

# Prob 1

```
ModelSim SE-64 10.7
File Edit View Compile Simulate Add Transcript Tools Layout Bookmarks Window Help
ColumnLayout AllColumns
Help
Layout Coverage
sim (Recursive Coverage Aggregation) - Default
Library Files Instance sim
Analysis Assertions Cover Directives Covergroups rp_16_tb.v rp_16.v
Transcript
ModelSim> vsim -coverage -vopt work.ripple_carry_16_bit_tb -c -do "coverage save -onexit -directive -codeAll rp_16.ucdb; run -all"
# vsim -coverage -vopt work.ripple_carry_16_bit_tb -c -do "coverage save -onexit -directive -codeAll rp_16.ucdb; run -all"
# Start time: 23:33:27 on Nov 10, 2022
# ** Note: (vsim-3812) Design is being optimized...
# Loading work.ripple_carry_16_bit_tb(fast)
# Loading work.ripple_carry_16_bit(fast)
# Loading work.ripple_carry_16_bit(fast)
# Loading work.full_adder(fast)
# Loading work.half_adder(fast)
# coverage save -onexit -directive -codeAll rp_16.ucdb
# run -all
# 0 << Starting the Simulation >>
# time=
# 0A=000000000000000000
# B=ab,
# Cin=000000000000000000
# : Sum= 0,
# Cout=out0
# time=
# 100A=00000000000011111,
# B=ab,
# Cin=000000000000001100
# : Sum= 0,
# Cout=out0
# time=
# 120A=1100011000011111,
# B=ab,
# Cin=00000000110001100
# : Sum= 1,
# Cout=out0
# ...
# 0 << Starting the Simulation >>
# time=
# 0A=000000000000000000
# B=ab,
# Cin=000000000000000000
# : Sum= 0,
# Cout=out0
# time=
# 100A=00000000000011111,
# B=ab,
# Cin=000000000000001100
# : Sum= 0,
# Cout=out0
# time=
# 120A=1100011000011111,
# B=ab,
# Cin=00000000110001100
# : Sum= 1,
# Cout=out0
# time=
# 130A=11111111111111111,
# B=ab,
# Cin=000000000000000000
# : Sum= 1,
# Cout=out1
VSM9> vcover report -html rp_16.ucdb
# Model Technology ModelSim SE-64 vcover 10.7 Coverage Utility 2017.12 Dec 7 2017
# Start time: 23:36:50 on Nov 10, 2022
# vcover report -html rp_16.ucdb
# ** Error: (vcover-7) Failed to open UCDB file "rp_16.ucdb" in read mode.
# Check if the file exists and the file isn't empty or corrupted.
# Also, make sure that the current user has read access to the file.
# End time: 23:36:51 on Nov 10, 2022, Elapsed time: 0:00:01
# Errors: 2, Warnings: 0
VSM10>
```

covhtmlreport	11/10/2022 11:36 PM	File folder	
work	11/10/2022 11:33 PM	File folder	
modelsim.ini	11/10/2022 11:15 PM	Configuration setti...	96 KB
rp_16.cr.mti	11/6/2022 1:28 PM	MTI File	1 KB
rp_16.mpf	11/6/2022 1:16 PM	MPF File	99 KB
rp_16.v	11/6/2022 11:44 AM	V File	2 KB
rp_16.v.bak	11/6/2022 11:40 AM	BAK File	1 KB
rp_16.tb.v	11/6/2022 11:45 AM	V File	1 KB
rp_16.tb.v.bak	11/6/2022 11:41 AM	BAK File	2 KB

Tệp | F:\VHDL\ET5080E%20-%2020221\Note\covhtmlreport/pages/\_frametop.htm

Testplan Design DesUnits

ripple\_carry\_16\_bit\_tb

## ModelSim Coverage Report

Number of tests run: 1  
Passed: 1  
Warning: 0  
Error: 0  
Fatal: 0

[List of tests included in report...](#)  
[List of global attributes included in report...](#)  
[List of Design Units included in report...](#)

### Coverage Summary by Structure:

Design Scope	Hits %	Coverage %
ripple_carry_16_bit_tb	25.87%	60.27%
unit	20.35%	20.35%

### Coverage Summary by Type:

Coverage Type	Bins	Hits	Misses	Weight	% Hit	Coverage
Total Coverage: 25.87% 60.27%						
Statements	21	21	0	1	100.00%	100.00%
Toggles	292	60	232	1	20.54%	20.54%

Report generated by [ModelSim](#) (ver. 10.7) on Thursday 10 November 2022 23:42:47 with command line:  
vcover report -html rp\_16.ucdb

