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timescale 1ns / 1ps
////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
// Company:
// Engineer:
//
// Create Date: 11/02/2020 10:48:48 PM
// Design Name:
// Module Name: countUD4L
// Project Name:
// Target Devices:
// Tool Versions:
// Description:
//
// Dependencies:
//
// Revision:
// Revision 0.01 - File Created
// Additional Comments:
//
////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////

```

```

module countUD4L(
    input clk, Up, Dw, LD,
    input [3:0] Din,
    output [3:0] Q, // uncomment this line if you want Q as an output
    output UTC, DTC
);

//wire [1:0] Q; // comment this line if you want Q as an output
wire d0, d1, d2, d3;
wire q0, q1, q2, q3;
wire t1;

assign t1 = (LD|Up^Dw);
assign Q = {q3, q2, q1, q0};

assign d0 = ((q0^(Up|Dw))&~LD)|LD&Din[0];
assign d1 = ((q1^((Up&q0)|(Dw&~q0)))&~LD)|LD&Din[1];
assign d2 = ((q2^((Up&q0&q1)|(Dw&~q0&~q1)))&~LD)|LD&Din[2];
assign d3 = ((q3^((Up&q0&q1&q2)|(Dw&~q0&~q1&q2)))&~LD)|LD&Din[3];

//assign d0 = ((~Q[0]&Up&~Dw)|(~Q[4]&~Up&Dw))&~LD | LD&Din[0];
//assign d1 = (((Q[1]^Q[0])&Up&~Dw)|(((~Q[4]&Q[3])|(Q[4]&Q[3]))&~Up&Dw))&~LD |
LD&Din[1];
//assign d2 =

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(((Q[2]&~Q[0])|(Q[2]&~Q[1])|(~Q[2]&Q[1]&Q[0]))&Up&~Dw)|(((~Q[2]&~Q[3]&~Q[4])|(Q[4]&
Q[2])|(Q[3]&Q[2]))&~Up&Dw))&~LD | LD&Din[2];

//assign d3 =
(((Q[3]&~Q[2])|(Q[3]&~Q[0])|(Q[3]&~Q[1])|(~Q[3]&Q[2]&Q[1]&Q[0]))&Up&~Dw)|(((Q[1]&Q
[2])|(Q[1]&Q[4])|(Q[1]&Q[3])|(~Q[1]&~Q[2]&~Q[3]&~Q[4]))&~Up&Dw))&~LD | LD&Din[3];

//assign d1 = ((Q[0]^((Up&~Dw)|(~Up&Dw)))&~LD | LD&Din[0];
//assign d2 = ((Q[1]^((Up&~Dw&Q[0])|(~Up&Dw&~Q[0])))&~LD | LD&Din[1];
//assign d3 = ((Q[2]^((Up&~Dw&Q[0]&Q[1])|(~Up&Dw&~Q[0]&~Q[1])))&~LD | LD&Din[2];
//assign d4 = ((Q[3]^((Up&~Dw&Q[0]&Q[1]&Q[2])|(~Up&Dw&~Q[0]&~Q[1]&~Q[2])))&~LD
| LD&Din[3];

FDRE #(.INIT(1'b0)) Q0_FF (.C(clk), .R(1'b0), .CE(t1), .D(d0), .Q(q0));
FDRE #(.INIT(1'b0)) Q1_FF (.C(clk), .R(1'b0), .CE(t1), .D(d1), .Q(q1));
FDRE #(.INIT(1'b0)) Q2_FF (.C(clk), .R(1'b0), .CE(t1), .D(d2), .Q(q2));
FDRE #(.INIT(1'b0)) Q3_FF (.C(clk), .R(1'b0), .CE(t1), .D(d3), .Q(q3));

assign UTC = Q[3] & Q[2] & Q[1] & Q[0];
assign DTC = ~Q[3] & ~Q[2] & ~Q[1] & ~Q[0];

endmodule

```