

Student name: _____

1. Perform the following operations involving 7-bit 2's complement numbers. Find the decimal values of the resulting 2's complement numbers. Indicate whether arithmetic overflow occurs or not.

$$\begin{array}{r} 1110101 \\ + 1011110 \\ \hline \end{array}$$

The result is 1010011.
The decimal value of the result is -45.
The arithmetic overflow does not occur.

$$\begin{array}{r} 0110101 \\ - 1001111 \\ \hline \end{array}$$

The result is 1100110.
The decimal value of the result is -26.
The arithmetic overflow occurs.

2. Find the simplest product-of-sums (POS) expression for g . Show your work.

$$g(a, b, c) = M_0 M_2 M_3 M_4$$

$$\begin{aligned} g &= (a + b + c)(a + b' + c)(a + b' + c')(a' + b + c) \\ &= (a + c)(a + b')(b + c) \\ &= (a + b')(b + c) \end{aligned}$$

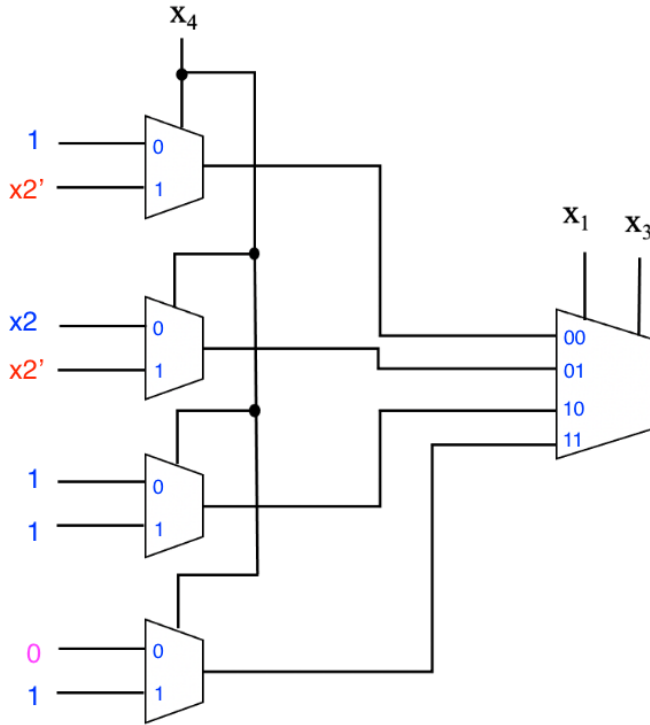
3. Find the simplest sum-of-products (SOP) expression for the function F whose K-map is shown below, where A , C , W , and Y are the inputs.

		AC			
		00	01	11	10
WY	00	0	1	0	0
	01	1	1	0	1
	11	1	0	1	1
	10	1	0	0	0

$$F = YC' + A'C'W + A'CW' + AWY$$

4. Complete a combinational circuit design using the given Multiplexers and logic gates (if needed) that fulfills the function $f(x_1, x_2, x_3, x_4) = M_2 M_5 M_7 M_{10} M_{14}$. Show all your work.

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$f = 0$ when

- 1) $x_1 = 0, x_2 = 0, x_3 = 1, x_4 = 0$
- 2) $x_1 = 0, x_2 = 1, x_3 = 0, x_4 = 1$
- 3) $x_1 = 0, x_2 = 1, x_3 = 1, x_4 = 1$
- 4) $x_1 = 1, x_2 = 0, x_3 = 1, x_4 = 0$ OR
- 5) $x_1 = 1, x_2 = 1, x_3 = 1, x_4 = 0$

Case i) When $x_1=x_3=0, x_4=0$:

if $x_2 = 0, f = 1$

if $x_2 = 1, f = 1$

To summarize, $f = 1$

Case ii) When $x_1=x_3=0, x_4=1$:

if $x_2 = 0, f = 1$

if $x_2 = 1, f = 0$

To summarize, $f = x_2'$

Case iii) When $x_1=0, x_3=1, x_4=0$:

if $x_2 = 0, f = 0$

if $x_2 = 1, f = 1$

To summarize, $f = x_2$

Case iv) When $x_1=0, x_3=1, x_4=1$:

if $x_2 = 0, f = 1$

if $x_2 = 1, f = 0$

To summarize, $f = x_2'$

Case v) When $x_1=1, x_3=0, x_4=0$:

if $x_2 = 0, f = 1$

if $x_2 = 1, f = 1$

To summarize, $f = 1$

Case vi) When $x_1=1, x_3=0, x_4=1$:

if $x_2 = 0, f = 1$

if $x_2 = 1, f = 1$

To summarize, $f = 1$

Case vii) When $x_1=x_3=1, x_4=0$:

if $x_2 = 0, f = 0$

if $x_2 = 1, f = 0$

To summarize, $f = 0$

Case viii) When $x_1=x_3=1, x_4=1$:

if $x_2 = 0, f = 1$

if $x_2 = 1, f = 1$

To summarize, $f = 1$