## Prob 2

## Full Adder

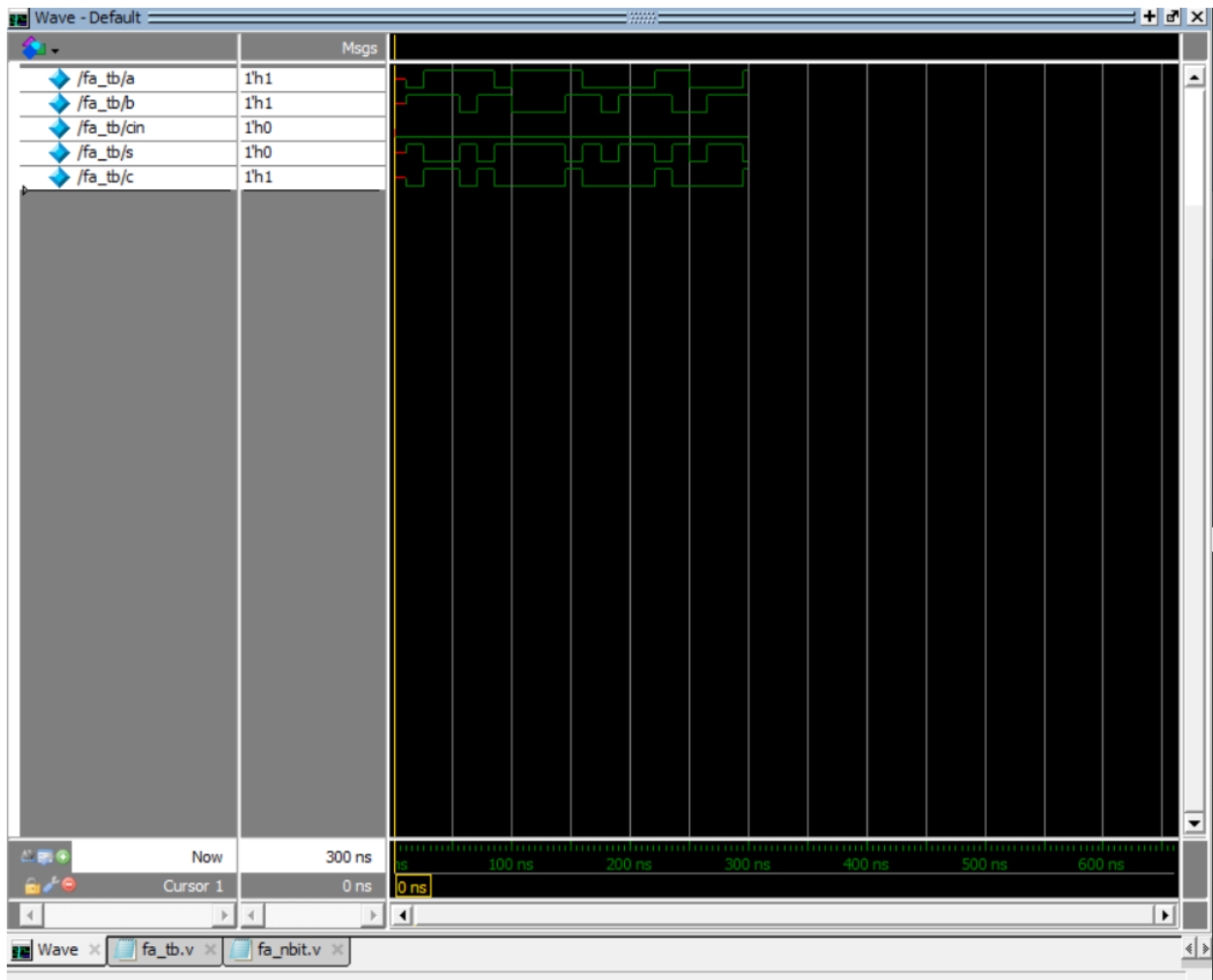
## Verilog

```
F:\VHDL\ET5080E - 20221\HW5\Full Adder n-bit\fa_nbit.v - Default
Ln#
1  module fa(a,b,cin,s,c);
2      input a,b,cin;
3      output s,c;
4      wire n1,n2,n3;
5      xor x1(s,a,b,cin);
6      and a1(n1,a,b);
7      and a2(n2,b,cin);
8      and a3(n3,a,cin);
9      or o1(c,n1,n2,n3);
10  endmodule : fa
11
```

Testbench

```
F:\VHDL\ET5080E - 20221\HW5\Full Adder n-bit\fa_tb.v (/fa_tb) - Default
Ln#
1  module fa_tb();
2  reg a,b,cin;
3  wire s,c;
4
5  fa dut(
6  .a(a),
7  .b(b),
8  .cin(cin),
9  .s(s),
10 .c(c)
11 );
12
13 initial begin
14 cin =1'b0;
15 repeat(20) begin
16 #10;
17 a = $random();
18 b = $random();
19 #5;
20 $display(": \t\t a =",a," \t\t b =",b, " \t\t cin= ",cin," \t\t s = ", s, " \t\t c= ", c);
21 end
22 $stop;
23 end
24
25 endmodule : fa_tb
26
```

Waveform



## Transcript

```
add wave -position insertpoint sim:/fa_tb/
VSIM 11> run
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =1          b =1          cin= 0          s = 0          c= 1
# :          a =1          b =1          cin= 0          s = 0          c= 1
# :          a =1          b =0          cin= 0          s = 1          c= 0
# :          a =1          b =1          cin= 0          s = 0          c= 1
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =1          b =0          cin= 0          s = 1          c= 0
# :          a =1          b =0          cin= 0          s = 1          c= 0
# :          a =1          b =0          cin= 0          s = 1          c= 0
# :          a =1          b =1          cin= 0          s = 0          c= 1
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =0          b =0          cin= 0          s = 0          c= 0
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =1          b =1          cin= 0          s = 0          c= 1
# :          a =1          b =0          cin= 0          s = 1          c= 0
# :          a =0          b =0          cin= 0          s = 0          c= 0
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =0          b =1          cin= 0          s = 1          c= 0
# :          a =1          b =1          cin= 0          s = 0          c= 1
# ** Note: $stop : F:/VHDL/ET5080E - 20221/HW5/Full Adder n-bit/fa_tb.v(22)
# Time: 300 ns Iteration: 0 Instance: /fa_tb
# Break in Module fa_tb at F:/VHDL/ET5080E - 20221/HW5/Full Adder n-bit/fa_tb.v line 22
```

## Report

Testplan Design DesUnits

fa\_tb

### ModelSim Coverage Report

Number of tests run: 1  
Passed: 1  
Warning: 0  
Error: 0  
Fatal: 0

[List of tests included in report...](#)  
[List of global attributes included in report...](#)  
[List of Design Units included in report...](#)

**Coverage Summary by Structure:**

Design Scope	Hits %	Coverage %
fa_tb	73.33%	81.81%
dut	62.50%	62.50%

**Coverage Summary by Type:**

Total Coverage:						73.33%	81.81%
Coverage Type	Bins	Hits	Misses	Weight	% Hit	Coverage	
Statements	8	8	0	1	100.00%	100.00%	
Toggles	22	14	8	1	63.63%	63.63%	

Report generated by [ModelSim](#) (ver. 10.7) on Sunday 13 November 2022 19:59:21 with command line:  
vcover report -html fa\_cov.ucdb

F:\VHDL\ET5080E - 20221\HWS\Full Adder n-bit\...\alobattrlist.html

## Carry Look Ahead Adder

### Verilog

#### CLA Verilog code

```
`timescale 1ns / 1ps
```

```
module full_adder_gp(  
    input wire A,  
    input wire B,  
    input wire Ci,  
    output wire S,  
    output wire Co  
);  
  
    assign S = A ^ B ^ Ci;  
  
endmodule
```

```
`timescale 1ns / 1ps
```

```
module GP(  
    input wire A,  
    input wire B,  
    input wire Ci,  
    output reg G,  
    output reg P,  
    output reg C  
);  
  
    always @(*)  
    begin  
        G = A & B;  
        P = A | B; // A xor B can also be used  
        C = G | P & Ci;  
    end  
endmodule
```

```
`timescale 1ns / 1ps
```

```
module CLA (A,B,Ci,S,Co,PG,GG,CG);
```

```
    parameter N = 4;  
    input wire [N-1:0] A;  
    input wire [N-1:0] B;  
    input wire Ci;  
    output wire [N-1:0] S;
```

```

output wire Co;
output reg PG,GG,CG;

wire [N-1:0] P;
wire [N-1:0] G;

wire [N:0] C;

assign C[0] = Ci;

genvar i;
generate
    for (i=0; i < N; i=i+1)
        begin : Build
            full_adder_gp COMP1(.A(A[i]), .B(B[i]), .Ci(C[i]), .S(S[i]));
            GP      COMP2(.A(A[i]), .B(B[i]), .Ci(C[i]), .G(G[i]), .P(P[i]), .C(C[i+1]));
        end
    endgenerate

assign Co = C[N];

always@(*)
    begin
        PG = &P;
        GG = C[N];
        CG = GG | PG & Ci;
    end

endmodule

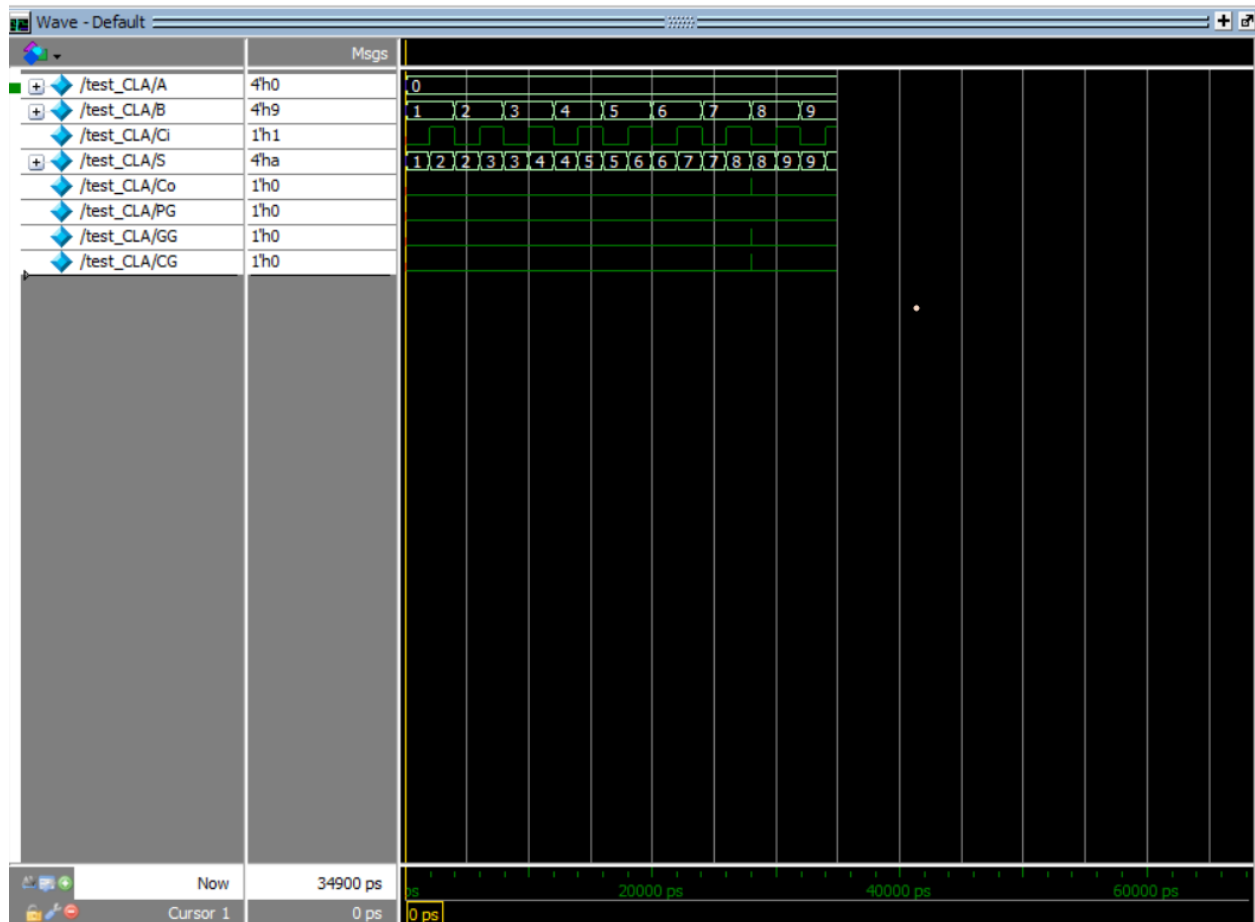
```



