

Assignment 1

Due: Thu 6/14/2018 by 11:59pm

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Practice Problems

Prepare for graded problems by completing the following problems which have solutions in the textbook. Some of these problems may covered in Discussion Exercises.

- Section 1.1: 1, 3, 5, 9(a,c,e,g), 13(a,b,d,f), 23(b,d,f,h), 27, 33(a,c,e), 37(a,c,e), 43
- Section 1.2: 7, 11, 17, 41
- Section 1.3: 5, 7, 13, 19, 25, 33, 49, 57

Graded Problems

Complete the problems on the following pages. *Electronic submission is preferred* : save a copy of this document, fill in answers, and convert to a PDF to upload it.

If electronic work proves difficult, you may print these pages, write your answers on them, scan/photograph them, convert to a PDF, and then upload as your assignment.

Problem 1 (20 points)

(5 points for each part)

Show the results of performing the following boolean operations on the given bit strings. Show some **intermediate steps** for these problems.

a) $1\ 1000 \wedge (0\ 1011 \vee 1\ 1011)$

b) $(0\ 1111 \wedge 1\ 0101) \vee 0\ 1000$

c) $(0\ 1010 \oplus 1\ 1011) \oplus 0\ 1000$

d) $(1\ 1011 \vee 0\ 1010) \wedge (1\ 0001 \vee 1\ 1011)$

Problem 2 (10 points)

Determine if these system specifications consistent. If not, show how the specifications are contradictory.

1. Whenever the system software is being upgraded, users cannot access the file system.
2. If users can access the file system, then they can save new files.
3. If users cannot save new files, then the system software is not being upgraded."

Problem 3 (10 points)

5 points for each part

The police have three suspects for the murder of Mr. Cooper: Mr. Smith, Mr. Jones, and Mr. Williams.

These three all declare that they are innocent. Each also makes the following additional statements.

- Smith: Cooper and Jones were friends while Cooper was disliked Williams.
- Jones: Jones did not know Cooper and that he was out of town the day Cooper was killed.
- Williams: Saw both Smith and Jones with Cooper the day of the killing and that either Smith or Jones must have killed him.

Determine the murderer or murderers in the following two cases or describe why the case cannot be solved on the present information.

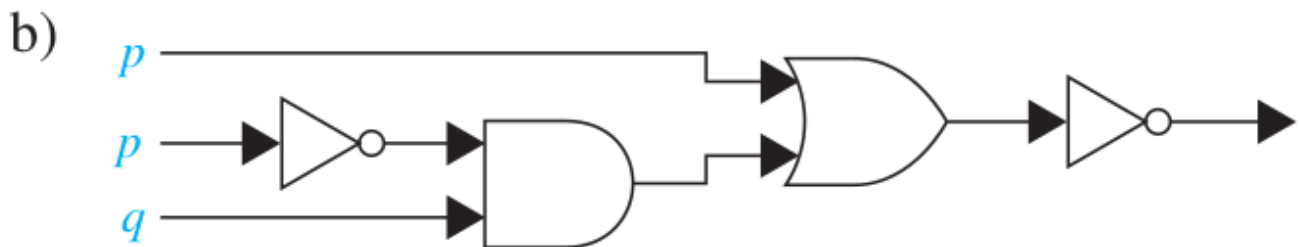
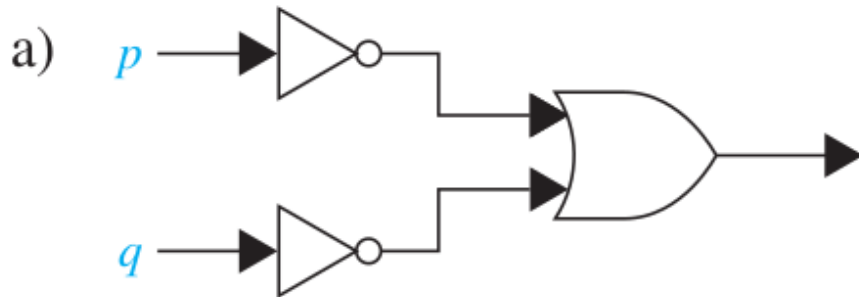
- a) Assume that one of the three suspects is guilty. The two innocent people are telling the truth, but the statements of the guilty person may or may not be true.

- b) Assume that innocent people do not lie while guilty people may lie. *Hint: This is a weaker assumption than part (a)*

Problem 4 (10 points)

5 points for each part

Write boolean expressions representing the single output for the following circuits.



a)

b)

Problem 5 (20 points)

5 points for each part

Use De Morgan's laws to find the negation of each of the following statements. State the negations in English.

a) Kwame will take a job in industry or go to graduate school.

b) Yoshiko knows Java and calculus.

c) James is young and strong.

d) Rita will move to Oregon or Washington.

Problem 6 (10 points)

Show that $\neg p \rightarrow (q \rightarrow r)$ and $q \rightarrow (p \vee r)$ are logically equivalent. Do so in two ways.

a) Using a truth table.

b) Using a sequence of logical equivalences

Problem 7 (10 points)

Show that $(p \wedge q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ are NOT logically equivalent.

Problem 8 (10 points)

5 points per part

Construct a logic circuit that outputs the value of the following boolean expressions. If you are working on a digital assignment, edit the provided picture by double clicking, copying / deleting gates, and drawing lines between them.



Template Gates

a) $\neg x \vee y$



Draw here

b) $\neg(x \vee y) \wedge x$



Draw here