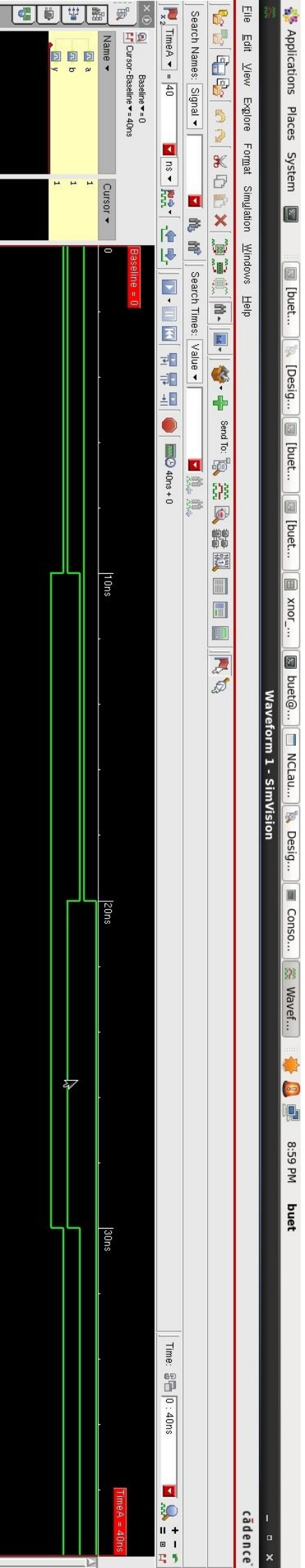
    reg a, b;
    wire y;

    xnor_c A1(a, b, y);

    initial
    begin
        $monitor("Time=%t,a=%b, b=%b, y=%b",$time, a, b, y);
    end

    initial
    begin
        #0; {a, b} = 2'd0;
        #10; {a, b} = 2'd1;
        #10; {a, b} = 2'd2;
        #10; {a, b} = 2'd3;
        #10;
        $finish;
    end

endmodule
```







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xor\_c.v



```
module xor_c(a,b,y);
```

```
    input a,b;
```

```
    output y;
```

```
    wire w;
```

```
    xnor_c XN1(a,b,w);
```

```
    not_c NOT1(w,y);
```

```
endmodule
```





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Text Search:



 40ns + 0



```
ncsim>
ncsim> database -open waves -into waves.shm -default
Created default SHM database waves
ncsim> probe -create -shm xor_c_tb.a xor_c_tb.b xor_c_tb.y
Created probe 1
ncsim> run
Time=          0, a=0, b=0, y=0
Time=         10, a=0, b=1, y=1
Time=         20, a=1, b=0, y=1
Time=         30, a=1, b=1, y=0
Simulation complete via $finish(1) at time 40 NS + 0
./xor_c_tb.v:20      $finish;
ncsim>
```

xor\_c\_tb.v

```
module xor_c_tb();

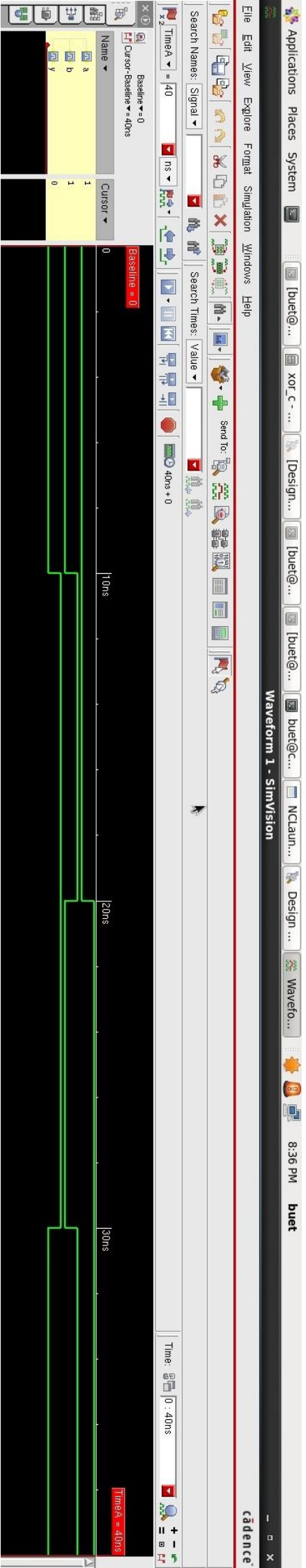
    reg a, b;
    wire y;

    xor_c A1(a, b, y);

    initial
    begin
        $monitor("Time=%t,a=%b, b=%b, y=%b",$time, a, b, y);
    end

    initial
    begin
        #0; {a, b} = 2'd0;
        #10; {a, b} = 2'd1;
        #10; {a, b} = 2'd2;
        #10; {a, b} = 2'd3;
        #10;
        $finish;
    end

endmodule
```





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Undo



half\_adder\_c.v



