Jefferson Bui

CMPEN 271

25 September 2019

HW #4

# BCD Design Problem

Design a digital circuit that detects if a 4-bit input code is a valid BCD (Binary-Coded Decimal) code. That is, if the input value is in the range 0-9, then the output of the circuit is 1, otherwise the output of the circuit is 0. 1.) Draw truth table (label all inputs and outputs) 2.) Clearly indicate which variable is the lsb. 3.) Minimize boolean function using K-Map. 4.) Draw circuit (Use AND, OR, NOT gates) 5.) Include problem statement in the header.

Truth Table

Inputs: True = 1 / False = 0 Outputs:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| bitOne | bitTwo | bitThree | bitFour | LIT |
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | X |
| 1 | 0 | 1 | 1 | X |
| 1 | 1 | 0 | 0 | X |
| 1 | 1 | 0 | 1 | X |
| 1 | 1 | 1 | 0 | X |
| 1 | 1 | 1 | 1 | X |

Can utilize Don’t Cares in this problem because anything after 9 is an invalid BCD code.

The Least Significant Bit in this problem would be bitFour

Minimizing with K-Map:

Making things simpler (bitOne = A, bitTwo = B, bitThree = C, bitFour = D)

F = A’ + AB’C’

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | C’D’ | C’D | CD | CD’ |
| A’B’ | 1 | 1 | 1 | 1 |
| A’B | 1 | 1 | 1 | 1 |
| AB | 0 | 0 | 0 | 0 |
| AB’ | 1 | 1 | 0 | 0 |

Circuit:

