**CMPEN 270: Digital Design: Theory and Practice**

**Module 3 Lab: Boolean Equations**

**Due: 1/30/2022**

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**Grading Rubric**

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| **Criteria** | **Grade** |
| Initial grade, based on how well the functional specification is met  Excellent (exceptional achievement) 90-100%  Good (extensive achievement) 80-89%  Satisfactory (acceptable achievement) 72-79%  Poor (minimal achievement) 65 to 71%  Failure (inadequate achievement) 0-64% | / 25 |
| Modification for design documents  Block diagrams  State diagrams  State tables  Other |  |
| Modification for coding style, comments, efficiency  Header comments for files  Other comments (informative but not excessive)  Proper code indenting, alignment, use of whitespace  Code is clean (doesn't have commented out code without a good reason)  Self documenting code (good signal and component names, clear structure, etc.)  General approach (algorithms)  Coding details (operations)  Proper use of components  VHDL matches design documents  Other |  |
| Modification for sections in this report  Design  Verification  Evaluation  Questions  Other |  |
| Bonus (optional challenge, etc.) |  |
| Penalties  No grade until all deliverables are submitted, late submission penalty for anything submitted late  Late submission: (<1 day) -10%, (<1 week) -30%, (<2 weeks) -50%, (>=2 weeks) -99%  Attachments missing, not in order, instructions not followed: -10%  Other |  |
| TOTAL (Max is 100% of total points unless specified otherwise in handout) | / 25 |

**ACKNOWLEDGEMENT**

This work is entirely my own and I did not provide any assistance except as noted.

100% Robert Myers \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Robert Myers\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**ATTACHMENTS**

The following are attached, in this order:

* The truth table you made when you tested your circuit

**DESIGN**

There was no design for this lab.

**VERIFICATION**

To complete this lab, and specifically the Operation portion of the Functional Specification, I started by completing the Boolean algebra for each row of the truth table by hand. Evaluating the algebra, I reduced each equation using exclusively the Combining theorem (SOP for 7-15 and POS for 0-7). After calculating one row at a time, I converted my reduced Boolean equation from A, B, C, D notation to S3, S2, S1, and S0 notation and entered this into my .vhdl file. I then ran the simulator to ensure the resulting 1’s and 0’s (LEDx on/off) was correct.

**EVALUATION**

No performance metrics are required for this lab.

**QUESTIONS**

1. Write the function for LD0 using sigma notation:

LD0(SW3,SW2,SW1,SW0) =

1. Write the function for LD0 using pi notation:

LD0(SW3,SW2,SW1,SW0) =

1. Write the function for LD1 in canonical product-of-sums (POS) form:

LD1 =

1. Use Boolean algebra to simplify the equation for LD1 and indicate which theorem you used to do it:

LD1 =

= **Associativity Dual Theorem**

= **Combining Dual Theorem**

1. Write the function for LD11 using sigma notation:

LD11(SW3,SW2,SW1,SW0) =

1. Write the function for LD11 using pi notation:

LD11(SW3,SW2,SW1,SW0) =

1. Write the function for LD11 in canonical sum-of-products (SOP) form:

LD11 =

1. Use Boolean algebra to simplify the equation for LD11. Show each step and indicate which theorem you used for each step:

LD11 =

= Associativity Theorem

= Combining Theorem

= Combining Theorem

Truth Table Verification:

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