```
module half_adder_c(a,b,sum,cout);
```

```
    input a,b;
```

```
    output sum,cout;
```

```
    xor_c X1(a,b,sum);
```

```
    and_c A1(a,b,cout);
```

```
endmodule
```

Applications Places System [buet...] half\_a... [Desig...] [buet...] [buet...] buet...

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Text Search: [ ] [ ] [ ]

60ns + 0

```
nccsim>
nccsim> database -open waves -into waves.shm -default
Created default SHM database waves
nccsim> probe -create -shm half_adder_tb_c.a half_adder_tb_c.b half_adder_tb_c.cout half_adder_tb_c.sum
Created probe 1
nccsim> run
Time=          0 a=0 b=0 sum=0 cout=0
Time=         10 a=0 b=1 sum=1 cout=0
Time=         20 a=1 b=0 sum=1 cout=0
Time=         30 a=1 b=1 sum=0 cout=1
Simulation complete via $finish(1) at time 60 NS + 0
./half_adder_tb_c.v:16 $finish;
nccsim>
```

```
module half_adder_tb_c();

    reg a,b;
    wire sum,cout;

    half_adder_c HA1(a,b,sum,cout);

    initial
    begin

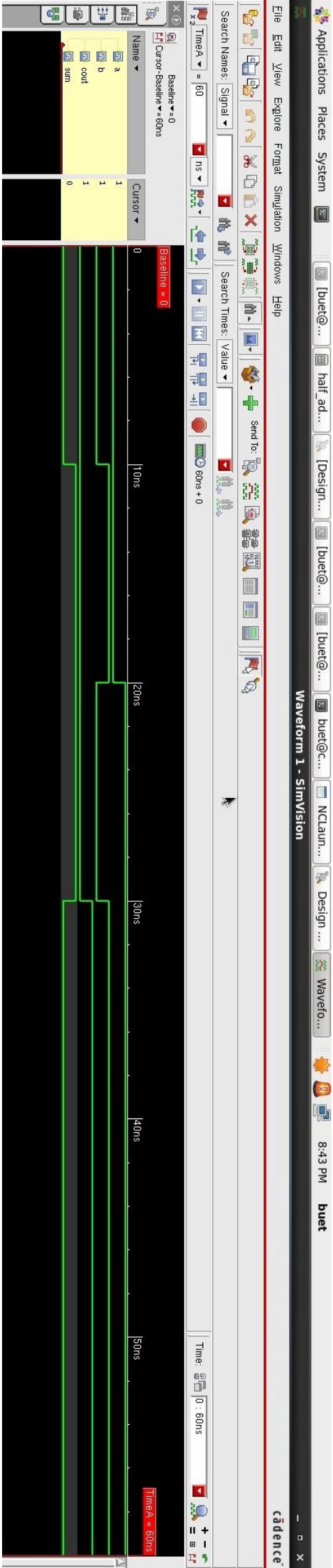
        #0; {a,b}= 2'd0;
        #10; {a,b}= 2'd1;
        #10; {a,b}= 2'd2;
        #10; {a,b}= 2'd3;
        #30;
        $finish;

    end

    initial
    begin

        $monitor("Time=%t a=%b b=%b sum=%b cout=%b",$time,a,b,sum,cout);

    end
endmodule
```







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Undo



half\_adder\_g.v



```
module half_adder_g(a,b,sum,cout);
```

```
    input a,b;
```

```
    output sum,cout;
```

```
    xor X1(sum,a,b);
```

```
    and A1(cout,a,b);
```

```
endmodule
```

Applications Places System [Co... g - ... [bu... bue... Des... [bu...

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Text Search: [ ] [ ] [ ]

60ns + 0

```
ncsim>
ncsim> database -open waves -into waves.shm -default
Created default SHM database waves
ncsim> probe -create -shm half_adder_tb_g.a half_adder_tb_g.b half_adder_tb_g.cout half_adder_tb_g.sum
Created probe 1
ncsim> run
Time=          0 a=0 b=0 sum=0 cout=0
Time=         10 a=0 b=1 sum=1 cout=0
Time=         20 a=1 b=0 sum=1 cout=0
Time=         30 a=1 b=1 sum=0 cout=1
Simulation complete via $finish(1) at time 60 NS + 0
./half_adder_tb_g.v:16 $finish;
ncsim>
```

half\_adder\_tb\_g.v

```
module half_adder_tb_g();

    reg a,b;
    wire sum,cout;

    half_adder_g HA1(a,b,sum,cout);

    initial
    begin

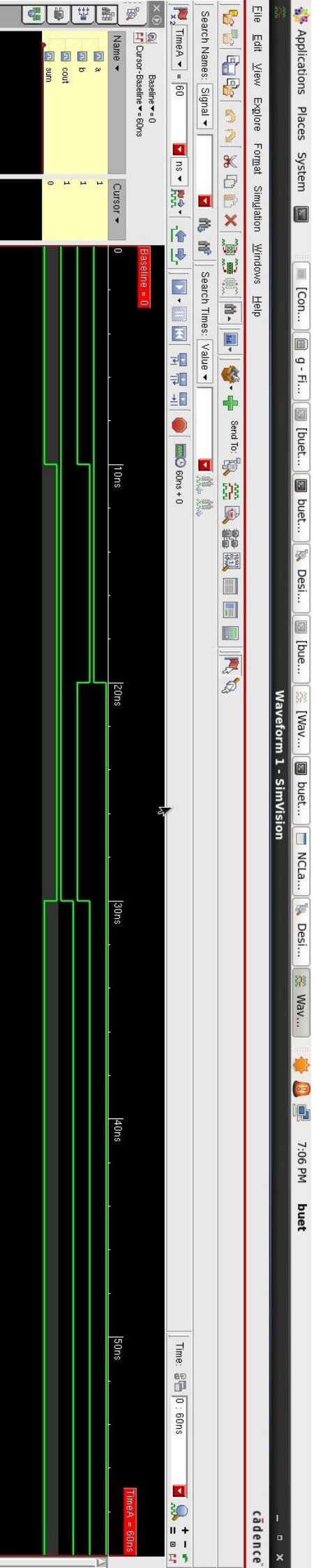
        #0; {a,b}= 2'd0;
        #10; {a,b}= 2'd1;
        #10; {a,b}= 2'd2;
        #10; {a,b}= 2'd3;
        #30;
        $finish;

    end

    initial
    begin

        $monitor("Time=%t a=%b b=%b sum=%b cout=%b",$time,a,b,sum,cout);

