LW: Boolean Logic

# Requirements

* **A grade of "complete" on this lab work requires a score of at least 52 in the autograder.**
* **Avoid working on this labwork in advance. Wait and do it collaboratively with other students during your lab session.**

# Submission

Submit the following files to Gradescope:

* boolean\_functions.cpp
* problem8.cpp
* problem9.cpp

# Tasks

Download the [start code](https://drive.google.com/file/d/1us6WtsTleBH1vbz_jIn1gqtW3Jpw_Ogp/view).

Complete the code for the boolean\_function.cpp file's seven functions:

1. booleanLogic1(): [5 points] Print the truth table for NOT
2. booleanLogic2(): [5 points] Print the truth table for OR
3. booleanLogic3(): [5 points] Print the truth table for AND
4. booleanLogic4(): [5 points] Print the truth table for XOR
5. booleanLogic5(): [16 points] Compute x OR y OR z, given assigned truth values
6. booleanLogic6(): [16 points] Compute x AND y AND z, given assigned truth values
7. booleanLogic7(): [16 points] Compute x XOR y XOR z, given assigned truth values

# Challenge Tasks

1. [16 points] Compute f(x, y, z) given an assignment of truth values and the truth table and implement the function in problem8.cpp.

x | y | z | f

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0 | 0 | 0 | 0

0 | 0 | 1 | 1

0 | 1 | 0 | 1

0 | 1 | 1 | 1

1 | 0 | 0 | 1

1 | 0 | 1 | 0

1 | 1 | 0 | 0

1 | 1 | 1 | 1

One way to do this is to identify the rows of the table where f(x,y,z) is true. Then express the assignment of truth values as a boolean formula (e.g. (x,y,z) = (1,0,1) is expressed “x AND NOT y AND z”). The disjunction (OR) of all of those formulas will be a formula for f.

Another way to do it is to do the same thing for all the rows where f is false, combine them into one big disjunction, then take the negation (NOT) of the whole formula to obtain a formula for f.

A third way is to stare really hard at the table and crush the problem in your mind-vice to produce a succinct and elegant formula. This method is not recommended for novice logicians.

1. [16 points] Find an assignment to the boolean variables w,x,y,z that satisfies the boolean formula. Set these values in problem9.cpp. Note: There are two possible solutions, either will work.

x AND (w OR y) AND (NOT w OR NOT z) AND (NOT y or z)

Crush it in your mind-vice: assign a truth value to one variable at a time and reduce the set of possible values of the rest until only 1 or 2 possibilities remain.

# Instructions

For each of the first seven task functions, run the following compile and run statements.

| $ g++ -std=c++17 -Wall -Werror -g -pedantic -Weffc++ boolean\_functions.cpp test#.cpp  $ ./a.out  *program output*  $ |
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Note:

* *#* is the number of the corresponding function in boolean\_functions.cpp.
* Do not type the $ symbol.

For tasks 8 and 9, you should write code to test your implementation.