HW #3

CSc 137, Harvey

Adder/Mux (12 pts)

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

2. Design a 1 bit, 2 to 1 multiplexer (Mux). Outputs Y when S = 0; X when S = 1. (6 pts)
   a. Generate the truth table
   b. Using K-map, determine the logical expression for output
   c. Based on the logical expression, create the schematic diagram for Mux

(1.) Design a single cell -1 bit Carry Propagate (Ripple Carry Adder) full adder.

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a) Generate Truth Table

	Inputs			Outputs	
	A_x	B_x	C_{in}	S (sum output)	C_{out}
R1	0	0	0	0	0
R2	0	0	1	1	0
R3	0	1	0	1	0
R4	0	1	1	0	1
R5	1	0	0	1	0
R6	1	0	1	0	1
R7	1	1	0	0	1
R8	1	1	1	1	1

b) Using K-map, determine the logical expression for Carry out (c-out) and Sum (s)

$S = R2 + R3 + R5 + R8$

$C_{out} = R4, R6, R7, R8$

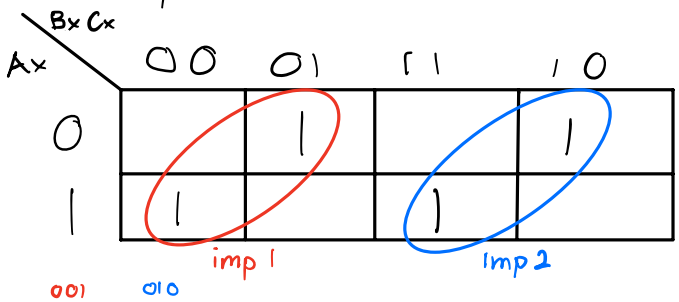
$S = \bar{A}_x \bar{B}_x C_x + \bar{A}_x B_x \bar{C}_x + A_x \bar{B}_x \bar{C}_x + A_x B_x C_x$

$= A \oplus B \oplus C$

$C_{out} = \bar{A}_x B_x C_x + A_x \bar{B}_x C_x + A_x B_x \bar{C}_x + A_x B_x C_x$

$= A_x C_x + B_x C_x + A_x B_x$

S k-map:

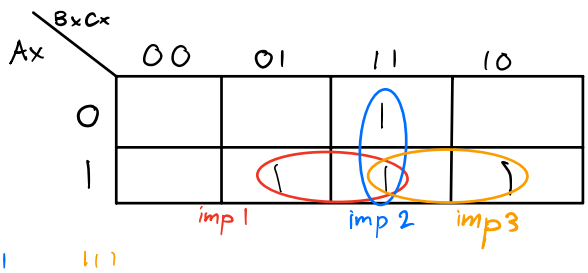


001 100 → $\bar{B}_x$ + 010 111 → B_x

$S = \bar{B}_x + B_x$

$= A_x \oplus B_x \oplus C_x$

Cout k-map:



101 011 11
111 111 10

$Cout = AxCx + BxCx + AxBx$

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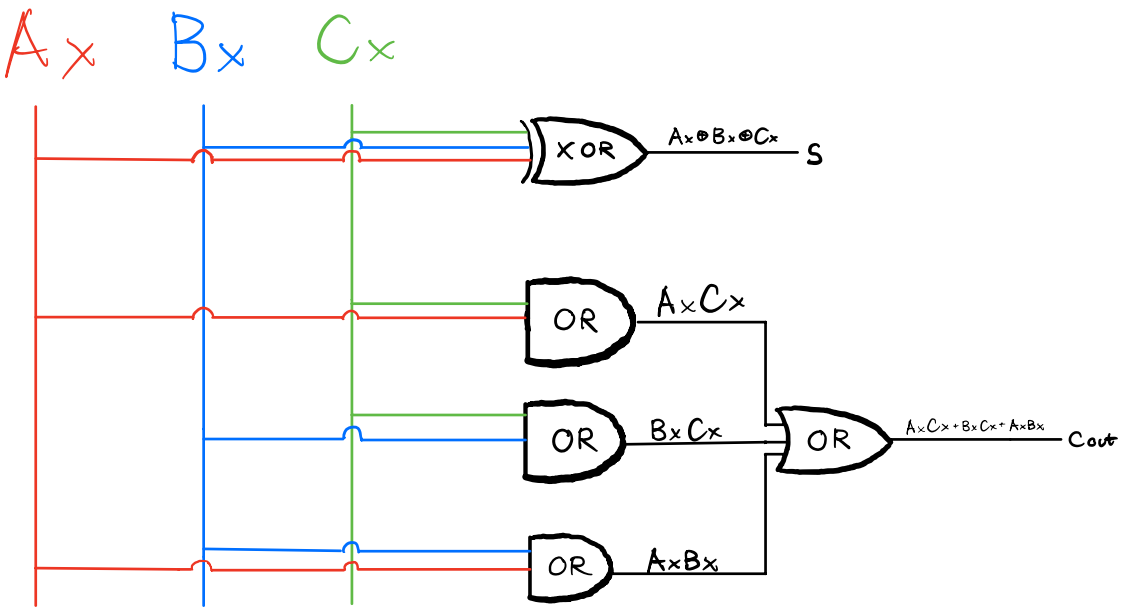
c) Based on the logical expression, create the schematic diagram for full adder



② Design a 1-bit, 2 to 1 MUX.
Output Y when S = 0, X when S = 1

a) Generate truth table

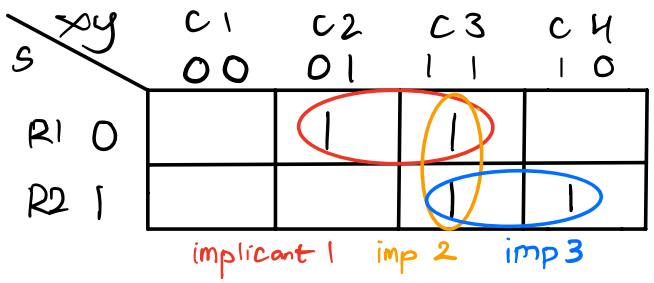
control signal	input signals		output
S	x	y	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Y when S = 0

X when S = 1

b) Using K-Map, determine the logical expression for output

when r = 1: $r = \bar{S}\bar{x}y, \bar{S}xy, Sx\bar{y}, Sxy$
R2 R4 R7 R8



001 011 011 111 111 110

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

c) Based on the logical expression, create the schematic diagram for MUX

$r = \bar{s}y + sx$