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CSC 137 Assignment 3

Design a Single Cell CPA (Ripple Carry Adder) full adder
A.   Input - A_x, B_x, C_{in} Output - S_x, C_{out}
3 inputs so 8 total possiblities for truth table 2^3

A.

	Input			Output	
	A_x	B_x	C_{in}	S_x	C_{out}
r_0	0	0	0	0	0
r_1	0	0	1	1	0
r_2	0	1	0	1	0
r_3	0	1	1	0	1
r_4	1	0	0	1	0
r_5	1	0	1	0	1
r_6	1	1	0	0	1
r_7	1	1	1	1	1

Step 1 Generate Truth table

$0+0=0$ $0+1=1$
$0,0$ $1+0=1$ $1+1=10$
$0,1$
$1,0$
$1,1$

Step 2 Determine logical expression with high numbers
$S_x = \overline{A_x} \overline{B_x} C_{in} + \overline{A_x} B_x \overline{C_{in}} + A_x \overline{B_x} \overline{C_{in}} + A_x B_x C_{in}$
$C_{in} = \overline{A_x} B_x C_{in} + A_x \overline{B_x} C_{in} + A_x B_x \overline{C_{in}} + A_x B_x C_{in}$

B, Step 3   Simplify with Kmap

S_x

A_x \ B_x C_{in}	00	01	11	10
0		1		1
1	1		1	

C_{out}

A_x \ B_x C_{in}	00	01	11	10
0			1	
1		1	1	1

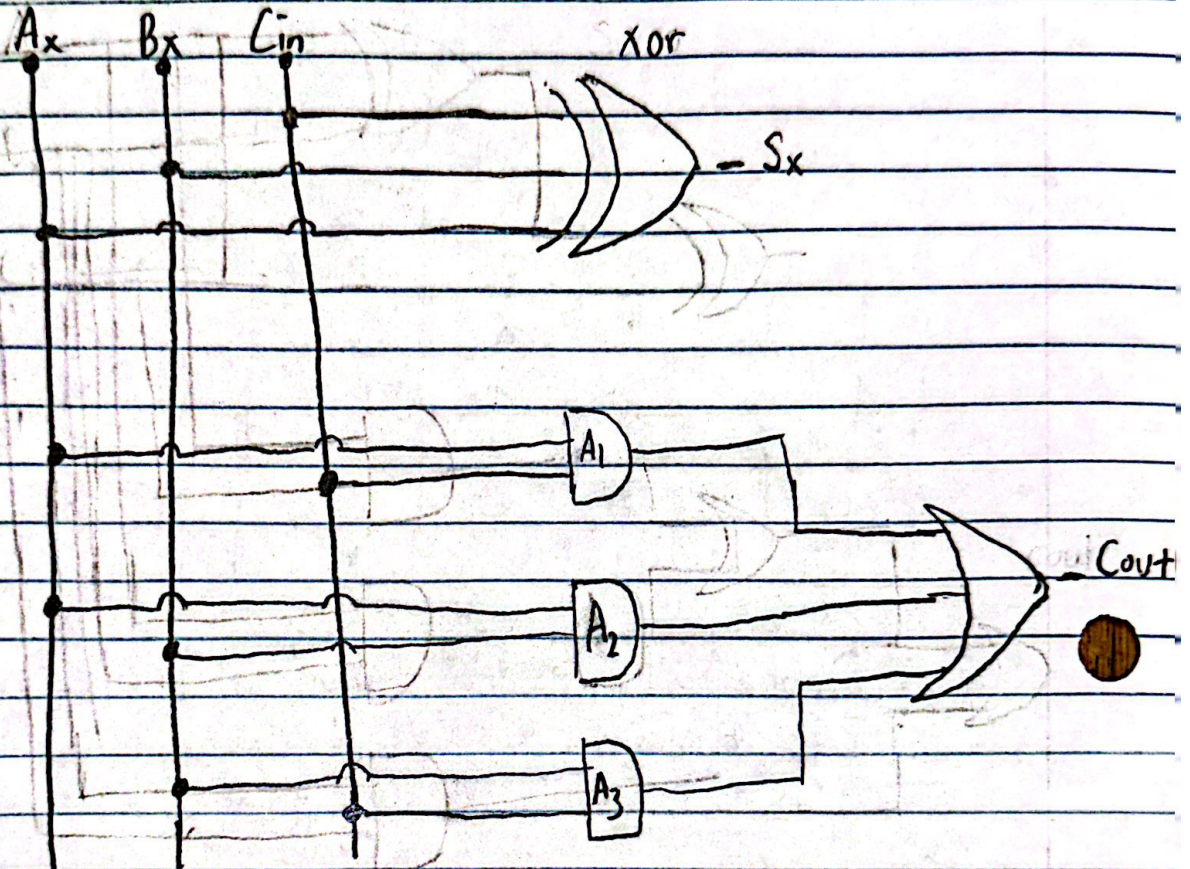Special case since diagonal
$S_x = A_x \oplus B_x \oplus C_x$
$\oplus$ exclusive or

#1 $101 \rightarrow 111$ #2 $111 \rightarrow 110$
#3 $111 \rightarrow 011$
$A_x C_{in} + A_x B_x + B_x C_{in}$
$A_1 \qquad A_2 \qquad A_3$

6. Create the Schematic diagram for the Full Adder

$A_x \oplus B_x \oplus C_x$ & $A_x C_{in} + A_x B_x + B_x C_{in}$

A_x   B_x   C_in   xor

                                                    — S_x

                              A_1

                                                    Cout

                              A_2

                              A_3

CSC 137 Assignment 3 Part 2

2. Design a 1 bit, 2 to 1 multiplexer. Outputs Y when S=0, X when S=1

A. Generate the truth table

0,0 $2^3 = 8$ outputs

S	X	Y	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

0,1
1,0
1,1

S=0 output y
S=1 output x

Step 2 determine Logical Expressions with high numbers

$$\bar{S}\bar{x}Y + \bar{S}xY + Sx\bar{y} + Sxy$$

B. Step 3 Simplify with Kmap

xy
S   00 01 11 10
 0   2
 1

001 → 011   111 → 110
             111 → 011   011 → 01

$$\bar{S}y + Sx$$

C | Schemstic Diagram for Mux

$$\bar{S}y + Sx$$
$$A_2'\ \ \ A_1$$

inverter