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/*-------------------------------------------------------------------------------
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CLass: EE417 Summer 2024
Lesson 07 HW Question 2
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Project Description: COntroller module sends control command to the Datapath to shift
the value 1 left or right in an input data
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/*----------------------------up/down counter controller--------------*/
module Controller (
    input clk,
    input reset,
    input done,
    output reg shift_left,
    output reg shift_right,
    output reg load
);

reg [1:0] state, next_state;

parameter    IDLE  = 2'b00;
parameter    LOAD  = 2'b01;
parameter    SHIFT = 2'b10;
parameter    DONE  = 2'b11;

// State transition logic
always @ (posedge clk or posedge reset) begin
    if (reset)
        state <= IDLE;
    else
        state <= next_state;
end

// Next state logic
always @ (*) begin
    case (state)
        IDLE: next_state = LOAD;
        LOAD: next_state = SHIFT;
        SHIFT: next_state = done ? DONE : SHIFT; //keep shifting if Done is false
        DONE: next_state = IDLE;
        default: next_state = IDLE;
    endcase
end

// Output logic
always @ (*) begin
    shift_left  = 0;   // Default direction
    shift_right = 0;
           load = 0;
    case (state)
        IDLE: begin
               load = 1;
             end
        LOAD: begin
               shift_left = 1;
              end
        SHIFT: begin
                 if (shift_left)
                 begin
                   shift_left = 1;
                   shift_right = 0;
                 end
            else begin
                   shift_left = 0;
                   shift_right = 1;
                 end
        end
        DONE: begin
```

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70                // No control signals
71            end
72        endcase
73    end
74
75    endmodule
```