## Testbench

```
1  `timescale 1ns / 1ps
2
3
4  module test_CIA();
5      parameter N = 4;
6      // inputs to the DUT
7      reg [N-1:0] A = 4'h0;
8      reg [N-1:0] B = 4'h0;
9      reg C1 = 0;
10     // outputs from the DUT
11     wire [N-1:0] S;
12     wire Co;
13     wire PG,GG,CG;
14
15     CIA DUT ( .A(A), .B(B), .C1(C1), .S(S), .Co(Co), .PG(PG), .GG(GG), .CG(CG) );
16
17     initial
18     begin
19         $display($time, " << Simulation Results >>");
20         $monitor($time, "A = %b, B = %b, C1 = %b, S = %b, Co = %b, PG = %b, GG = %b, CG = %b", A, B, C1, S, Co, PG, GG, CG);
21     end
22
23     initial
24     begin
25         forever begin
26             if (A <= 4'b1111)
27                 begin
28                     if (B < 4'b1111)
29                         begin
30                             B = B + 4'b0001;
31                             C1 = 0;
32                             #2;
33                             C1 = 1;
34                             #2;
35                         end else begin
36                             B = 4'b0000;
37                             A = A + 4'b0001;
38                         end
39                     end else begin
40                         $finish;
41                     end
42                 end
43             end
44         end
45     endmodule
46
```

## Wave



## Transcript

```

[add wave -position insertpoint sim:/test_CLA/*]
VSI6> run
#
# 0 << Simulation Results >>
#
run
0A = 0000, B = 0001, C1 = 0, S = 0001, Co = 0, PG = 0, GG = 0, CG = 0
run
run
run
run
#
2A = 0000, B = 0001, C1 = 1, S = 0010, Co = 0, PG = 0, GG = 0, CG = 0
run
run
run
#
4A = 0000, B = 0010, C1 = 0, S = 0010, Co = 0, PG = 0, GG = 0, CG = 0
run
#
6A = 0000, B = 0010, C1 = 1, S = 0011, Co = 0, PG = 0, GG = 0, CG = 0
#
8A = 0000, B = 0011, C1 = 0, S = 0011, Co = 0, PG = 0, GG = 0, CG = 0
run
#
10A = 0000, B = 0011, C1 = 1, S = 0100, Co = 0, PG = 0, GG = 0, CG = 0
#
12A = 0000, B = 0100, C1 = 0, S = 0100, Co = 0, PG = 0, GG = 0, CG = 0
#
14A = 0000, B = 0100, C1 = 1, S = 0101, Co = 0, PG = 0, GG = 0, CG = 0
run
#
16A = 0000, B = 0101, C1 = 0, S = 0101, Co = 0, PG = 0, GG = 0, CG = 0
#
18A = 0000, B = 0101, C1 = 1, S = 0110, Co = 0, PG = 0, GG = 0, CG = 0
run
#
20A = 0000, B = 0110, C1 = 0, S = 0110, Co = 0, PG = 0, GG = 0, CG = 0
#
22A = 0000, B = 0110, C1 = 1, S = 0111, Co = 0, PG = 0, GG = 0, CG = 0
#
24A = 0000, B = 0111, C1 = 0, S = 0111, Co = 0, PG = 0, GG = 0, CG = 0
run
#
26A = 0000, B = 0111, C1 = 1, S = 1000, Co = 0, PG = 0, GG = 0, CG = 0
#
28A = 0000, B = 1000, C1 = 0, S = 1000, Co = 0, PG = 0, GG = 0, CG = 0
VSI6> run
#
30A = 0000, B = 1000, C1 = 1, S = 1001, Co = 0, PG = 0, GG = 0, CG = 0
#
32A = 0000, B = 1001, C1 = 0, S = 1001, Co = 0, PG = 0, GG = 0, CG = 0
#
34A = 0000, B = 1001, C1 = 1, S = 1010, Co = 0, PG = 0, GG = 0, CG = 0
VSI6> ]

```

## Report

←→↺↻⌂

Tôp | F:\VHDL\ET5080E\20-%2020221\HW5\4%20-bit%20comparator\covhtmlreport\pages\\_frametop.htm

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TestplanDesignDesUnits

-No items in this menu...

# ModelSim Design Unit Coverage

**Design Unit:** work.four\_bit\_tb

**Design Unit Name:**  
work.four\_bit\_tb

**Language:**  
Verilog

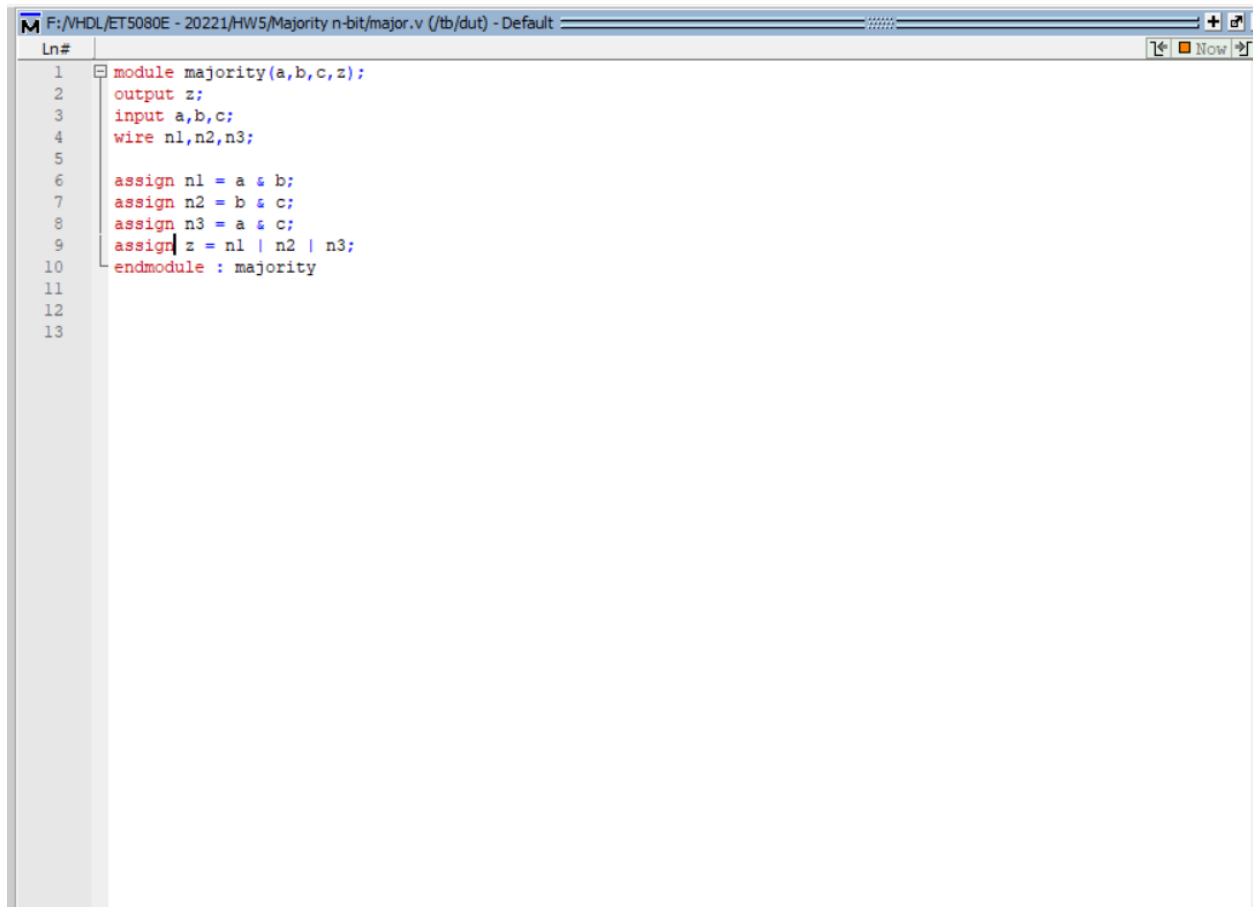
**Source File:**  
4bit\_comparator\_tb.v

