CS2110 Homework 4 Boolean Reduction Worksheet

Student Name: Bojun Yang

1 Instructions

The inputs for the reduction will be:

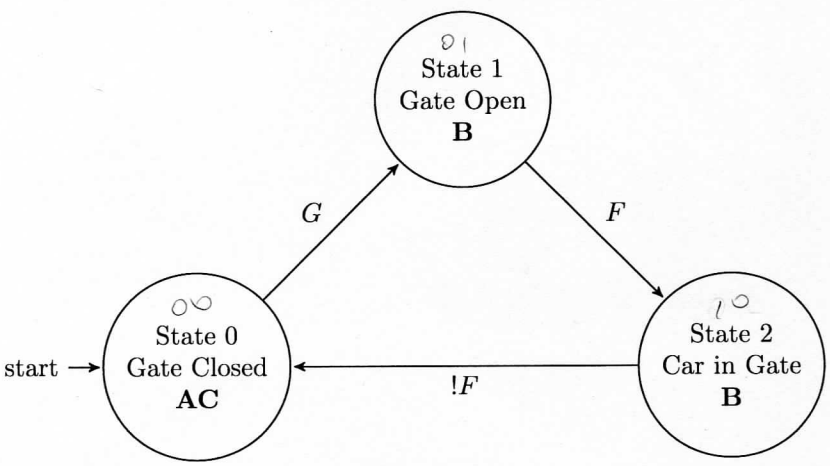
- S_0 = Current State 0th bit (least significant)
- S_1 = Current State 1st bit (most significant)
- G = Valid card scan from card scanner
- F = Gate sensor: whether or not there is a car under the gate

Your outputs for the reduction will be:

- N_0 = Next State 0th bit (least significant)
- N_1 = Next State 1st bit (most significant)
- A = *Scan Card Now* light at the kiosk
- B = Signal to the motor to keep the gate open
- C = Signal to the motor to keep the gate closed

1.1 State Machine Diagram

The diagram below represents the behavior of the state machine. For more information, refer to the assignment document.



2 Truth Table

2.1 Instructions

For all combinations of the inputs G, F, S_1, and S_0, fill in the corresponding outputs of the state machine.

This State Machine is a Moore State Machine, meaning the output values are determined solely by the current state (that is, you should not use the N_1 and N_0 outputs for determining the values for A, B, C.) **Use the character 'x' to denote don't care states.**

G	F	S_1	S_0	N_1	N_0	A	B	C
0	0	0	0	0	0	1	0	1
0	0	0	1	0	1	0	1	0
0	0	1	0	0	0	0	1	0
0	0	1	1	X	X	X	X	X
0	1	0	0	0	0	1	0	1
0	1	0	1	1	0	0	1	0
0	1	1	0	1	0	0	1	0
0	1	1	1	X	X	X	X	X
1	0	0	0	0	1	1	0	1
1	0	0	1	0	1	0	1	0
1	0	1	0	0	0	0	1	0
1	0	1	1	X	X	X	X	X
1	1	0	0	0	1	1	0	1
1	1	0	1	1	0	0	1	0
1	1	1	0	1	0	0	1	0
1	1	1	1	X	X	X	X	X

CHECKPOINT: Go on Canvas and submit your truth table in the **Homework 4 Worksheet Contents** assignment. Check your score and make any corrections necessary. You can submit as many times as you want.

3 K-Maps

For each K-Map, fill in the appropriate gray codes as column and row headers and perform the groupings for each output. **You MUST show the groupings! Try using different colored pens/pencils to make it easier to read.**

(a) K-Map for N_1

GF \ S_1S_0	00	01	11	10
00	0	0	X	0
01	0	1	X	1
11	0	1	X	1
10	0	0	X	0

(b) K-Map for [redacted] N_0

GF \ S_1S_0	00	01	11	10
00	0	1	X	0
01	0	0	X	0
11	1	0	X	0
10	1	1	X	0

(a) K-Map for A

GF \ S_1S_0	00	01	11	10
00	1	0	X	0
01	1	0	X	0
11	1	0	X	0
10	1	0	X	0

(b) K-Map for B

GF \ S_1S_0	00	01	11	10
00	0	1	X	1
01	0	1	X	1
11	0	1	X	1
10	0	1	X	1

(a) K-Map for C

GF \ S_1S_0	00	01	11	10
00	1	0	X	0
01	1	0	X	0
11	1	0	X	0
10	1	0	X	0

4 Reduced Expressions

Now use the K-maps to write down the reduced expressions.

$N_1 =$ $FS_1 + FS_0$

$N_0 =$ $GS_1'S_0' + F'S_0$

$A =$ $S_1'S_0'$

$B =$ $S_1 + S_0$

$C =$ $S_1'S_0'$

5 Submit

Complete the following steps:

1. Enter all of your K-Map and Reduced Expression work into the **Homework 4 Worksheet Contents** assignment on Canvas. For information on how to enter your reduced expressions, see below.
2. Once that's done, scan this document and submit the scan, with all of the pages, onto the **Homework 4 Worksheet Scan** assignment on Gradescope. This will be used during the demo.

The following is the formatting requirement for your reduced boolean expressions (not following these will get you penalized).

1. Use apostrophe (') to denote negation. e.g. if you have an expression where `F` is 0, denote this with `F'`, not `!F`.
2. Your expressions should be ordered from longest term to shortest term. For example, if you have the terms S_0 and GFS_1S_0, write the final expression as `GFS1S0+S0`, since `GFS1S0` is a longer term.
3. Each term should be ordered $G > F > S_1 > S_0$. So `GFS1` would be valid, but `S1FG` would not.
4. In the case of two terms of same length, break ties "alphabetically" where the "alphabet" is GFS_1S_0. So between `FS1` and `GS0`, you would write `GS0+FS1` because G is higher priority.
5. Don't put any spaces in the expressions: write `f+g` and not `f + g`.

You need to submit on BOTH platforms!