CO450 Computer Architectures Week 9 Exercise Handout

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***

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***	$\boldsymbol{a \cdot b}$	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:

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

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

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

$f = a + b$

a	b	$a + b$	f

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

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

$f = \bar{a}$

a	$\bar{a}$	f

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

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

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

$f = \overline{a + b}$

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

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

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

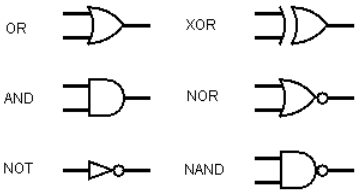
a	b	c	d	$a \cdot b$	$c \cdot d$	$\overline{a \cdot b}$	$\overline{c \cdot d}$	f

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

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

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

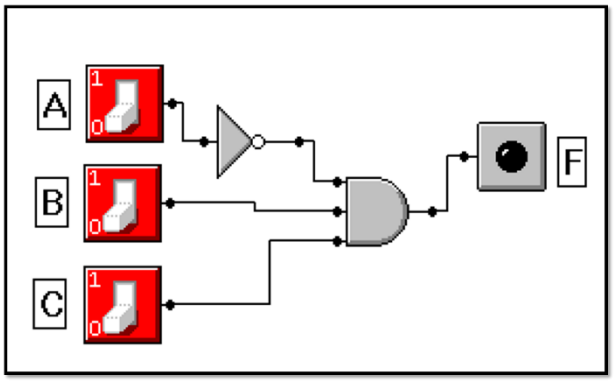
Building Logic Circuits from Expressions



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

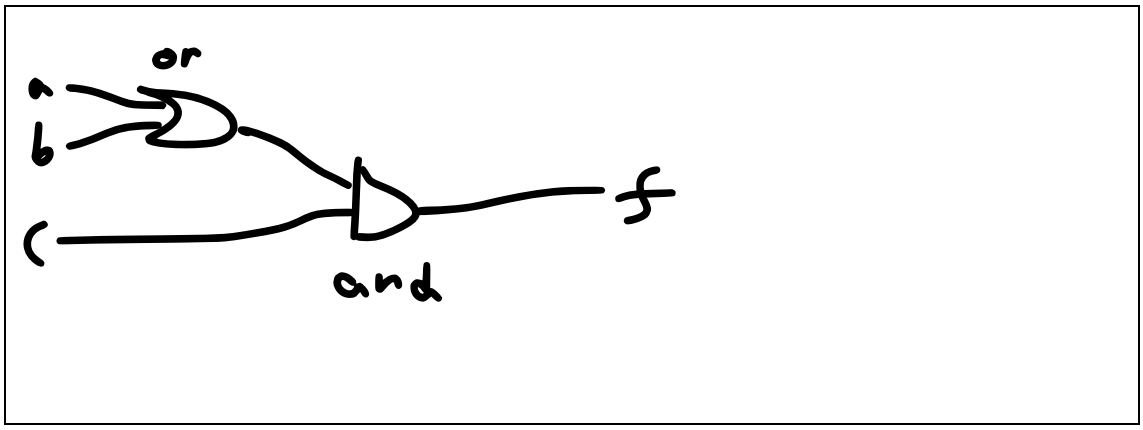
$f = \bar{a} \cdot b \cdot c$

We have done this first one for you.



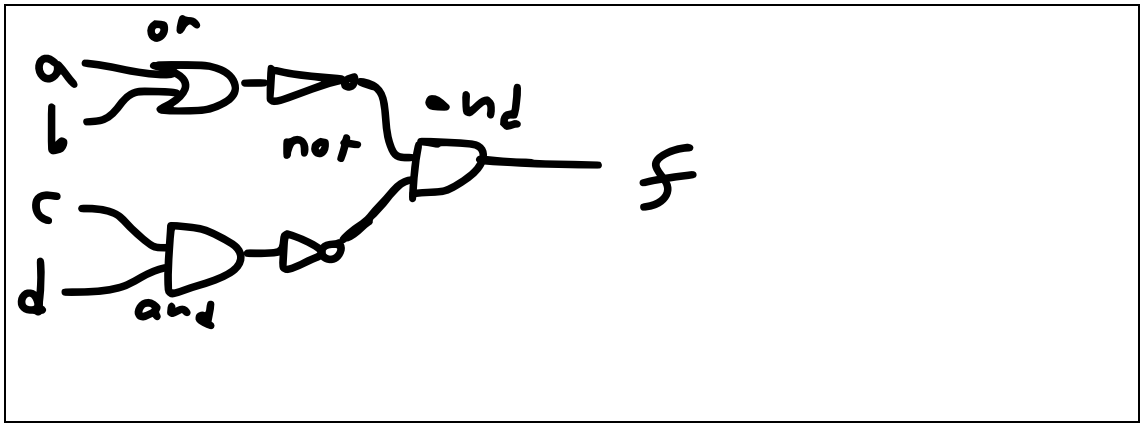
2. Create a Logic Circuit Design for the following logic expression:

