

Exam 3 , Chapter 3 preview

CS 210 Fall 2017

Chapter 3.1: Set definitions and operations

Question 1

Using these sets:

$$\begin{array}{lll}
 U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} & A = \{5, 6, 9\} & B = \{3, 4, 9, 10\} \\
 & C = \{5, 6\} & D = \{2, 6, 8\}
 \end{array}$$

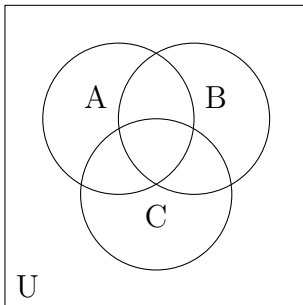
Find the results of the following set operations:

- | | | |
|---------------|------------|---------------|
| a. $A - C$ | b. $C - A$ | c. $A \cap C$ |
| d. $A \cup D$ | e. A' | f. $C \cup B$ |

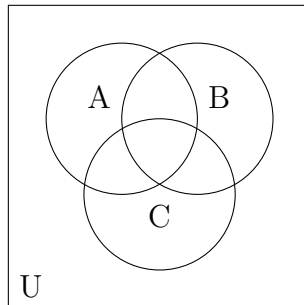
Question 2

Fill in the Venn diagrams for each of the following statements. Remember to include the Universe.

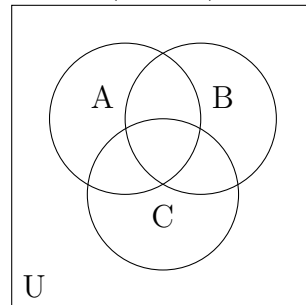
a. $U - A$



b. $B' - A$



c. $A \cup (B - C)$



Question 3

- The set of odd integers.
- The set of natural numbers that are even.

Chapter 3.2: More operations on sets

Question 4

Using these sets:

$$A = \{fast, slow\} \quad B = \{bike, car\}$$

Find the result of the following:

- $A \times B =$
- $\wp(B) =$
- List out all 2 partitions of A .

Question 5

Using these sets:

$$A = \{1, 2\} \quad B = \{a, b\}$$

Find the result of the following:

- $A \times B =$
- $\wp(A \times B) =$
- $\wp(A) =$
- $\wp(B) =$
- Fill out the table for $\wp(A) \times \wp(B)$:

	\emptyset	$\{1\}$	$\{2\}$	$\{1, 2\}$
\emptyset				
$\{a\}$				
$\{b\}$				
$\{a, b\}$				

Write out the set $\wp(A) \times \wp(B) =$

Chapter 3.4: Boolean algebra

Question 6

Rewrite each of the following with the equivalent Boolean Algebra version. Convert upper-case Set names to lower-case variables ($A \rightarrow a$) but keep the same letters for propositional variables ($p \rightarrow p$).

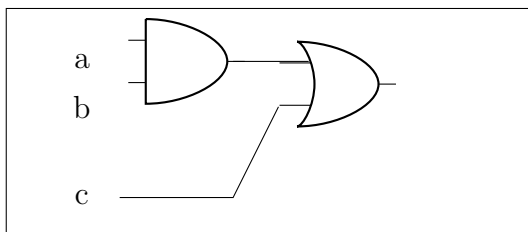
- | | | |
|-----------------|------------------|-----------------|
| a. $(A \cup B)$ | b. $C - D$ | c. $p \wedge q$ |
| d. $\neg q$ | e. $(A \cap B)'$ | f. $\neg(p)$ |

Chapter 3.5: Logic circuits

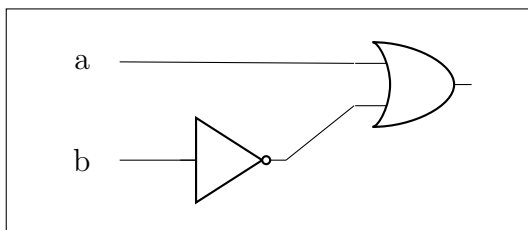
Question 7

Identify the Boolean Expression for the following diagrams. You do not need to simplify it.

a.



b.



Question 8

Draw a circuit diagram for the following Boolean Expression:

$$a'b + b'c$$

Question 9

For the following Karnaugh map:

	y	y'
x		✓
x'	✓	✓

Identify the following:

- All 3 terms:
- Simplified equation:

Question 10

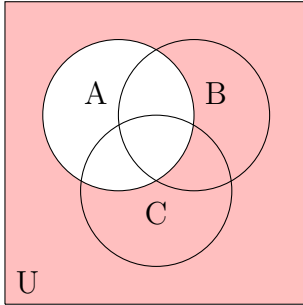
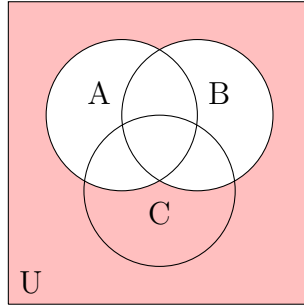
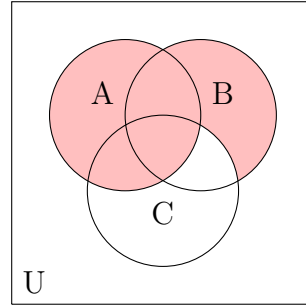
Simplify the following Boolean Expression. Mark the terms in the Karnaugh map, then build out rectangles to come up with a simplified expression.

