

1. Design a Single cell -1 bit Carry propagate (Ripple Carry Adder) full adder. (6 pts)
 - a. Generate the truth table
 - b. Using K-map, determine the logical expression for Carry out (C-out) and Sum (S)
 - c. Based on the logical expression, create the schematic diagram for full adder

Q. $X = 0111$
 $Y = 1111$

Inputs			Outputs	
X	Y	Z-in	S	Z-out
1	1	0	0	1
1	1	1	1	1
1	1	1	1	1
0	1	1	0	1

Always Zero

S = Sum

b. Output Logical Expression

$$S = \bar{X}\bar{Y}Z_{in} + \bar{X}Y\bar{Z}_{in} + X\bar{Y}\bar{Z}_{in} + XYZ_{in}$$

$$Z_{out} = \bar{X}YZ_{in} + X\bar{Y}Z_{in} + XY\bar{Z}_{in} + XYZ_{in}$$

K-map of the Output Logical Expression

$$S = \bar{X}\bar{Y}Z_{in} + \bar{X}Y\bar{Z}_{in} + X\bar{Y}\bar{Z}_{in} + XYZ_{in}$$

X \ Y, Z-in				
	00	01	11	10
0		1		1
1	1		1	

* See what changes in the implicants * * \oplus = XOR *

$$S_{\text{simplified}} = X \oplus Y \oplus Z_{in}$$

$$Z_{out} = \bar{X}YZ_{in} + X\bar{Y}Z_{in} + XY\bar{Z}_{in} + XYZ_{in}$$

X \ Y, Z-in				
	00	01	11	10
0			1	
1		1	1	1

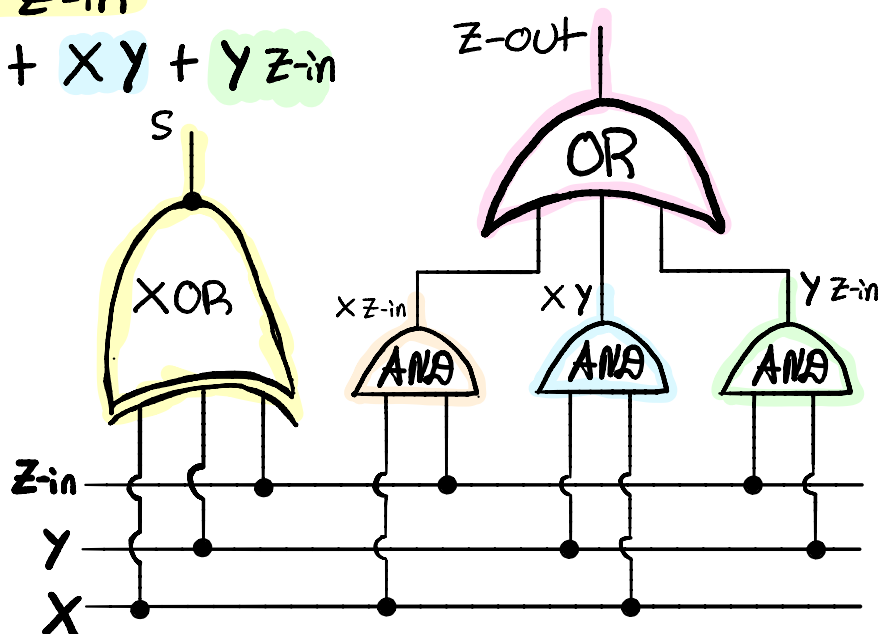
Implicant 02 BZ-in
Implicant 01 XB
Implicant 00 XZ-in

* See what changes in the implicants *

$$Z_{out} \text{ simplified} = XZ_{in} + XY + YZ_{in}$$

C. $S_{\text{simplified}} = X \oplus Y \oplus Z_{in}$

$$Z_{out} \text{ simplified} = XZ_{in} + XY + YZ_{in}$$



2. Design a 1 bit, 2 to 1 multiplexer (Mux) (6 pts)

- Generate the truth table
- Using K-map, determine the logical expression for output
- Based on the logical expression, create the schematic diagram for Mux

a)

ctrl	Input signals		output
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

b)

$$r = \bar{S}\bar{x}y + \bar{S}xy + Sx\bar{y}$$

Y, Z-in

X \ Y	00	01	11	10
0		1	1	
1			1	1

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

