Assignment 31: Generate PWM signal.

Design a System that can output a PWM signal to increase the brightness of the LED linearly reaching maximum brightness and then start decreasing the brightness of the LED till it reaches minimum level. Avoid abruptly going to zero level after reaching the highest brightness.

Code:

```
Module pwm(
input clk, rst,
output reg dout
);

parameter period = 100;
integer count = 0;
integer ton   = 0;
reg ncyc      = 1'b0;
reg dir       = 1'b0; // 0: increasing, 1: decreasing

always@(posedge clk)
begin
      if(rst == 1'b1)
         begin
          count <= 0;
          ton   <= 0;
          ncyc  <= 1'b0;
          dir   <= 1'b0; // Initialize dir
         end
      else
        begin
             if(count <= ton)
               begin
               count <= count + 1;
               dout  <= 1'b1;
               ncyc  <= 1'b0;
               end
             else if (count < period)
               begin
               count <= count + 1;
               dout <= 1'b0;
               ncyc <= 1'b0;
               end
             else
                begin
                ncyc  <= 1'b1;
                count <= 0;
                end
        end
end


always @(posedge clk) begin
    if (rst == 1'b0) begin
        if (ncyc == 1'b1) begin
            // Update direction based on ton value
            if (ton >= period) begin
                dir <= 1'b1;  // Start decrementing
                ton <= period - 5; // Ensure ton is set to period
            end else if (ton <= 0) begin
                dir <= 1'b0;  // Start incrementing
                ton <= 5;     // Ensure ton is set to 0
            end
            // Update ton based on direction
            if (dir == 1'b0) begin
                // Increment ton, but ensure it does not exceed period
                if (ton < period) begin
                    ton <= ton + 5;
                end
            end else if (dir == 1'b1) begin
                // Decrement ton, but ensure it does not go below 0
                if (ton > 0) begin
                    ton <= ton - 5;
                end
            end
        end
    end
end
endmodule
```

Simulation: