CSCI 160 Test 1

Anton Goretsky

TOTAL POINTS

103.5 / 113

QUESTION 1

1 Bonus from Quizzes **2.5 / 5**

+ **0 pts** 0

+ **2.5** **Point adjustment**

QUESTION 2

2 1a) i. **4 / 4**

✓ **- 0 pts All correct!**

QUESTION 3

3 1a) ii **4 / 4**

✓ **- 0 pts All correct!**

QUESTION 4

4 1b) **5 / 5**

✓ **- 0 pts All correct!**

QUESTION 5

5 1c) **7 / 7**

✓ **- 0 pts All correct!**

QUESTION 6

6 2a) **7 / 7**

✓ **- 0 pts All correct!**

QUESTION 7

7 2b) **0 / 6**

✓ **- 6 pts Incorrect proof**

QUESTION 8

8 3a) Definition **2 / 2**

✓ **- 0 pts Correct!**

QUESTION 9

9 3a) Justify **3 / 3**

✓ **- 0 pts Correct!**

QUESTION 10

10 3b) Definition **2 / 2**

✓ **- 0 pts Correct!**

QUESTION 11

11 3b) Justify **2 / 3**

- 1 Point adjustment

Incorrect example: for x=1, y=0, z=1 the LS is 1 because 1 + 1 + 0 is 1.

QUESTION 12

12 4) **7 / 7**

✓ **- 0 pts All correct!**

QUESTION 13

13 General **8 / 8**

+ 8 Point adjustment

QUESTION 14

14 Part 1 Score **50 / 50**

+ 1 Point adjustment

gradescope

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Computer Architecture 1 - Computer Logic
Fall 2018

PLEASE DO FIRST WHAT YOU KNOW BEST! JUSTIFY YOUR ANSWERS!
PLEASE DON'T ASK QUESTIONS DURING THE EXAM.
DO WELL!!!

1. a) Consider the numbers $M = 1040$ and $N = 1164$, both in base 10. Write them in base r, and perform $M - N$ using the $(r-1)'s$ complement representation subtraction algorithm for:

(i) $r = 2$ M_2: 10000010000 N_2: 10010001100

Show algorithm:

1040		1164	
520	0	582	0
260	0	291	0
130	0	145	1
65	0	72	1
32	1	36	0
16	0	18	0
8	0	9	0
4	0	4	1
2	0	2	0
1	0	1	0
0	1	0	1

$M - N = M + N_{(r-1)'s)c}$ + e.a.c stuff

N: 10010001100
$N_{(r-1)'s c}$: 01101110011

$$\begin{array}{r} 10000010000 \\ +\ 01101110011 \\ \hline 11110000011 \end{array}$$

No e.a.c

$-(r-1)'s\ (11110000011) =$ $-$ 00001111100

$\boxed{-1111100}$

$(M-N)_2$: $-$ 00001111100

(ii) $r = 8$ M_8: 2020 N_8: 2214

Show algorithm:

$M_2 =$ $\underbrace{10}_{2}\underbrace{000}_{0}\underbrace{010}_{2}\underbrace{000}_{0}$

$N_2 =$ $\underbrace{10}_{2}\underbrace{010}_{2}\underbrace{001}_{1}\underbrace{100}_{4}$

M 2020
N 2214

$$\begin{array}{r} 2020 \\ +\ 5563 \\ \hline 7603 \end{array}$$

N: 2214
$N_{(7's)c}$ 5563

No e.a.c

$-(r-1)'s\ (7603) =$ $\boxed{-\ 174}$

$(M-N)_8$: -174

b) Consider the number 65432_8, written in base 8. Write the number in the $r's$ complement representation, that is in the 8's complement representation, since $r = 8$.

65432_8 $(r-1)'s_c$ of 65432 $=$ $\begin{array}{r} 77777 \\ -65432 \\ \hline 12345 \end{array}$ $\begin{array}{r} 12345 \\ +\ 1 \\ \hline 12346 \end{array}$ $\boxed{12346}$

Encircle final answer

c) Knowing that we have the equality:

$$424_{(x-2)} = 24A_{(x+1)}$$

determine the value of x.

Left-side: $4(x-2)^2 + 2(x-2) + 4 = 4(x^2-4x+4) + 2x - 4 + 4$
$\boxed{4x^2 - 14x + 16}$ - simplified

Right-side: $2(x+1)^2 + 4(x+1) + 10 = 2(x^2+2x+1) + 4x + 4 + 10$
$2x^2 + 4x + 2 + 4x + 4 + 10$ $\boxed{2x^2 + 8x + 16}$ - simp.

