```
`timescale 1ns / 1ns

module hamming_testbench();
    reg [21:0] data;
    wire [1:0] error;
    reg fi = 1'b0;

    hamming tu(
        .data(data),
        .error_code(error)
    );

    /*
    Error detection table
    +----------+-------------+--------------
+-----------------------------------------------+
    | syndrome |   overall   |  error type  |
notes                     |
    |          | Parity (P5) |
|                                               |
    +----------+-------------+--------------
+-----------------------------------------------+
    |    0     |      0      |   no error
|                                               |
    +----------+-------------+--------------
+-----------------------------------------------+
    |   /=0    |      1      | single error | correctable.syndrome holds incorrect
bit      |
    |          |             |              |
position.                                     |
    +----------+-------------+--------------
+-----------------------------------------------+
    |   /=0    |      0      | double error | not
correctable.                              |
    +----------+-------------+--------------
+-----------------------------------------------+
    |    0     |      1      | parity error | overall parity. P5 is in error and can
be     |
    |          |             |              |
corrected.                                    |
    +----------+-------------+--------------
+-----------------------------------------------+
    */

    initial begin
        $dumpfile("hamming_testbench.vcd");
        $dumpvars(0, hamming_testbench);
        data = 22'b1111111111111111111111;
        #1;
        $display("Error code: %b", error);
        if (error != 2'b11) begin
            fi = 1'b1;
        end
        data = 22'b0100010000001100001110;
        #1;
        $display("Error code: %b", error);
        if (error != 2'b10) begin
            fi = 1'b1;
        end
        data = 22'b0100010000001100001100;
        #1;
        $display("Error code: %b", error);
        if (error != 2'b00) begin
            fi = 1'b1;
        end
        data = 22'b0110011001100110011001;
        #1;
        $display("Error code: %b", error);
        if (error != 2'b00) begin
            fi = 1'b1;
        end
        data = 22'b1100010000001100001100;
        #1;
        $display("Error code: %b", error);
        if (error != 2'b01) begin
            fi = 1'b1;
        end
        if (fi == 1'b0) begin
            $display("Pass");
        end else begin
            $display("Fail");
        end
        $finish();
    end
endmodule
```