

Name: _____

Date: _____

CS270 Homework Assignment 3 (HW3)

Goals: To understand boolean algebra, combinational logic and sequential circuits. You need to submit your Logisim design, in addition to the document with the answers that you will submit.

The Assignment

You can use a prime (') to indicate complement if you like.

1. [20 pts] We have seen that according to the Boolean algebra $xy + x\bar{y} = x$, which was used by Maurice Karnaugh to come up with his famous K-maps. Simplify the expression below using Boolean algebra. Combine the first two terms and the last two terms. Can you combine the resulting two terms themselves to simplify it further. If so, give the simplest expression you can find.

$$\begin{aligned} ab\bar{c} + abc + \bar{a}bc + \bar{a}b\bar{c} &= && (2 \text{ terms}) \\ &= && (1 \text{ term}) \end{aligned}$$

2. [10 pts] Fill the for terms above in a 3-variable K-map. Color the first two terms in red and the second two terms in green. Then see what Boolean expression the 4 terms together correspond to. Does it match what you have in question 1?

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- b. Implement its combinational part as a subcircuit Comb with combinational logic with inputs s, q1, q0 and outputs d1 and d0. Use Logisim's built-in Combinational Analysis capability to enter and minimize the design. Verify that it works correctly.
- c. Now create a main circuit that has an input labeled S, two D flip-flops labeled Q1 and Q0, and the subcircuit Comb. Connect them appropriately and verify the operation.
- d. Copy and paste the circuit below. Also submit the circuit as a .circ file.

Submission Instructions

Submit as a PDF document using RAMCT.