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| **Department of Electrical and Computer Engineering****Concordia University**DIGITAL DESIGN, COEN 212 Instructor: Asim J. Al-Khalili, P.Eng.  |
|  Time Allowed 3:00 hrs. Final December, 2015, 2 pages No materials are allowed |

**Question 1**

**Design** a circuit that adds two BCD digits together with an input carry from the previous stage. You may assume to have 4-bit binary adders if needed. Give design details.

## **Question 2**

**Design** a synchronous BCD counter. Use T-Flip Flops for your implementation. Give design details starting with state diagram.

**Question 3**

1. **Design** a network that will add either 1 or 2 to a 3-bit binary number N. Let the inputs N2, N1, N0 represent N. The input K is a control signal. The network should have outputs M= M2, M1, M0, which represent the 3-bit binary number M. When K = 0, M = N + 1

 K = 1, M = N + 2

 **Assume that the inputs for which M > 1112 will never occur.**

1. Implement M2 using a 4-t0-1 multiplexer with minimum external logic.

**Question 4**

1. Using Boolean Algebra, show that the two functions **f1 and f2** are equal:

**f1(a,b,c) = a’c + b’c’ + ab**

**f2(a,b,c) = a’b’ + bc + ac’**

1. Using Boolean Algebra, minimize the following function:

**f(a,b,c,d) = ac’ + ab’d + a’b’c + a’cd’ + b’c’d’**

1. Give the maxterm equivalent of the following function:

**f(a,b,c,d) = bd**

1. Represent the following by a Boolean equation.

The air conditioner, (A), should be turned on if the temperature(TE) is greater than 750F, the time is between 8 a.m. and 5 p.m (TI). and it is not a holiday (H) (letters in the bracket represent the variables).

## **Question 5**

**Design** a clocked sequential network for a communication circuit which will investigate an input sequence X and will produce an output Z = 1 for any input sequence ending in 1101 or 011.

 Example: X = 0 0 1 1 0 1 1 0 1 0 1 1 0 1 0

 Z = 0 0 0 1 0 1 1 0 1 0 0 1 0 1 0

**Question 6**

**Analyze** the following circuit

