

(Exercise reference: David M. Harris, Sarah L. Harris, Digital Design and Computer Architecture, 2nd Edition, Elsevier, 2013, ISBN-13: 978-0-12-394424-5)

- 1) Write a Boolean equation in sum-of-products canonical form for each of the truth tables shown below.

(a)			(b)				(c)			
A	B	Y	A	B	C	Y	A	B	C	Y
0	0	1	0	0	0	1	0	0	0	1
0	1	0	0	0	1	0	0	0	1	0
1	0	1	0	1	0	0	0	1	0	1
1	1	1	0	1	1	0	0	1	1	0
			1	0	0	0	1	0	0	1
			1	0	1	0	1	0	1	1
			1	1	0	0	1	1	0	0
			1	1	1	1	1	1	1	1

- 2) Write a Boolean equation in product-of-sums canonical form for each of the truth tables shown in Exercise 1 above.
- 3) Minimize each of the Boolean equations from Exercise 1.
- 4) Sketch a simple combinational circuit implementing each of the functions from Exercise 3 using only NOT gates and 2-input AND and 2-input OR gates.

Exercise Solutions:

1)

(a) $Y = \bar{A}\bar{B} + A\bar{B} + AB$

(b) $Y = \bar{A}\bar{B}\bar{C} + ABC$

(c) $Y = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C} + A\bar{B}C + ABC$

2)

(a) $Y = (A + \bar{B})$

(b)

$$Y = (A + B + \bar{C})(A + \bar{B} + C)(A + \bar{B} + \bar{C})(\bar{A} + B + C)(\bar{A} + B + \bar{C})(\bar{A} + \bar{B} + C)$$

(c) $Y = (A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + \bar{B} + C)$

3)

(a)

$$Y = \bar{A}\bar{B} + A(\bar{B} + B)$$

$$Y = \bar{A}\bar{B} + A$$

$$Y = (\bar{A} + A)(\bar{B} + A)$$

$$Y = \bar{B} + A = A + \bar{B}$$

(b) Cannot be simplified further.

(c)

$$Y = \bar{A}\bar{C}(\bar{B} + B) + A\bar{B}\bar{C} + AC(\bar{B} + B)$$

$$Y = \bar{A}\bar{C} + A\bar{B}\bar{C} + AC$$

$$Y = \bar{A}\bar{C} + A(\bar{B}\bar{C} + C)$$

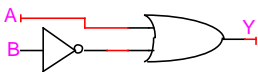
$$Y = \bar{A}\bar{C} + A((\bar{B} + C)(\bar{C} + C))$$

$$Y = \bar{A}\bar{C} + A(\bar{B} + C)$$

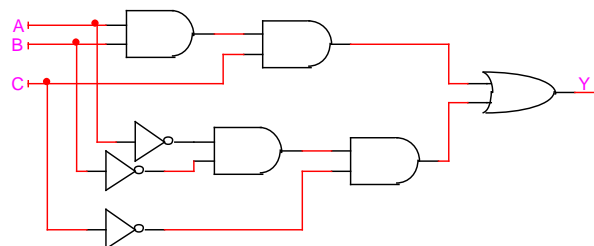
$$Y = \bar{A}\bar{C} + A\bar{B} + AC$$

4)

(a)



(b)



(c)

