Boolean Algebra

1. Design a clocked sequential circuit that recognizes the input sequence 0010. For example, when the input sequence x is 001001000010010, the output sequence z is 000100100001001. Use JK flip-flops for the implementation.

2. Design a serial binary adder that computes the sum of two n-bits binary number, one bit at a time, beginning with the least significant bit. Use a D flip-flop for the implementation.

3. Design an up/down counter with four states (0,1,2,3) using clocked JK flip-flops. A control signal x is to be used as follows: when x = 0 the circuit counts forward (up); when x = 1, backward (down). Use JK flip-flops for the implementation.

4. Design a control unit for a simple coin-operated candy machine. Candy costs 20 cents, and the machine accepts nickels and dimes. Change should be returned if more than 20 cents is deposited. No more than 25 cents can be deposited in a single purchase; therefore, the maximum change is one nickel. Use JK flip-flops for the implementation.

5. Design a serial parity generation circuit. The circuit receives a sequence of bits and determines whether the sequence contains an even or an odd number of ones. The output p should be 0 for even parity, that is, if the sequence contains an even number of ones, and 1 for odd parity. Use JK flip-flops for the implementation.

6. A sequential circuit has two inputs and two outputs. The input (x1, x2) represent a 2-bits binary number, N. If the present value of N is greater than the previous value, then z1 = 1, if the present value of N is less than the previous value, then z2 = 1. Otherwise, z1 and z2 are 0. Use JK flip-flops for the implementation.