$$xyz' + xy'z' + x'yz + x'yz' + x'y'z' + x'y'z$$

	yz	yz'	$y'z'$	$y'z$
x				
x'				

Exam 3 , Chapter 3 preview answer key**Chapter 3.1: Set definitions and operations****Question 1**

- $A - C = \{9\}$
- $C - A = \emptyset$
- $A \cap C = \{5, 6\}$
- $A \cup D = \{2, 5, 6, 8, 9\}$
- $A' = \{1, 2, 3, 4, 7, 8, 10\}$
- $C \cup B = \{3, 4, 5, 6, 9, 10\}$

Question 2a. $U - A$ b. $B' - A$ c. $A \cup (B - C)$ **Question 3**

- a. The set of odd integers. $\{2k + 1 : k \in \mathbb{Z}\}$
- b. The set of natural numbers that are even. $\{2k : k \in \mathbb{N}\}$

Question 4

- a. $A \times B = \{(fast, bike), (fast, car), (slow, bike), (slow, car)\}$
- b. $\wp(B) = \{\emptyset, \{bike\}, \{car\}, \{bike, car\}\}$
- c. List out all 2 partitions of A .
- (a) $\{\{fast\}, \{slow\}\}$
- (b) $\{\{fast, slow\}\}$

Question 5

- a. $A \times B = \{(1, a), (1, b), (2, a), (2, b)\}$
- b. $\wp(A \times B) = \{\emptyset,$
 $\{(1, a)\}, \{(1, b)\}, \{(2, a)\}, \{(2, b)\},$
 $\{(1, a), (1, b)\}, \{(1, a), (2, a)\}, \{(1, a), (2, b)\},$
 $\{(1, b), (2, a)\}, \{(1, b), (2, b)\}, \{(2, a), (2, b)\},$
 $\{(1, a), (1, b), (2, a)\}, \{(1, a), (1, b), (2, b)\},$
 $\{(1, a), (2, a), (2, b)\}, \{(1, b), (2, a), (2, b)\},$
 $\{(1, a), (1, b), (2, a), (2, b)\}\}$

c. $\wp(A) = \{\emptyset, \{1\}, \{2\}, \{1, 2\}\}$

d. $\wp(B) = \{\emptyset, \{a\}, \{b\}, \{a, b\}\}$

e. Fill out the table for $\wp(A) \times \wp(B)$:

	\emptyset	$\{1\}$	$\{2\}$	$\{1, 2\}$
\emptyset	(\emptyset, \emptyset)	$(\emptyset, \{1\})$	$(\emptyset, \{2\})$	$(\emptyset, \{1, 2\})$
$\{a\}$	$(\{a\}, \emptyset)$	$(\{a\}, \{1\})$	$(\{a\}, \{2\})$	$(\{a\}, \{1, 2\})$
$\{b\}$	$(\{b\}, \emptyset)$	$(\{b\}, \{1\})$	$(\{b\}, \{2\})$	$(\{b\}, \{1, 2\})$
$\{a, b\}$	$(\{a, b\}, \emptyset)$	$(\{a, b\}, \{1\})$	$(\{a, b\}, \{2\})$	$(\{a, b\}, \{1, 2\})$

Write out the set $\wp(A) \times \wp(B) = \{(\emptyset, \emptyset), (\emptyset, \{1\}), (\emptyset, \{2\}), (\emptyset, \{1, 2\}), (\{a\}, \emptyset), (\{a\}, \{1\}), (\{a\}, \{2\}), (\{a\}, \{1, 2\}), (\{b\}, \emptyset), (\{b\}, \{1\}), (\{b\}, \{2\}), (\{b\}, \{1, 2\}), (\{a, b\}, \emptyset), (\{a, b\}, \{1\}), (\{a, b\}, \{2\}), (\{a, b\}, \{1, 2\})\}$

Question 6

$$(A \cup B) \quad (a + b)$$

$$p \wedge q \quad p \cdot q$$

$$(A \cap B)' \quad (a \cdot b)'$$

$$C - D \quad c \cdot d'$$

$$\neg q \quad q'$$

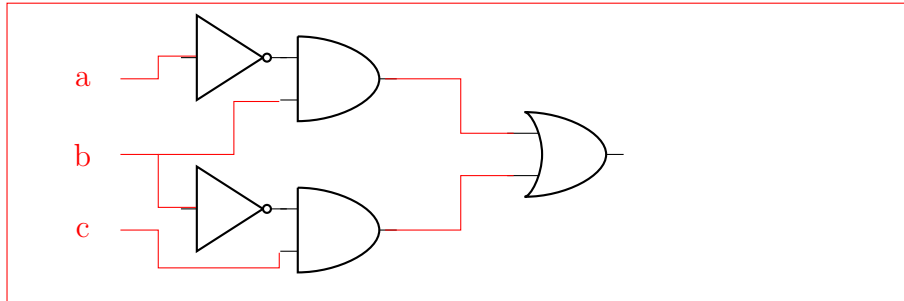
$$\neg(p) \quad (p)'$$

Question 7

a. $(a \cdot b) + c$

b. $(a + b')$

Question 8



Question 9

- a. All 3 terms: $x'y, x'y', xy'$
- b. Simplified equation: $x' + y'$

Question 10

	yz	yz'	$y'z'$	$y'z$
x		✓	✓	
x'	✓	✓	✓	✓

Can simplify to...

$$x' + xz'$$