COS 140

Homework 2

Mapping the Problem

Spring 2025

Submission

Due Sept 24th as class starts (2pm), turn it in to me directly.

Submit on paper. Handwriting must be legible. Answers I can't understand will be considered wrong.

Section 1: Boolean Algebra Simplification

For each of the following boolean algebra expressions, simplify them using boolean algebra laws. Show all steps clearly and state which law you are applying at each step.

Problem 1

Simplify the following expression:

$$f_1 = A\overline{B} + AB + \overline{A}B \tag{1}$$

Problem 2

Simplify the following expression:

$$f_2 = (A + B)(\overline{A} + B)(A + \overline{B}) \tag{2}$$

Problem 3

Simplify the following expression:

$$f_3 = \overline{A}BC + A\overline{B}C + AB\overline{C} + ABC \tag{3}$$

Section 2: Expression to Logic Gates

Given the following boolean algebra expression, simplify it first, then draw the corresponding logic gate diagram.

Problem 4

$$f_4 = \overline{(A + \overline{B})\overline{C}} + \overline{A}(B + C) + A\overline{B}C + \overline{(\overline{A} + B)\overline{C}} + \overline{AB}(C + \overline{C}) \tag{4}$$

a) Simplify the expression using boolean algebra laws

b) Draw the logic gate diagram for the simplified expression

Section 3: Truth Tables to K-Maps to Gates

For each of the following truth tables, create the Karnaugh map, find the simplified boolean expression, and draw the logic gate diagram.

Problem 5

Given the following truth table:

A	B	C	f_5
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

a) Create the Karnaugh map for f_5

b) Find the simplified boolean expression using the K-map

c) Draw the logic gate diagram for the simplified expression

Problem 6

Given the following truth table:

A	B	C	D	f_6
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

a) Create the Karnaugh map for f_6

b) Find the simplified boolean expression using the K-map

c) Draw the logic gate diagram for the simplified expression