**Design Unit Coverage Details:**

Total Coverage:					100.00%	100.00%
Coverage Type	Bins	Hits	Misses	Weight	% Hit	Coverage
Statements	13	13	0	1	100.00%	100.00%
Toggles	22	22	0	1	100.00%	100.00%

## Majority

## Verilog

A screenshot of a VHDL code editor window. The title bar shows the file path: "F:\VHDL\ET5080E - 20221\HW5\Majority n-bit\major.v (/tb/dut) - Default". The editor contains a VHDL module named "majority" with three inputs (a, b, c) and one output (z). The code uses three intermediate wires (n1, n2, n3) to calculate the majority function. The code is as follows:

```
1 module majority(a,b,c,z);  
2   output z;  
3   input a,b,c;  
4   wire n1,n2,n3;  
5  
6   assign n1 = a & b;  
7   assign n2 = b & c;  
8   assign n3 = a & c;  
9   assign z = n1 | n2 | n3;  
10  endmodule : majority  
11  
12  
13
```

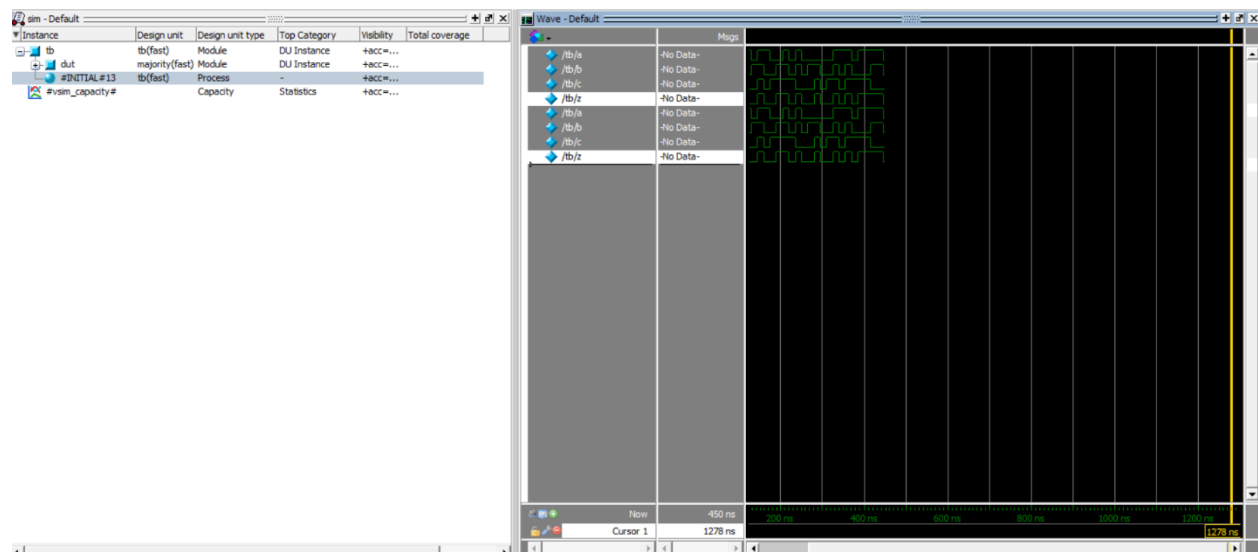
Testbench

```
F:/VHDL/ET5080E - 20221/HW5/Majority n-bit/majority_tb.v (/tb) - Default
Ln#
1  module tb ();
2
3      reg a, b, c;
4      wire z;
5
6      majority dut(
7          .a(a),
8          .b(b),
9          .c(c),
10         .z(z)
11     );
12
13     initial begin
14         repeat(30) begin
15             #10;
16             a = $random();
17             b = $random();
18             c = $random();
19             #5;
20             $display($time,":\t\t a = ",a,"\t\t b = ",b,"\t\t c = ",c,"\t\t z =",z);
21         end
22         | $stop;
23     end
24
25     endmodule : tb
26
```

Script

```
VSIM 9> run
#          15:  a = 0  b = 1          c = 1          z = 1
#          30:  a = 1  b = 1          c = 1          z = 1
#          45:  a = 1  b = 0          c = 1          z = 1
#          60:  a = 1  b = 0          c = 1          z = 1
#          75:  a = 1  b = 0          c = 1          z = 1
#          90:  a = 0  b = 1          c = 0          z = 0
#         105:  a = 1  b = 1          c = 0          z = 1
#         120:  a = 1  b = 0          c = 0          z = 0
#         135:  a = 0  b = 1          c = 0          z = 0
#         150:  a = 1  b = 1          c = 1          z = 1
#         165:  a = 1  b = 0          c = 0          z = 0
#         180:  a = 0  b = 0          c = 1          z = 0
#         195:  a = 0  b = 1          c = 1          z = 1
#         210:  a = 1  b = 1          c = 1          z = 1
#         225:  a = 0  b = 0          c = 1          z = 0
#         240:  a = 1  b = 1          c = 0          z = 1
#         255:  a = 0  b = 0          c = 0          z = 0
#         270:  a = 0  b = 1          c = 0          z = 0
#         285:  a = 0  b = 1          c = 1          z = 1
#         300:  a = 0  b = 0          c = 0          z = 0
#         315:  a = 0  b = 0          c = 1          z = 0
#         330:  a = 1  b = 1          c = 1          z = 1
#         345:  a = 1  b = 0          c = 0          z = 0
#         360:  a = 1  b = 1          c = 1          z = 1
#         375:  a = 0  b = 0          c = 1          z = 0
#         390:  a = 1  b = 0          c = 1          z = 1
#         405:  a = 1  b = 0          c = 1          z = 1
#         420:  a = 1  b = 1          c = 0          z = 1
#         435:  a = 1  b = 1          c = 0          z = 1
#         450:  a = 0  b = 0          c = 0          z = 0
#
# ** Note: $stop      : F:/VHDL/ET5080E - 20221/HW5/Majority n-bit/majority_tb.v(22)
#      Time: 450 ns  Iteration: 0  Instance: /tb
# Break for Module tb at F:/VHDL/ET5080E - 20221/HW5/Majority n-bit/majority_tb.v(140) 33
```

## Wave



## Report

TestplanDesignDesUnits

tb

## ModelSim Coverage Report

Number of tests run: 1

Passed: 1

Warning: 0

Error: 0

Fatal: 0

[List of tests included in report...](#)

[List of global attributes included in report...](#)

[List of Design Units included in report...](#)

Coverage Summary by Structure:

Design Scope	Hits %	Coverage %
tb	100.00%	100.00%
dut	100.00%	100.00%

Coverage Summary by Type:

Total Coverage:							100.00%	100.00%
Coverage Type	Bins	Hits	Misses	Weight	% Hit	Coverage		
Statements	12	12	0	1	100.00%	100.00%		
FEC Expressions	9	9	0	1	100.00%	100.00%		
Toggles	20	20	0	1	100.00%	100.00%		

Report generated by [ModelSim](#) (ver. 10.7) on Thursday 17 November 2022 23:25:40 with command line:  
vcover report -html majority\_cov.ucdb

## Gray counter

### Verilog

```
C:\modeltech64_10.7\examples\gray1.v (gray_tb.dut) - Default
Ln#
1  module gray_ctr
2  # (parameter N = 4)
3  (input clk,
4   input rstn,
5   output reg [N-1:0] out);
6
7  reg [N-1:0] q;
8
9  always @(posedge clk) begin
10   if (!rstn) begin
11     q <= 0;
12     out <= 0;
13   end else begin
14     q <= q+1;
15   end
16   `ifndef FOR_LOOP
17   for(int i=0; i < N-1; i = i+1) begin
18     out[i] <= q[i+1] ^ q[i];
19   end
20   out[N-1] <= q[N-1];
21   `else
22   out <= {q[N-1], q[N-1:1] ^ q[N-2:0]};
23   `endif
24 end
25 endmodule
26
27
28
```

### Testbench

```

C:/modeltech64_10.7/examples/gray_tb.v (/gray_tb) - Default
Ln#
1 module gray_tb;
2 parameter N=4;
3
4 reg clk;
5 reg rstn;
6 wire [N-1:0] out;
7
8 gray_ctr du(
9   .clk(clk),
10  .rstn(rstn),
11  .out(out)
12 );
13
14 always #10 clk = ~clk;
15
16 initial begin
17   {clk,rstn} <=0;
18
19   $monitor("T=%t rstn=%0b out=0x%0h", $time, rstn, out);
20   repeat(20)@(posedge clk);
21   rstn <=1;
22   repeat(20)@(posedge clk);
23   $finish;
24 end
25 endmodule
26

```

## Script

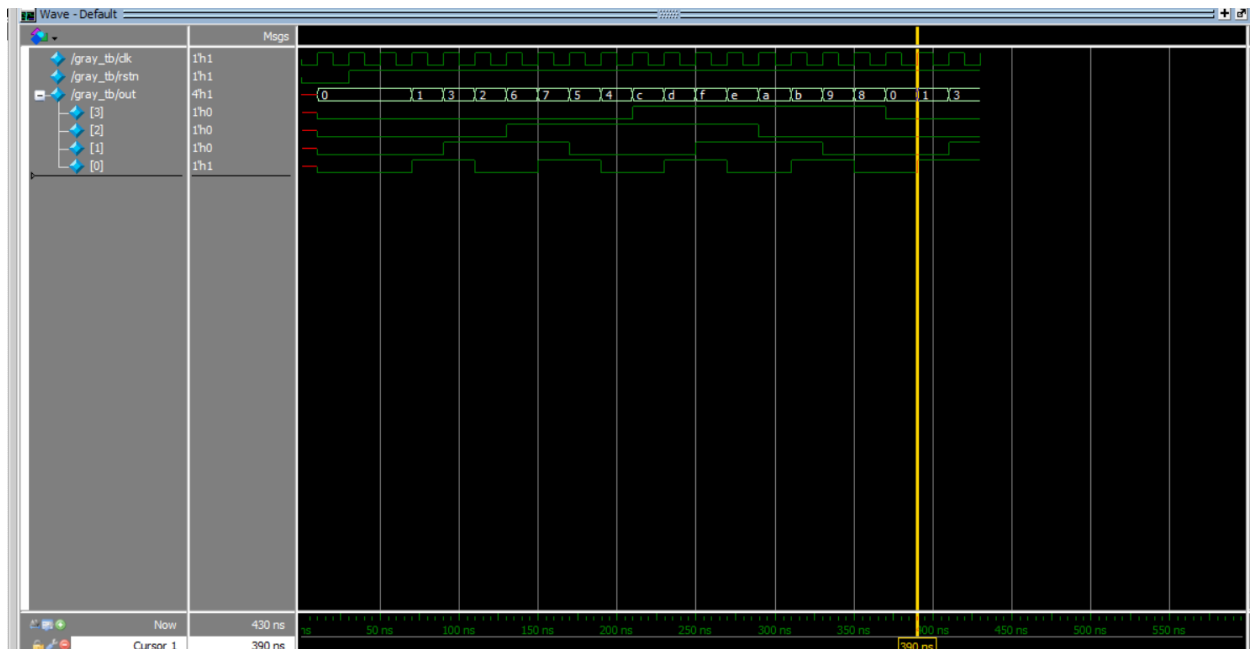
```

VSIM 4> run -all
# T=00000000000000000000000000000000t rstn=0 out=0xx
# T=00000000000000000000000000000012t rstn=0 out=0x0
# T=00000000000000000000000000000036t rstn=1 out=0x0
# T=00000000000000000000000000000106t rstn=1 out=0x1
# T=00000000000000000000000000000132t rstn=1 out=0x3
# T=00000000000000000000000000000156t rstn=1 out=0x2
# T=00000000000000000000000000000202t rstn=1 out=0x6
# T=00000000000000000000000000000226t rstn=1 out=0x7
# T=00000000000000000000000000000252t rstn=1 out=0x5
# T=00000000000000000000000000000276t rstn=1 out=0x4
# T=00000000000000000000000000000322t rstn=1 out=0xc
# T=00000000000000000000000000000346t rstn=1 out=0xd
# T=00000000000000000000000000000372t rstn=1 out=0xf
# T=00000000000000000000000000000416t rstn=1 out=0xe
# T=00000000000000000000000000000442t rstn=1 out=0xa
# T=00000000000000000000000000000466t rstn=1 out=0xb
# T=00000000000000000000000000000512t rstn=1 out=0x9
# T=00000000000000000000000000000536t rstn=1 out=0x8
# T=00000000000000000000000000000562t rstn=1 out=0x0
# T=00000000000000000000000000000606t rstn=1 out=0x1
# T=00000000000000000000000000000632t rstn=1 out=0x3
# ** Note: $finish : grayl_tb.v(23)
# Time: 430 ns Iteration: 1 Instance: /grayl_tb
# 1
# Break in Module grayl_tb at grayl_tb.v line 23

```

## Wave





## Report

→ Tép | F:/VHDL/ET5080E%20-%2020221/Note/covhtmlreport/pages/\_frametop.htm

Testplan Design DesUnits

ripple\_carry\_16\_bit\_tb

Number of tests run: 1

Passed: 1

Warning: 0

Error: 0

Fatal: 0

[List of tests included in report...](#)

[List of global attributes included in report...](#)

[List of Design Units included in report...](#)

Coverage Summary by Structure:			Coverage Summary by Type:						
Design Scope	Hits %	Coverage %	Total Coverage:						
ripple_carry_16_bit_tb	25.87%	60.27%							
uut	20.35%	20.35%							
			Total Coverage:		25.87% 60.27%				
			Coverage Type	Bins	Hits	Misses	Weight	% Hit	Coverage
			Statements	21	21	0	1	100.00%	100.00%
			Toggles	292	60	232	1	20.54%	20.54%

Report generated by [ModelSim](#) (ver. 10.7) on Thursday 10 November 2022 23:42:47 with command line:  
vcov report -html rp\_16.ucdb

## 4-bit comparator

## Verilog

```

1  `timescale 1ns / 1ps
2
3  module four_bit_comp(G, L, E, a0, a1, a2, a3, b0, b1, b2, b3);
4      input a0, a1, a2, a3, b0, b1, b2, b3;
5      output G, L, E;
6
7      wire g1, g2, l1, l2, e1, e2;
8
9      two_bit_comp comp1(g2, l2, e2, a3, a2, b3, b2);
10     two_bit_comp comp2(g1, l1, e1, a1, a0, b1, b0);
11
12     assign G = (g2)|(e2&g1);
13     assign L = (l2)|(e2&l1);
14     assign E = e1&e2;
15 endmodule
16
17 module two_bit_comp(G, L, E, a1, a0, b1, b0);
18     input a1, a0, b1, b0;
19     output G, L, E;
20
21     assign G = ((a1&(~b1))|(((a1)^(b1))&((a0)&(~b0))));
22     assign L = ((~a1)&(b1))|(((a1)^(b1))&((~a0)&(b0)));
23     assign E = (a1~b1)&(a0~b0);
24 endmodule
25

```

## Testbench

```

1  `timescale 1ns / 1ps
2
3  module four_bit_tb();
4      reg a0, a1, a2, a3;
5      reg b0, b1, b2, b3;
6      wire G, L, E;
7
8      four_bit_comp dut(G, L, E, a0, a1, a2, a3, b0, b1, b2, b3);
9
10     initial begin
11         repeat(16) begin
12             #10;
13             a0 = $random();
14             a1 = $random();
15             a2 = $random();
16             a3 = $random();
17             b0 = $random();
18             b1 = $random();
19             b2 = $random();
20             b3 = $random();
21             #2;
22             $display($time, "\t\t a0 = ",a0,"\t\t a1 = ",a1,"\t\t a2 = ",a2,"\t\t a3 = ",a3,"\t\t b0 = ",b0,"\t\t b1 = ",b1,"\t\t b2 = ",b2,"\t\t b3 = ",b3,"\t\t G= ",G,"\t\t L = ",L,"\t\t E=",E);
23         end
24     $stop;
25 end
26 endmodule : four_bit_tb
27