    end
endmodule
```





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[Console]



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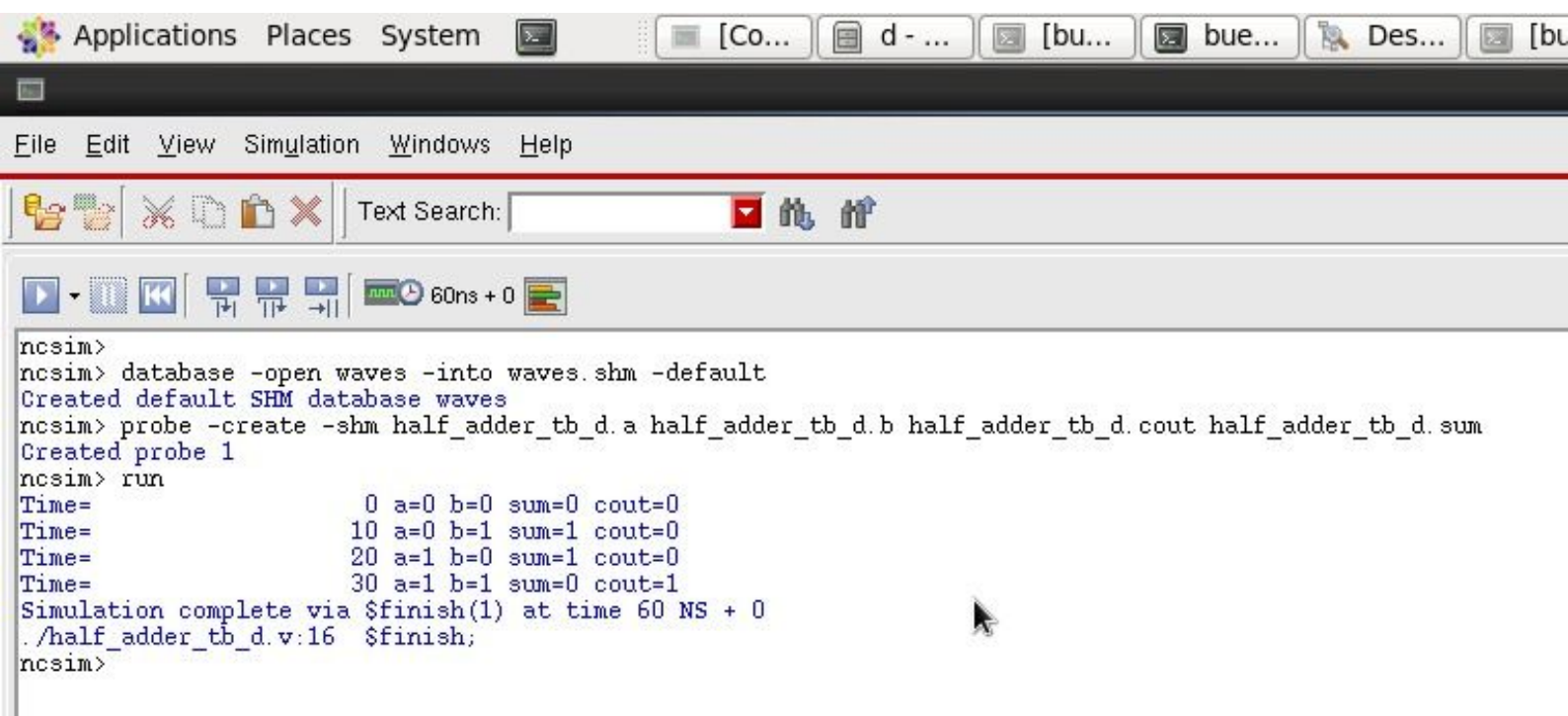
Undo



half\_adder\_d.v



```
module half_adder_d(a,b,sum,cout);  
  
    input a,b;  
    output sum,cout;  
  
    assign {cout,sum} = {a&b,a^b};  
endmodule
```



half\_adder\_tb\_d.v

```
module half_adder_tb_d();

    reg a,b;
    wire sum,cout;

    half_adder_d HA1(a,b,sum,cout);

    initial
    begin

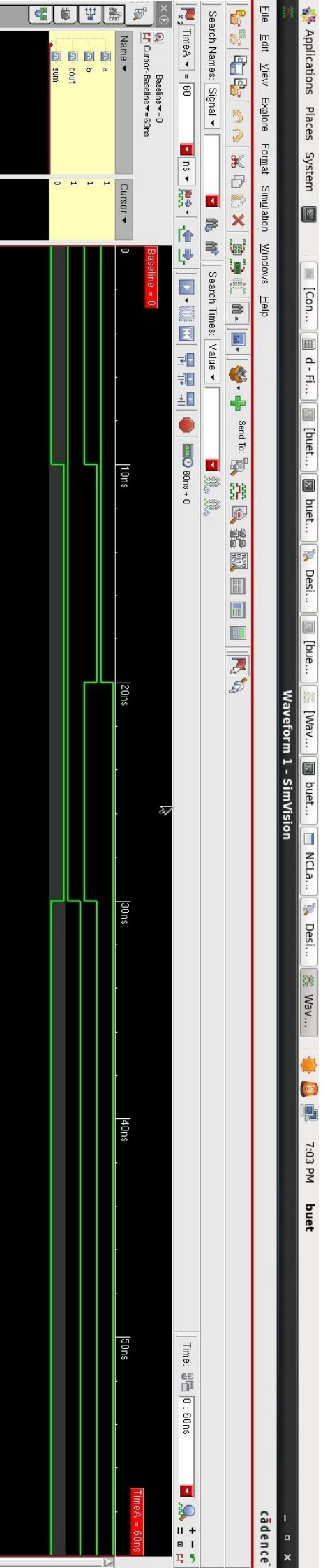
        #0; {a,b}= 2'd0;
        #10; {a,b}= 2'd1;
        #10; {a,b}= 2'd2;
        #10; {a,b}= 2'd3;
        #30;
        $finish;

    end

    initial
    begin

        $monitor("Time=%t a=%b b=%b sum=%b cout=%b",$time,a,b,sum,cout);

    end
endmodule
```







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Undo



half\_adder\_b.v ✕

