SYSC 2310 A Introduction to Digital Systems

Lab Report

Lab 5: Combinational Logic Circuits

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**Exercise 1.A: (PRE-LAB)**

***1. Draw a Complete Block Diagram of proposed ALU***

Diagram

Description automatically generated

***2. Any Block that has not been designed previously***

*a) 4-bit adder-subtractor with overflow detection*

Diagram

Description automatically generated

*b) 4-bit A+1 adder*

*Diagram

Description automatically generated*

*c) 1-bit full adder*

*Diagram

Description automatically generated*

*d)7 Segment Decoder*

*Diagram, schematic

Description automatically generated*

***3. Computer the total number of gates***

Assuming the hates have the same implementation area, the total number of gates in the proposed ALU design is 150 gates.

***4. Compute the Critical Path Delay (CPD)***

Assuming all of the gates have the same delay, the CPD of the proposed ALU design is 9 gates.

**Exercise 1.B**

***1. Implement Circuit in Logisim***

Diagram

Description automatically generated

***2. Logging File for ALU***

Table

Description automatically generated

Table

Description automatically generated

**Exercise 2: Study an Industrial ALU**

**Diagram, schematic

Description automatically generated**

Text, letter

Description automatically generated

**Exercise 3: Describe the Circuit (BONUS)**

Circuit Name: 4-bit ALU

8 Different Functions

1. Logic Functions (Only occur when S2 is equal to zero)

Output: LED’s

Input: 4 bits

Uses a MUX

a) A AND B

Occurs when S1 = 0

Occurs when S0 = 0

b) A OR B

Occurs when S1 = 0

Occurs when S0 = 1

c) A XOR B

Occurs when S1 = 1

Occurs when S0 = 0

d) A XNOR B

Occurs when S1 = 1

Occurs when S0 = 1

2. Arithmetic Functions (Only occur when S2 is equal to one)

Output: 7 Segment Decoder

Input: 4 bits

Uses a MUX, C-Out and Overflow Indicator Included

a) A+1

Occurs when S1 = 0

Occurs when S0 = 0

Occurs when C\_in= 0

b) A+B

Occurs when S1 = 0

Occurs when S0 = 1

Occurs when C\_in = 0

c) A-B

Occurs when S1 = 1

Occurs when S0 = 0

Occurs when C\_in = 1

d) B-A

Occurs when S1 = 1

Occurs when S0 = 1

Occurs when C\_in = 1