```

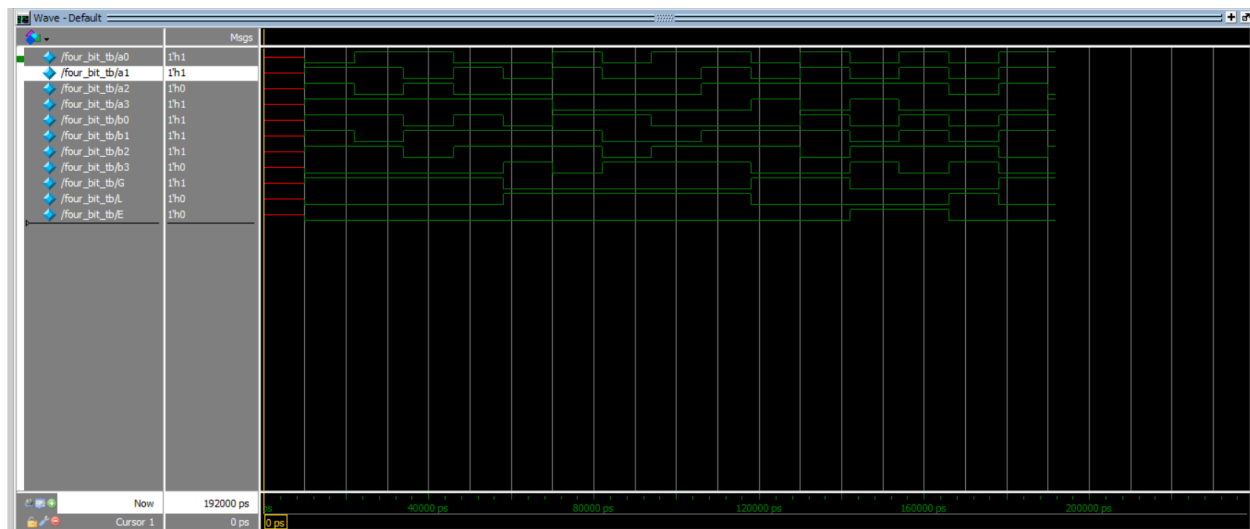
## Script

```

VSIM 50> run
#          12:  a0 = 0  a1 = 1      a2 = 1      a3 = 1      b0 = 1      b1 = 1      b2 = 1
b3 = 0      G= 1      L =0      E=0
#          24:  a0 = 1  a1 = 1      a2 = 0      a3 = 1      b0 = 1      b1 = 0      b2 = 1
b3 = 0      G= 1      L =0      E=0
#          36:  a0 = 1  a1 = 0      a2 = 1      a3 = 1      b0 = 0      b1 = 1      b2 = 0
b3 = 0      G= 1      L =0      E=0
#          48:  a0 = 0  a1 = 1      a2 = 0      a3 = 1      b0 = 1      b1 = 1      b2 = 1
b3 = 0      G= 1      L =0      E=0
#          60:  a0 = 0  a1 = 0      a2 = 0      a3 = 1      b0 = 0      b1 = 1      b2 = 1
b3 = 1      G= 0      L =1      E=0
#          72:  a0 = 1  a1 = 1      a2 = 0      a3 = 0      b0 = 1      b1 = 1      b2 = 1
b3 = 0      G= 0      L =1      E=0
#          84:  a0 = 0  a1 = 0      a2 = 0      a3 = 0      b0 = 1      b1 = 0      b2 = 0
b3 = 1      G= 0      L =1      E=0
#          96:  a0 = 1  a1 = 0      a2 = 0      a3 = 0      b0 = 0      b1 = 0      b2 = 1
b3 = 1      G= 0      L =1      E=0
#          108: a0 = 1  a1 = 1      a2 = 1      a3 = 0      b0 = 0      b1 = 1      b2 = 1
b3 = 1      G= 0      L =1      E=0
#          120: a0 = 0  a1 = 0      a2 = 1      a3 = 1      b0 = 0      b1 = 1      b2 = 1
b3 = 0      G= 1      L =0      E=0
#          132: a0 = 1  a1 = 1      a2 = 1      a3 = 0      b0 = 1      b1 = 1      b2 = 0
b3 = 0      G= 1      L =0      E=0
#          144: a0 = 0  a1 = 0      a2 = 1      a3 = 1      b0 = 0      b1 = 0      b2 = 1
b3 = 1      G= 0      L =0      E=1
#          156: a0 = 1  a1 = 1      a2 = 1      a3 = 0      b0 = 1      b1 = 1      b2 = 1
b3 = 0      G= 0      L =0      E=1
#          168: a0 = 0  a1 = 0      a2 = 0      a3 = 0      b0 = 0      b1 = 0      b2 = 1
b3 = 1      G= 0      L =1      E=0
#          180: a0 = 1  a1 = 1      a2 = 1      a3 = 0      b0 = 1      b1 = 1      b2 = 0
b3 = 0      G= 1      L =0      E=0
#          192: a0 = 1  a1 = 1      a2 = 0      a3 = 1      b0 = 1      b1 = 1      b2 = 1
b3 = 0      G= 1      L =0      E=0
# ** Note: $stop      : C:/modelstech64_10.7/examples/4bit_comparator_tb.v(24)
#      Time: 192 ns  Iteration: 0  Instance: /four_bit_tb

```

## Wave



## Report

```
Design Unit Name:
    work.four_bit_tb
Language:
    Verilog
Source File:
    4bit_comparator_tb.v
```

Total Coverage:					100.0%	100.0%
Coverage Type	Bins	Hits	Misses	Weight	% Hit	Coverage
Statements	13	13	0	1	100.0%	100.0%
Toggles	22	22	0	1	100.0%	100.0%