```
module half_adder_b(a,b,sum,cout);
```

```
    input a,b;
```

```
    output reg sum,cout;
```

```
    always@(*)
```

```
    case({a,b})
```

```
    2'd0:begin {cout,sum} = 2'd0; end
```

```
    2'd1:begin {cout,sum} = 2'd1; end
```

```
    2'd2:begin {cout,sum} = 2'd1; end
```

```
    2'd3:begin {cout,sum} = 2'd2; end
```

```
    endcase
```

```
endmodule
```

```
ncsim>
ncsim> database -open waves -into waves.shm -default
Created default SHM database waves
ncsim> probe -create -shm half_adder_tb_b.a half_adder_tb_b.b half_adder_tb_b.cout half_adder_tb_b.sum
Created probe 1
ncsim> run
Time=          0 a=0 b=0 sum=0 cout=0
Time=         10 a=0 b=1 sum=1 cout=0
Time=         20 a=1 b=0 sum=1 cout=0
Time=         30 a=1 b=1 sum=0 cout=1
Simulation complete via $finish(1) at time 60 NS + 0
./half_adder_tb_b.v:16 $finish;
ncsim>
```

half\_adder\_tb\_b.v

```
module half_adder_tb_b();

    reg a,b;
    wire sum,cout;

    half_adder_b HA1(a,b,sum,cout);

    initial
    begin

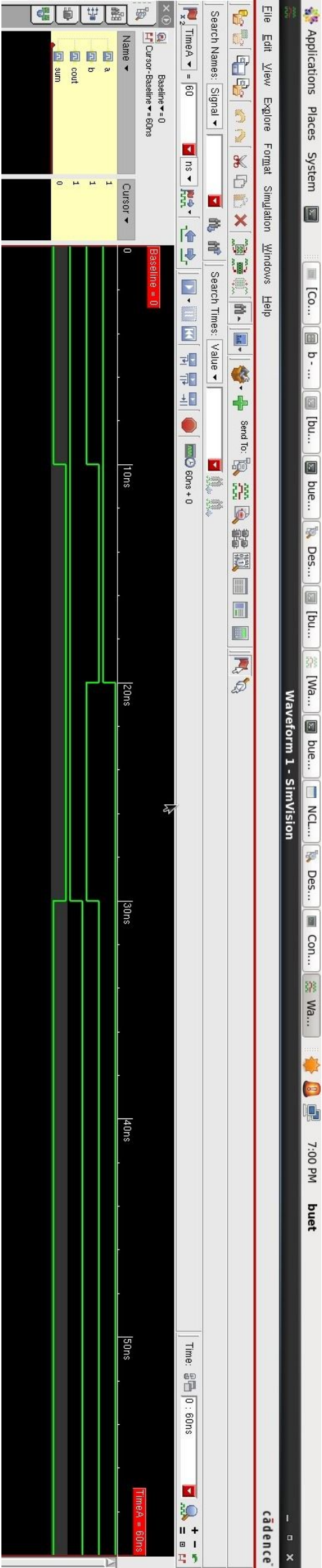
        #0; {a,b}= 2'd0;
        #10; {a,b}= 2'd1;
        #10; {a,b}= 2'd2;
        #10; {a,b}= 2'd3;
        #30;
        $finish;

    end

    initial
    begin

        $monitor("Time=%t a=%b b=%b sum=%b cout=%b",$time,a,b,sum,cout);

    end
endmodule
```





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half\_adder\_nand.v ✕

```
module half_adder_nand(a,b,sum,cout);  
  
    input a,b;  
    output sum,cout;  
    wire [2:0]w;  
  
    nand NA1(w[0],a,b);  
    nand NA2(w[1],a,w[0]);  
    nand NA3(w[2],b,w[0]);  
    nand NA4(sum,w[2],w[1]);  
    nand NA5(cout,w[0],w[0]);  
  
endmodule
```

Applications Places System [Co... na -... [bu... bue... Des... [bu...

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Text Search: [ ] [ ] [ ]

60ns + 0

