Chapter 7: (Part 1)

Chapter 7. Behavioural Modelling

7.11 Exercises

1. Declare a register called oscillate. Initialize it to 0 and make it toggle every 30 time units. Do not use always statement (Hint: Use the forever loop).

My answer:

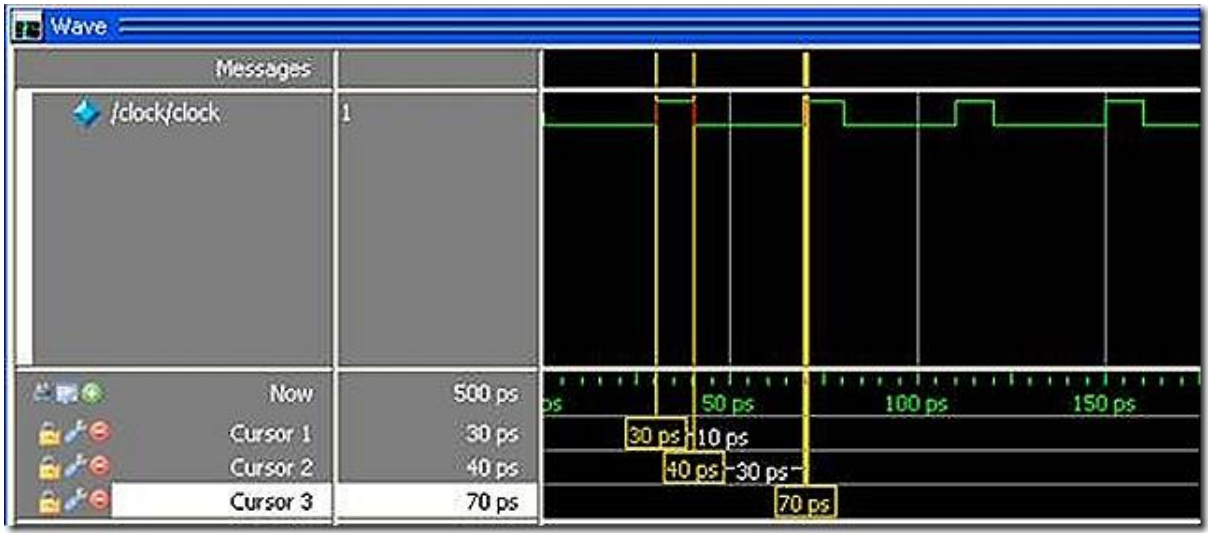
```
1  //ex7_1 forever loop
2  //module test;
3  reg oscillate;
4
5  initial
6  begin
7    oscillate=1'b0;
8    forever #30 oscillate=~oscillate;
9  end
10
11 /*initial
12   $monitor($time, " oscillate= %b",oscillate);
13
14 initial
15   #500 $finish;
16
17 endmodule*/
```

```
  0 oscillate= 0
 30 oscillate= 1
 60 oscillate= 0
 90 oscillate= 1
120 oscillate= 0
150 oscillate= 1
180 oscillate= 0
210 oscillate= 1
240 oscillate= 0
270 oscillate= 1
300 oscillate= 0
```

2. Design a clock with time period = 40 and a duty cycle of 25% by using the always and initial statements. The value of clock at time = 0 should be initialized to 0.

My answer:

```
1  //ex7_2 clock
2  module clock;
3  reg clock;
4
5  initial
6    clock=1'b0;
7
8  always
9  begin
10   #30 clock=~clock;
11   #10 clock=~clock;
12 end
13
14 initial
15   $monitor($time, " clock= %b", clock);
16
17 endmodule
```



3. Given below is an initial block with blocking procedural assignments. At what simulation time is each statement executed? What are the intermediate and final values of a, b, c, d?

```
initial
begin
    a = 1'b0;
    b = #10 1'b1;
    c = #5 1'b0;
    d = #20 {a, b, c};
end
```

My answer:

```
  0 a= 0, b= x, c= x, d= xxx
 10 a= 0, b= 1, c= x, d= xxx
 15 a= 0, b= 1, c= 0, d= xxx
 35 a= 0, b= 1, c= 0, d= 010
```

4. Repeat exercise 3 if nonblocking procedural assignments were used.

My answer:

```
  0 a= 0, b= x, c= x, d= xxx
  5 a= 0, b= x, c= 0, d= xxx
 10 a= 0, b= 1, c= 0, d= xxx
```

5. What is the order of execution of statements in the following Verilog code? Is there any ambiguity in the order of execution? What are the final values of a,b,c,d?

```
initial
begin
        a = 1'b0;
        #0 c = b;
end
initial
begin
        b = 1'b1;
        #0 d = a;
end
```

My answer:

```
0 a= 0, b= 1, c= 1, d= 0
```

6. What is the final value of d in the following example? (Hint: See intra-assignment delays.)

```
initial
begin
        b = 1'b1; c = 1'b0;
        #10 b = 1'b0;
initial
begin
        d = #25 (b | c);
end
```

My answer:

```
 0  b= 1, c= 0, d= x
10  b= 0, c= 0, d= x
25  b= 0, c= 0, d= 1
```