

CO450 Computer Architectures Week 9 Exercise Handout

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Truth Tables

1. Create a truth table for two inputs (a, b)

We have done this first one for you.

a	b
0	0
1	0
0	1
1	1

2. Create a truth table for four inputs (a, b, c, d):

a	b	c	d
.	.	.	.
.	.	.	
.	.		.
.	.		
.		.	.
.		.	
.			.
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	.	.	.
	.	.	
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	.		
		.	.
		.	
			.

Truth Tables from Logic Expressions

1. Create a Truth Table for the following logic expression:

$$f = a \cdot b$$

We have done this first one for you.

a	b	$a \cdot b$	f
0	0	0	0
1	0	0	0
0	1	0	0
1	1	1	1

2. Create a Truth Table for the following logic expression:

$$f = (a \cdot b) \cdot (c \cdot d)$$

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a · b</i>	<i>c · d</i>	<i>f</i>
1	1	1	1	1	1	1
1	1	1	0	1	0	0
1	1	0	1	1	0	0
1	1	0	0	1	0	0
1	0	1	1	0	1	0
1	0	1	0	0	0	0
1	0	0	1	0	0	0
1	0	0	0	0	0	0
0	1	1	1	0	1	0
0	1	1	0	0	0	0
0	1	0	1	0	0	0
0	1	0	0	0	0	0
0	0	1	1	0	1	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	0	0	0

3. Create a Truth Table for the following logic expression:

$$f = a + b$$

<i>a</i>	<i>b</i>	<i>a + b</i>	<i>f</i>
1	1	1	1
1	0	1	1
0	1	1	1
0	0	0	0

4. Create a Truth Table for the following logic expression:

$$f = (a + b) \cdot (c + d)$$

a	b	c	d	$a + b$	$c + d$	f
1	1	1	1	1	1	1
1	1	1	0	1	1	1
1	1	0	1	1	1	1
1	1	0	0	1	0	0
1	0	1	1	1	1	1
1	0	1	0	1	1	1
1	0	0	1	1	1	1
1	0	0	0	1	0	0
0	1	1	1	1	1	1
0	1	1	0	1	1	1
0	1	0	1	1	1	1
0	1	0	0	1	0	0
0	0	1	1	0	1	0
0	0	1	0	0	1	0
0	0	0	1	0	1	0
0	0	0	0	0	0	0

5. Create a Truth Table for the following logic expression:

$$f = \bar{a}$$

a	\bar{a}	f
1	0	0
0	1	1

6. Create a Truth Table for the following logic expression:

$$f = \bar{a} \cdot \bar{b}$$

a	b	\bar{a}	\bar{b}	$\bar{a} \cdot \bar{b}$	f
1	1	0	0	0	0
1	0	0	1	0	0
0	1	1	0	0	0
0	0	1	1	1	1

7. Create a Truth Table for the following logic expression:

$$f = \overline{a \cdot b}$$

a	b	$a \cdot b$	$\overline{a \cdot b}$	f
1	1	1	0	0
1	0	0	1	1
0	1	0	1	1
0	0	0	1	1

8. Create a Truth Table for the following logic expression:

$$f = \overline{a + b}$$

a	b	$a + b$	$\overline{a + b}$	f
1	1	1	0	0
1	0	1	0	0
0	1	1	0	0
0	0	0	1	1

9. Create a Truth Table for the following logic expression:

$$f = (\overline{a \cdot b}) \cdot (\overline{c \cdot d})$$

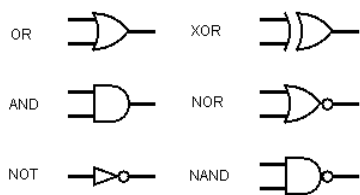
a	b	c	d	$a \cdot b$	$c \cdot d$	$\overline{a \cdot b}$	$\overline{c \cdot d}$	f
1	1	1	1	1	1	0	0	0
1	1	1	0	1	0	0	1	0
1	1	0	1	1	0	0	1	0
1	1	0	0	1	0	0	1	0
1	0	1	1	0	1	1	0	0
1	0	1	0	0	0	1	1	1
1	0	0	1	0	0	1	1	1
1	0	0	0	0	0	1	1	1
0	1	1	1	0	1	1	0	0
0	1	1	0	0	0	1	1	1
0	1	0	1	0	0	1	1	1
0	1	0	0	0	0	1	1	1
0	0	1	1	0	1	1	0	0
0	0	1	0	0	0	1	1	1
0	0	0	1	0	0	1	1	1
0	0	0	0	0	0	1	1	1

10. Create a Truth Table for the following logic expression:

$$f = (\overline{a + b}) + (\overline{c + d})$$

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>a + b</i>	<i>c + d</i>	$\overline{a + b}$	$\overline{c + d}$	<i>f</i>
1	1	1	1	1	1	0	0	0
1	1	1	0	1	0	0	1	0
1	1	0	1	1	1	0	0	0
1	1	0	0	1	0	0	1	0
1	0	1	1	0	1	1	0	0
1	0	1	0	0	0	1	1	1
1	0	0	1	0	1	1	0	0
1	0	0	0	0	0	1	1	1
0	1	1	1	1	1	0	0	0
0	1	1	0	1	0	0	1	0
0	1	0	1	1	1	0	0	0
0	1	0	0	1	0	0	1	0
0	0	1	1	0	1	1	0	0
0	0	1	0	0	0	1	1	1
0	0	0	1	0	1	1	0	0
0	0	0	0	0	0	1	1	1

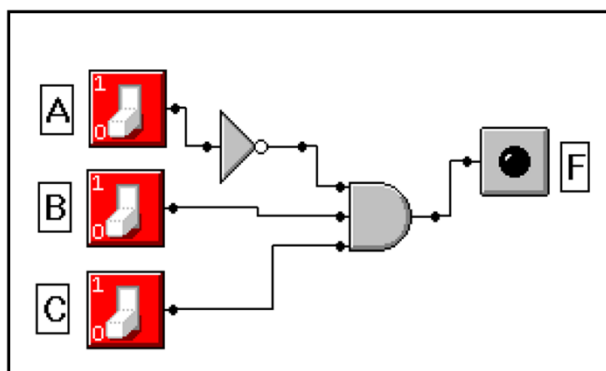
Building Logic Circuits from Expressions



1. Create a Logic Circuit Design for the following logic expression:

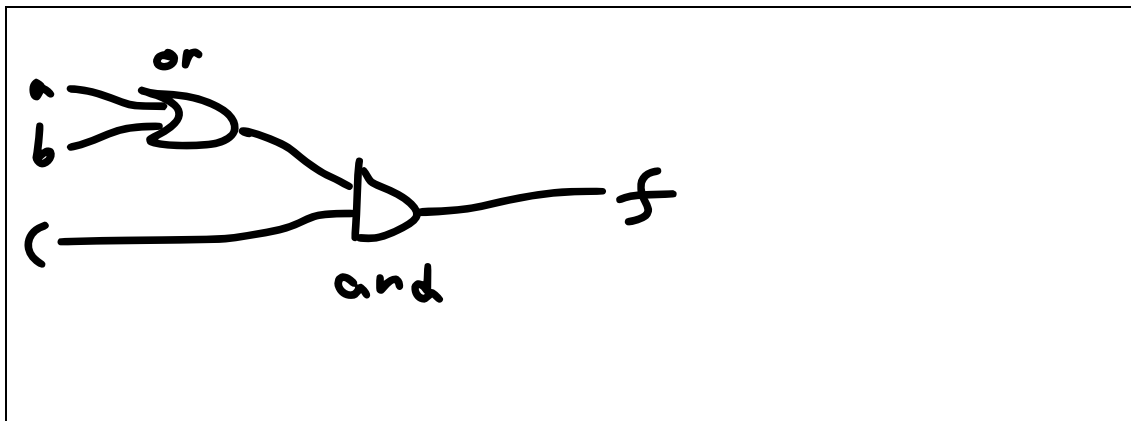
$$f = \bar{a} \cdot b \cdot c$$

We have done this first one for you.



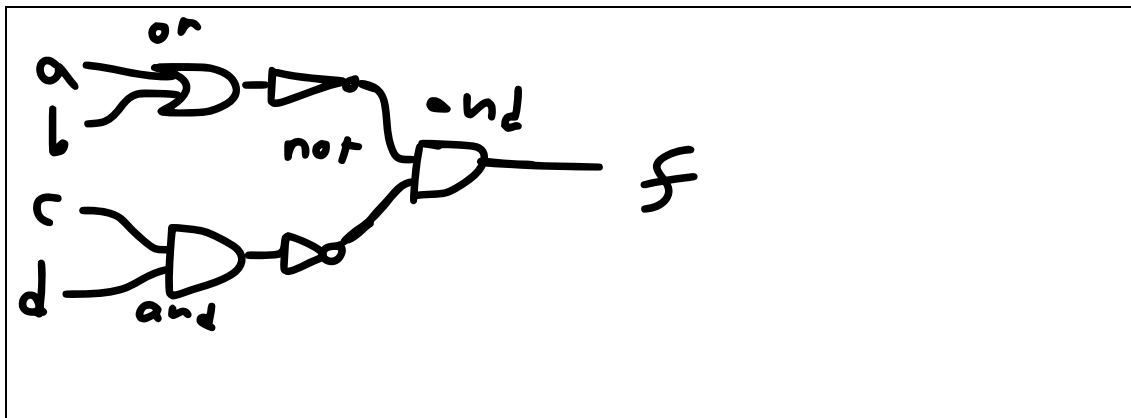
2. Create a Logic Circuit Design for the following logic expression:

$$f = (a + b) \cdot c$$



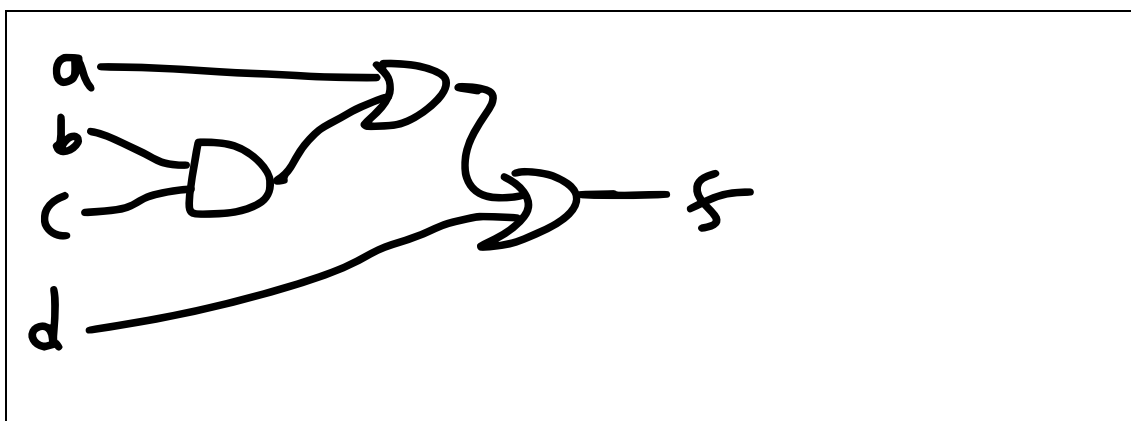
3. Create a Logic Circuit Design for the following logic expression:

$$f = \overline{(a + b)} \cdot \overline{(c \cdot d)}$$



4. Create a Logic Circuit Design for the following logic expression:

$$f = a + (b \cdot c) + d$$



The Answers

Truth Tables

1.

a	b
0	0
1	0
0	1
1	1

2.

a	b	c	d
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	0
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	0
0	0	0	1
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	1	1

Truth Tables from Logic Expressions

1. $f = a \cdot b$

a	b	$a \cdot b$	f
0	0	0	0
1	0	0	0
0	1	0	0
1	1	1	1

$$2. f = (a \cdot b) \cdot (c \cdot d)$$

a	b	c	d	$a \cdot b$	$c \cdot d$	f
0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
1	1	0	0	1	0	0
0	0	1	0	0	0	0
1	0	1	0	0	0	0
0	1	1	0	0	0	0
1	1	1	0	1	0	0
0	0	0	1	0	0	0
1	0	0	1	0	0	0
0	1	0	1	0	0	0
1	1	0	1	1	0	0
0	0	1	1	0	1	0
1	0	1	1	0	1	0
0	1	1	1	0	1	0
1	1	1	1	1	1	1

$$3. f = a + b$$

a	b	$a + b$	f
0	0	0	0
1	0	1	1
0	1	1	1
1	1	1	1

$$4. f = (a + b) \cdot (c + d)$$

a	b	c	d	$a + b$	$c + d$	f
0	0	0	0	0	0	0
1	0	0	0	1	0	0
0	1	0	0	1	0	0
1	1	0	0	1	0	0
0	0	1	0	0	1	0
1	0	1	0	1	1	1
0	1	1	0	1	1	1
1	1	1	0	1	1	1
0	0	0	1	0	1	0
1	0	0	1	1	1	1
0	1	0	1	1	1	1
1	1	0	1	1	1	1
0	0	1	1	0	1	0
1	0	1	1	1	1	1
0	1	1	1	1	1	1
1	1	1	1	1	1	1