```
nccsim>
nccsim> database -open waves -into waves.shm -default
Created default SHM database waves
nccsim> probe -create -shm half_adder_nand_tb.a half_adder_nand_tb.b half_adder_nand_tb.cout half_adder_nand_tb.sum
Created probe 1
nccsim> run
Time=          0 a=0 b=0 sum=0 cout=0
Time=         10 a=0 b=1 sum=1 cout=0
Time=         20 a=1 b=0 sum=1 cout=0
Time=         30 a=1 b=1 sum=0 cout=1
Simulation complete via $finish(1) at time 60 NS + 0
./half_adder_nand_tb.v:16      $finish;
nccsim>
```

half\_adder\_nand\_tb.v

```
module half_adder_nand_tb();

    reg a,b;
    wire sum,cout;

    half_adder_nand HA1(a,b,sum,cout);

    initial
    begin

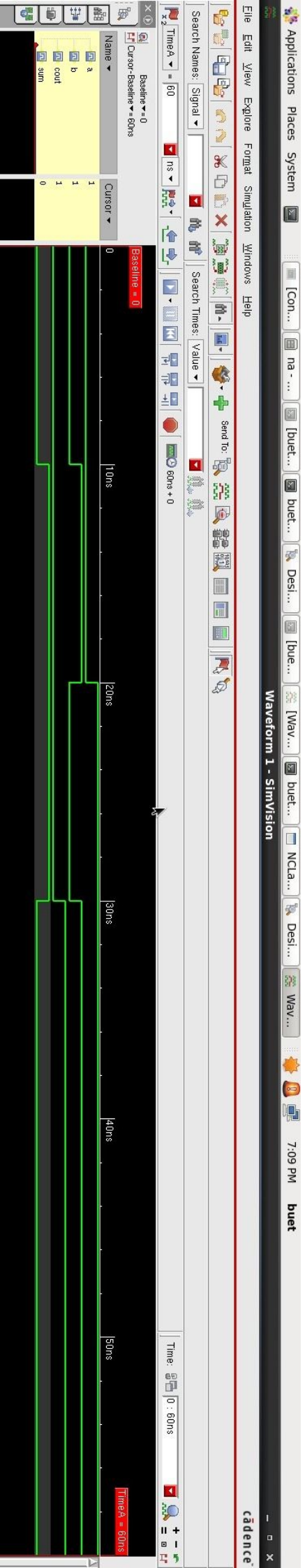
        #0; {a,b}= 2'd0;
        #10; {a,b}= 2'd1;
        #10; {a,b}= 2'd2;
        #10; {a,b}= 2'd3;
        #30;
        $finish;

    end

    initial
    begin

        $monitor("Time=%t a=%b b=%b sum=%b cout=%b",$time,a,b,sum,cout);

    end
endmodule
```







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half\_adder\_nor.v



```
module half_adder_nor(a,b,sum,cout);
```

```
    input a,b;
```

```
    output sum,cout;
```

```
    wire [3:0]w;
```

```
    nor N01(w[0],a,a);
```

```
    nor N02(w[1],b,b);
```

```
    nor N03(cout,w[0],w[1]);
```




```
    nor N04(w[3],a,b);
```

```
    nor N05(sum,w[3],cout);
```

```
endmodule
```



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Text Search:    

      60ns + 0 

```
nccsim>
nccsim> database -open waves -into waves.shm -default
Created default SHM database waves
nccsim> probe -create -shm half_adder_nor_tb.a half_adder_nor_tb.b half_adder_nor_tb.cout half_adder_nor_tb.sum
Created probe 1
nccsim> run
Time=          0 a=0 b=0 sum=0 cout=0
Time=         10 a=0 b=1 sum=1 cout=0
Time=         20 a=1 b=0 sum=1 cout=0
Time=         30 a=1 b=1 sum=0 cout=1
Simulation complete via $finish(1) at time 60 NS + 0
./half_adder_nor_tb.v:16      $finish;
nccsim>
```

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half\_adder\_nor\_tb.v

```
module half_adder_nor_tb();

    reg a,b;
    wire sum,cout;

    half_adder_nor HA1(a,b,sum,cout);

    initial
    begin

        #0; {a,b}= 2'd0;
        #10; {a,b}= 2'd1;
        #10; {a,b}= 2'd2;
        #10; {a,b}= 2'd3;
        #30;
        $finish;

    end

    initial
    begin

        $monitor("Time=%t a=%b b=%b sum=%b cout=%b",$time,a,b,sum,cout);

    end

endmodule
```

