CSE352 Spring 2015 Homework #2

Instructor: Joshua Smith

TA: Hanchuan Li

Due Online in Catalyst 4/17/2015

Homework will be graded on both effort and correctness. If you find yourself having trouble with a problem, write down what you know and how far you were able to get to get partial credit. Solutions that are correct but do not adequately explain the question may not receive full credit. Solutions that are incorrect and show no work will not receive any credit.

You are encouraged to collaborate with your peers. However, each person must write up their homework assignments individually. Justice will be enforced if you are caught cheating. If you need an extension, you are required to submit a Haiku explaining why you need an extension BEFORE the homework deadline. Late homework is subject to a late penalty of 20 percent per day.

If you have any questions, please email to 'staff_cse352 15sp@cs.washington.edu'

Problem 1 *Bubble Pushing*

Using De Morgan equivalent gates and bubble pushing methods, redraw the circuit below so that you can find the Boolean equation by inspection. Write the Boolean equation.

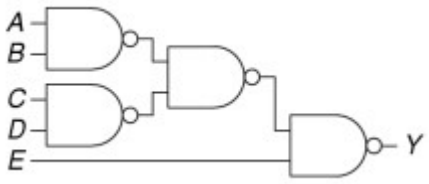


Figure 1: Circuit for Problem 1

This question has multiple solutions and one of them is:

Problem 2 *Multiplexer*

Julie needs to implement the function $Y = \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{C}$ for her senior project, but when she looks in her lab kit, the only part she has left is an 8:1 multiplexer. How does she implement the function?

Problem 3 *Karnaugh Map*

(a) Write Boolean equations for the circuit below. Do not minimize the equations. (b) Minimize the Boolean equations from part (a) and sketch an improved circuit with the same function.

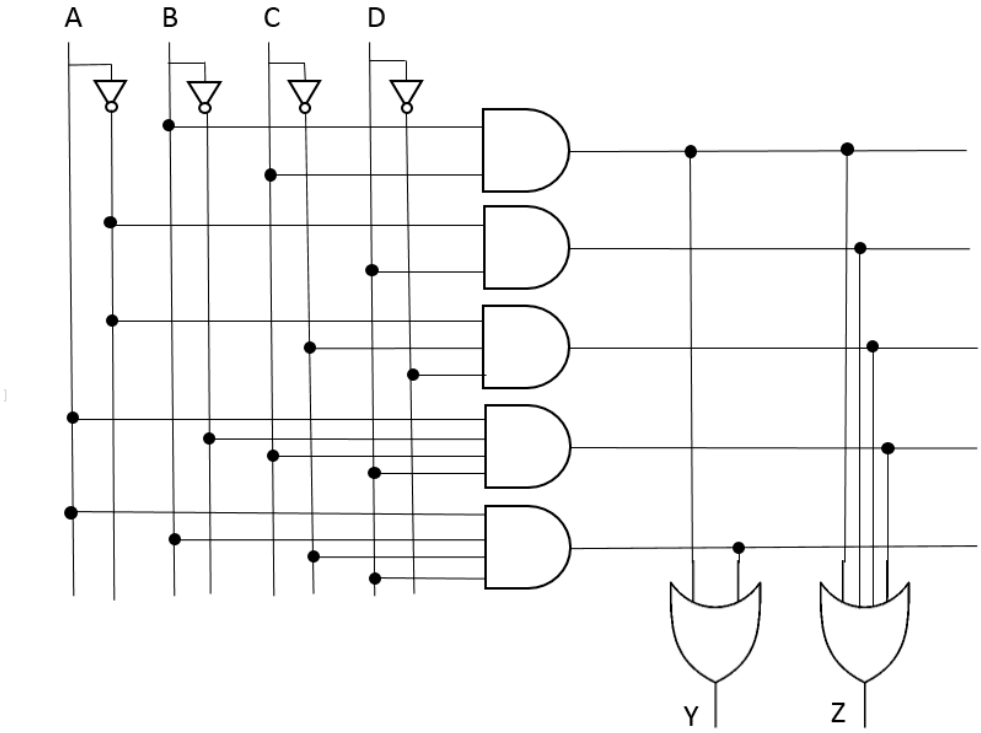


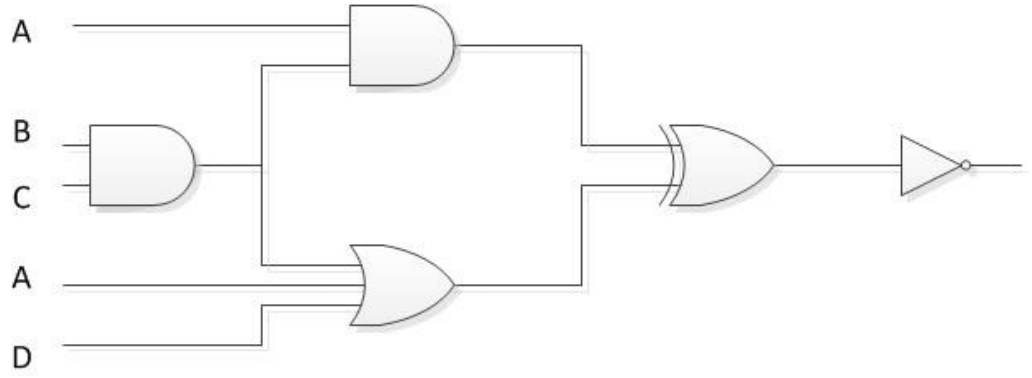
Figure 2: Circuit for Problem 3

Problem 4 *Thermometer code*

An M-bit *thermometer code* for the number k consists of k 1s in the least significant bit positions and $M - k$ 0s in all the more significant bit positions. A *binary-to-thermometer code converter* has N inputs and $2^N - 1$ outputs. It produces a $2^N - 1$ bit thermometer code for the number specified by the input. For example, if the input is 110, the output should be 0111111. Design a 3:7 binary-to-thermometer code converter. Give a simplified Boolean equation for each output, and sketch a schematic.

Problem 5 *Critical Path Delay*

Suppose we have the following circuit where the delay of an n-input gate is given by 3+4n nanoseconds.



(a) What is the propagation delay of this circuit?

(b) Suppose in this system the combinational logic works out such that the input signal A is always 1. Can you simplify this circuit to improve the delay? If so what is the new delay?