Dept. of CSE, Bennett University

ECSE217L – Microprocessor and Computer Architecture Lab

Assignment – 2

In this lab, you will learn to simulate some more complex type of combinational circuits.This will help you learn more about digital system design.

1. In reference to a Boolean function consider a function 'Divide_Three' with a four-bit number as its argument. The four-bit number has the bit values as A, B, C, D such that all of A, B, C, D are one-bit binary values. The function will produce a 'one' in its output if the four-bit number is found to be divisible by 3, and a 'zero' if not divisible by 3. For example, Divide_Three(0, 1, 1, 0) will produce the output 1, because '6' is divisible by '3'. Write a Boolean algebraic formula for Divide_Three(A, B, C, D). Implement your formula as a circuit in Logisim.

   Write a short explanation along with the truth table of your expression and submit along with the Logisim circuit.

2. Design a 4-bit ripple carry adder using the 1-bit full adder unit available in Logisim.
3. Consider a logic unit with three input A, B, and C and two output as X and Y. X and Y is used to produce numbers as two-bit binary number as output depending on the number of 1 presented in the input bits. For example, if A = 0, B = 1, C = 0, then output should be 0 1; if inputs are like A = 1, B = 1, C = 0, then output should be 1 0, etc. Design the circuit. Prepare the truth table and explain the logic separately and submit them also.
4. Use a D flip-flop, a two-to-one-line multiplexer, and an inverter to design a JK flipflop. Include the explanation in the word file.
5. Design a counter that used to go through states 0, 3, 5, 6, 0, … - using 'T' flipflop.
6. Design an encoder for use in a domestic burglar alarm that has sensors for each of eight zones. Each sensor signal is 1 when an intrusion is detected in that zone, and 0 otherwise. Include the explanation in the word file. The encoder has three bits of output, encoding the zone as follows:

   Zone 1: 000 ; Zone 2: 001; Zone 3: 010; Zone 4: 011; Zone 5: 100; Zone 6: 101;
   Zone 7: 110; Zone 8: 111

Submission Instructions:

- Submit your .circ file from LMS within given timeline. Save all the filesas per the format RollNo_Lab#_QuestionNo.circ (Example: E19CSE632_Lab1_Q2.circ). Make a .zip file and upload.
- Write your Name and Roll No in the design itself. Without this you will scorezero for that particular question.
- Provide label for all the input and output.
- Late submission will lead to penalty.