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



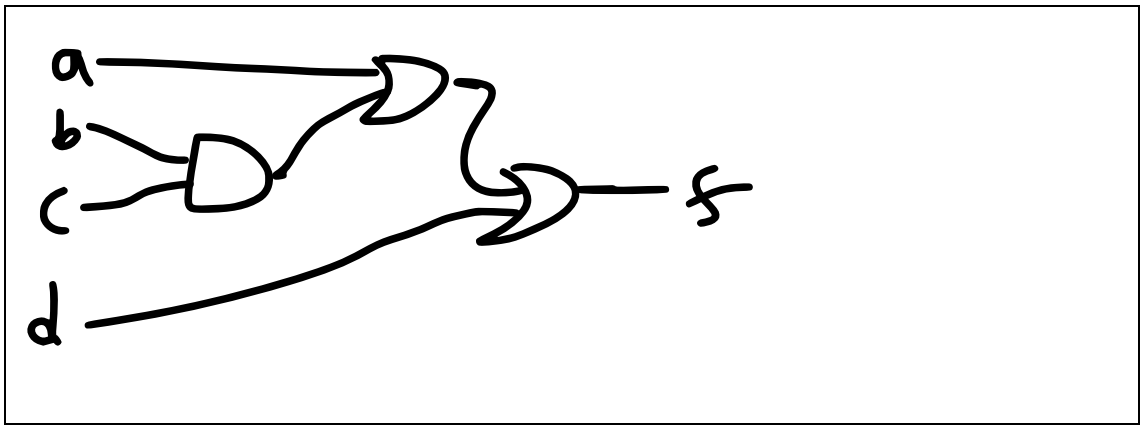
3. Create a Logic Circuit Design for the following logic expression:

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



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

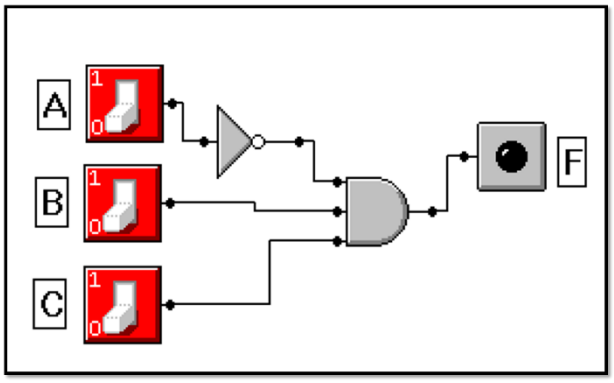
a	b	c	d	$\overline{a \cdot b}$	$\overline{c \cdot d}$	f
0	0	0	0	1	1	1
1	0	0	0	1	1	1
0	1	0	0	1	1	1
1	1	0	0	0	1	0
0	0	1	0	1	1	1
1	0	1	0	1	1	1
0	1	1	0	1	1	1
1	1	1	0	0	1	0
0	0	0	1	1	1	1
1	0	0	1	1	1	1
0	1	0	1	1	1	1
1	1	0	1	0	1	0
0	0	1	1	1	0	0
1	0	1	1	1	0	0
0	1	1	1	1	0	0
1	1	1	1	0	0	0

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

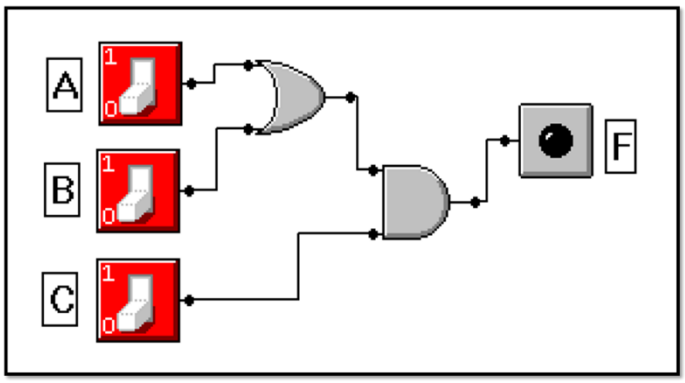
a	b	c	d	$\overline{a + b}$	$\overline{c + d}$	f
0	0	0	0	1	1	1
1	0	0	0	0	1	1
0	1	0	0	0	1	1
1	1	0	0	0	1	1
0	0	1	0	1	0	1
1	0	1	0	0	0	0
0	1	1	0	0	0	0
1	1	1	0	0	0	0
0	0	0	1	1	0	1
1	0	0	1	0	0	0
0	1	0	1	0	0	0
1	1	0	1	0	0	0
0	0	1	1	1	0	1
1	0	1	1	0	0	0
0	1	1	1	0	0	0
1	1	1	1	0	0	0

Building Logic Circuits from Expressions

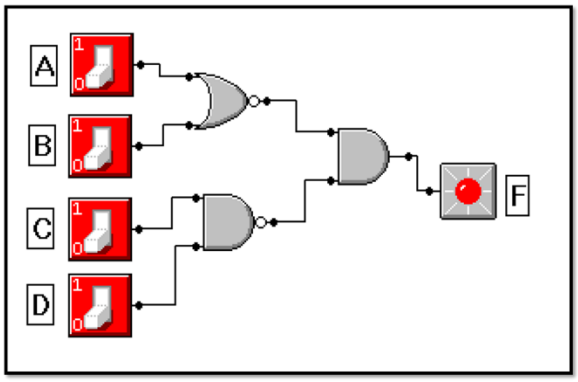
1. $f = \bar{a} \cdot b \cdot c$



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



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



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