Find x: $4x^2 - 14x + 16 = 2x^2 + 8x + 16$

$2x^2 - 22x = 0$

$2x(x - 11) = 0$

$x = 0$, $\boxed{x = 11}$

$424_{(9)} = 24A_{(12)}$

Encircle final answer

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2. (a) Compute and simplify $f = (xz + (y+t)' + (xz)'y')'$

$(xz + (y+t)' + (xz)'y')'$ (10)

$(xz + y't' + (x'+z')y')'$ (10)

$(xz + y't' + y'x' + y'z')'$ (10)

$(x'+z') \cdot (y+t) \cdot (y+x) \cdot (y+z)$

$(x'+z') \cdot (y+t) \cdot (y+x) + (y+z)$ (4)

$(yy) + yx + yt + xt$ (7)

$(y + yx) + yt + xt$ (12)

$(y + yt) + xt$ (12)

$y + xt$

$(x'+z') \cdot (y+xt) \cdot (y+z)$ (4) (11)

$((x'+z') \cdot (y+z)) \cdot (y+xt)$

$x'y + x'z + z'y + z'z$ (11)

$(x'y + x'z + z'y)(y + xt)$ (11)

$x'yy + x'zy + z'yy + x'yxt + x'zxt + z'yxt$ (5)

(12) $x'y + x'zy + z'y + z'yxt$

$\boxed{x'y + z'y}$

Encircle final answer

(b) Prove or disprove that in every Boolean algebra, B:
[xa=ya *and* xa'=ya'] imply $x = y$, $\forall a, x, y \in B$

$xa = ya$ $xa' = ya'$

let $x=1$, $y=0$, $a=1$

$1 \cdot 1 = 0 \cdot 1$ and $1 \cdot 0 = 0 \cdot 0$

$1 \neq 0$

let $x=1$ $y=0$, $a=0$

$1 \cdot 0 = 0 \cdot 0$ $1 \cdot 1 = 0 \cdot 1$

$0 = 0$ $1 \neq 0$

$\boxed{\text{True}}$ – Tested all methods of $x \neq 0$ all are false

3. Determine whether the following Boolean operator, that is defined by:

$$x \subset y = x + y'$$

is:

a. commutative

Definition of $\subset$ being commutative: This implies that reordering the variables x and y will maintain the same identity / value, aka: $x \subset y = y \subset x$

Justify $x \subset y = y \subset x$

$x + y' = y + x'$

let $x=1$ and $y=0$

$x+y' = y+x'$

$1+1 \neq 0+0$ Equivalence is proven false (Not true for all x, y)

True or False (Circle)

b. associative

Definition of $\subset$ being associative: This implies that order of operations on $\subset$ does not matter
Aka: $(x \subset y) \subset z = x \subset (y \subset z)$

Justify $(x \subset y) \subset z = x \subset (y \subset z)$

$(x+y') \subset z = x \subset (y+z')$

$(x+y') + z' = x + (y+z')'$

$x + y' + z' = x + y' \cdot z$ (10)

$x+y'+z' = x+y'z$

let $x=1$, $y=0$, $z=1$

$1+1+0 = 1+1(0)$

$0 = 1+0$

$0 \neq 1$ Not true for all x, y, z

hence false

True or False (Circle)

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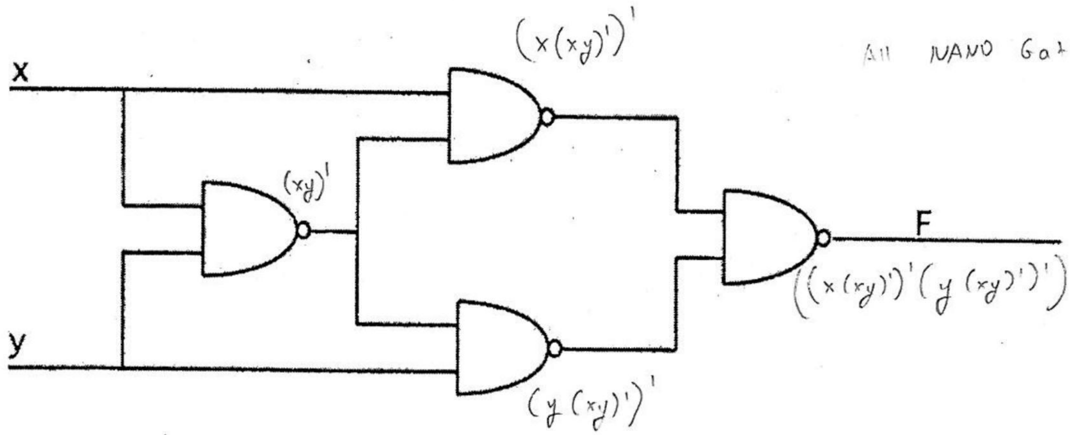
4. Consider the following circuit:



All NAND Gates

(i) Draw the truth table for the Boolean function F.
(ii) Compute F as a Boolean expression of x and y.
(iii) What is another name for the operation that F computes?

ii)

$((x(xy)')'(y(xy)')')'$ (10)

$\left((x'+xy)\cdot(y'+xy)'\right)'$ (10)

$(x(x'+y')) + (y(x'+y'))$ (4)

$xx' + xy' + yx' + yy'$

$xx' + xy' + yx' + yy'$ (5)

0 0

$xy' + yx'$

$\boxed{x'y + xy'}$

$x \oplus y$

All NAND Gates

i)

x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

Row 1 $1\cdot0 + 0\cdot1$ / $0+0$ / 0

Row 2 $1\cdot1 + 0\cdot0$ / 1

Row 3 $0\cdot0 + 1\cdot1$ / 1

Row 4 $0\cdot1 + 1\cdot0$ / 0

iii)

$x \oplus y$

XOR