5. $f = \bar{a}$

a	\bar{a}	f
0	1	1
1	0	0

6. $f = \bar{a} \cdot \bar{b}$

a	b	\bar{a}	\bar{b}	f
0	0	1	1	1
1	0	0	1	0
0	1	1	0	0
1	1	0	0	0

7. $f = \overline{a \cdot b}$

a	b	$\overline{a \cdot b}$	f
0	0	1	1
1	0	1	1
0	1	1	1
1	1	0	0

8. $f = \overline{a + b}$

a	b	$\overline{a + b}$	f
0	0	1	1
1	0	0	0
0	1	0	0
1	1	0	0

9. $f = (\overline{a \cdot b}) \cdot (\overline{c \cdot d})$

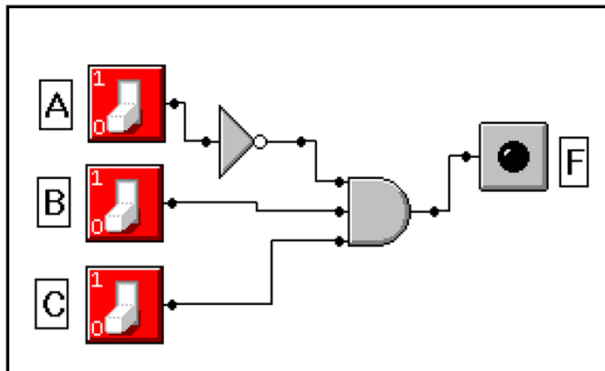
a	b	c	d	$\overline{a \cdot b}$	$\overline{c \cdot d}$	f
0	0	0	0	1	1	1
1	0	0	0	1	1	1
0	1	0	0	1	1	1
1	1	0	0	0	1	0
0	0	1	0	1	1	1
1	0	1	0	1	1	1
0	1	1	0	1	1	1
1	1	1	0	0	1	0
0	0	0	1	1	1	1
1	0	0	1	1	1	1
0	1	0	1	1	1	1
1	1	0	1	0	1	0
0	0	1	1	1	0	0
1	0	1	1	1	0	0
0	1	1	1	1	0	0
1	1	1	1	0	0	0

$$10. f = (\overline{a + b}) + (\overline{c + d})$$

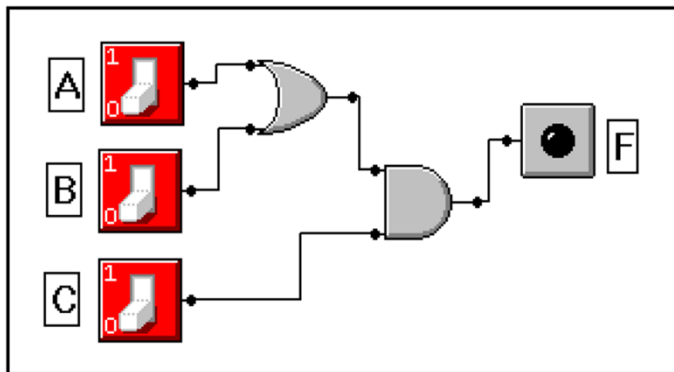
a	b	c	d	$\overline{a + b}$	$\overline{c + d}$	f
0	0	0	0	1	1	1
1	0	0	0	0	1	1
0	1	0	0	0	1	1
1	1	0	0	0	1	1
0	0	1	0	1	0	1
1	0	1	0	0	0	0
0	1	1	0	0	0	0
1	1	1	0	0	0	0
0	0	0	1	1	0	1
1	0	0	1	0	0	0
0	1	0	1	0	0	0
1	1	0	1	0	0	0
0	0	1	1	1	0	1
1	0	1	1	0	0	0
0	1	1	1	0	0	0
1	1	1	1	0	0	0

Building Logic Circuits from Expressions

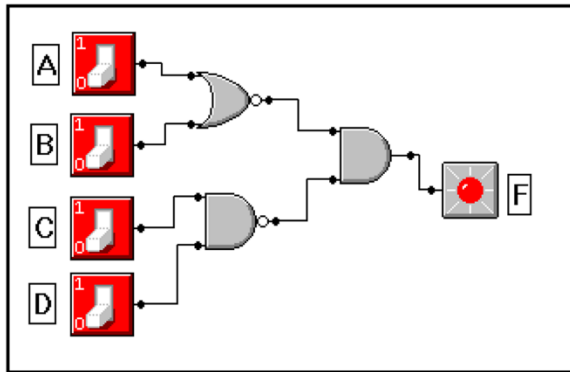
$$1. f = \bar{a} \cdot b \cdot c$$



$$2. f = (a + b) \cdot c$$



3. $f = \overline{(a + b)} \cdot \overline{(c \cdot d)}$



4. $f = a + (b \cdot c) + d$

