EEM16 Quiz #1

AURORA BEVERLEY YEH

TOTAL POINTS

18 / 20

QUESTION 1

1 (a)-(c) **7.5 / 7.5**

✓ **- 0 pts (a) Correct**

✓ **- 0 pts (b) Correct**

- 1 pts (b) incorrect literals

- 1 pts (b) not fully

✓ **- 0 pts (c) Correct**

- 1 pts (c) N instead of ~N

- 1 pts (c) not fully

- 1 pts (c) not conjunctive

- 0.5 pts (c) error in literals

QUESTION 2

2 (d)-(h) **10.5 / 12.5**

- 0 pts (d) Correct

- 1 pts (d) missing/incorrect prime implicant

- 1.5 pts (d) incorrect Kmap

✓ **- 1 pts (d) missing or incorrect essential**

- 0 pts (e) Correct

✓ **- 0.5 pts (e) too many terms**

- 1.5 pts (e) incorrect term

✓ **- 0 pts (f) Correct**

- 2.5 pts (f) incorrect factoring

✓ **- 0 pts (g) Correct**

- 0.5 pts (g) excess or lack of factoring

- 0.5 pts (g) partial application of DeMorgan

- 2.5 pts (g) incorrect DeMorgan

✓ **- 0 pts (h) Correct**

- 1 pts (h) missing or extra input/internal inversions

- 1.5 pts (h) incomplete erroneous design

- 0.5 pts (h) missing output inversion

- 0.5 pts (h) too many inversions (not optimized)

- 2 pts (h) not NAND

- 2.5 pts (h) incorrect

- 0.5 Point adjustment

(f) more factoring possible

Quiz #1

Name (Last, First): Yeh, Aurora

Student-Id #: 305110110

Do not start working until instructed to do so.

1. *You must answer in the **space provided** for answers after every question. We will ignore answers written anywhere else in the booklet. **All pages in this booklet must be accounted** for otherwise it will not be graded.*
2. *This quiz is closed book/notes.*
3. *You may not use any electronic device.*

Following table to be filled by course staff only.

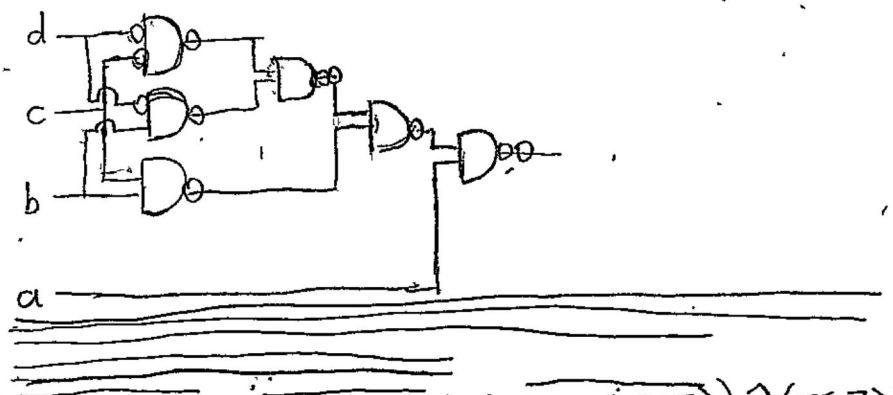
	Maximum Score	Your Score
TOTAL	20	

<intentionally blank – you may use this for scratch work>

T[0]=a
T[1]=b
T[2]=c
T[3]=d

~a^((~d^~c)v(~d^b)v(c^b))

~~a^(~(d v c) v ~(d v ~b) v ~(~c v ~b))~~



$(((\overline{(T[3]\wedge T[2])}\wedge\overline{(T[3]\wedge T[1])})\wedge\overline{(T[2]\wedge T[1])})\wedge(T[0]))$

$\sim((\sim(\sim d\wedge\sim c)\wedge\sim(\sim d\wedge b))\wedge\sim(b\wedge c))\wedge a$

$((\sim d\wedge\sim c)\vee(\sim d\wedge b)\vee(b\wedge c))\wedge a$ yea that's the same

Recall from Homework #1 where we have the 4 DNA nucleotides of G, C, T, and A. Let us represent them using 4-bit thermometer code, *t[3:0]*, where G=4'b0001, C=4'b0011, T=4'b0111, and A=4'b1111. A logic is used to indicate whether the input t[3:0] corresponds to a nucleotide. The output of this logic is *N*.

(a) Complete the truth table for N.

T[3]	T[2]	T[1]	T[0]	N
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

(b) Write the expression for N in Fully-Disjunctive Normal Form.

N = $(\sim T[3] \wedge \sim T[2] \wedge \sim T[1] \wedge T[0]) \vee (\sim T[3] \wedge \sim T[2] \wedge T[1] \wedge T[0]) \vee$
$(\sim T[3] \wedge T[2] \wedge T[1] \wedge T[0]) \vee (T[3] \wedge T[2] \wedge T[1] \wedge T[0])$

(c) Write the expression for ~N in Fully-Conjunctive Normal Form

$\sim($ T[
$(T[3] \vee T[2] \vee T[1] \vee \sim T[0]) \wedge (T[3] \vee T[2] \vee \sim T[1] \vee \sim T[0]) \wedge$
$(T[3] \vee \sim T[2] \vee \sim T[1] \vee \sim T[0]) \wedge (\sim T[3] \vee \sim T[2] \vee \sim T[1] \vee \sim T[0])$

~N =

(d) Draw the Karnaugh Map of the Truth Table. Circle the prime implicants, indicate which one(s) are essential (if any).

T[3:2] T[3] T[2]

T[1:0] T[0] T[1]	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	1	1	0
10	0	0	0	0

All are essential

(e) Using the K-map in (d) as the minimized 2-level logic, write the sum-of-product expression using the fewest number of terms and literals.

N = $(\sim T[3] \wedge \sim T[2] \wedge T[0]) \vee (\sim T[3] \wedge T[1] \wedge T[0]) \vee (T[2] \wedge T[1] \wedge T[0])$

(f) Can you do better (reduce the number of literals), by using Boolean properties? If so, write the expression and indicate which property you used.

N = $T[0] \wedge ((\sim T[3] \wedge \sim T[2]) \vee (\sim T[3] \wedge T[1]) \vee (T[2] \wedge T[1]))$

Property: factoring

(g) Use DeMorgan's theorem and write the inverse of the function in (f).

$\sim N = \sim T[0] \vee ((T[3] \vee T[2]) \wedge (T[3] \vee \sim T[1]) \wedge (\sim T[2] \vee \sim T[1]))$

(h) Show a combinational circuit that implements N from (f) (with *T[3:0]* as inputs) using only 2-input NAND gates.

This is a mess...