21W-COMSCIM51A-1 Homework 2

CHARLES ZHANG
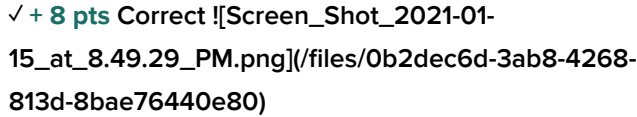
TOTAL POINTS

108 / 110

QUESTION 1

1 12 pts

1.1 a 8 / 8

✓ **+ 8 pts** Correct ![Screen_Shot_2021-01-15_at_8.49.29_PM.png](/files/0b2dec6d-3ab8-4268-813d-8bae76440e80)

+ 0 pts Placeholder: use point adjustment, 16*0.5 points

1.2 b 4 / 4

✓ **- 0 pts** Correct; $$F = AB$$

- 2 pts Wrong answer, correct procedure

- 3 pts Wrong answer, partially correct procedure

- 4 pts Wrong answer, no procedure

QUESTION 2

2 2 **2 / 4**

- 0 pts Correct

- 1 pts 1st gate incorrect

- 1 pts 2nd gate incorrect

✓ **- 1 pts** 3rd gate incorrect

✓ **- 1 pts** 4th gate incorrect

QUESTION 3

3 18 pts

3.1 a 2 / 2

✓ **- 0 pts** Correct (with a valid 9-bit UID or the table is filled out)

3.2 b 4 / 4

✓ **- 0 pts** Correct; Pick F=1, and for valuation of (A, B, C): 0 is negative, 1 is positive; $$\Sigma m(\cdots)$$ or just the sum of minterms are both ok.

- 4 pts Wrong answer

3.3 c 4 / 4

✓ **- 0 pts** Correct; Implements part (b)

- 0 pts Correct; simplified gate design is correct.

- 4 pts Wrong answer (no partial credit for this problem)

3.4 d 4 / 4

✓ **- 0 pts** Correct; Pick F=0, and for valuation of (A, B, C): 1 is negative, 0 is positive, $$\Pi M(\cdots)$$ or just the product of maxterms are all ok.

- 4 pts Wrong answer

3.5 e 4 / 4

✓ **- 0 pts** Correct; Implements part (d)

- 4 pts Wrong answer

QUESTION 4

4 14 pts

4.1 a 10 / 10

✓ **- 0 pts** Correct

- 0.5 pts D column single error

- 0.5 pts E column single error

- 0.5 pts F column single error

- 0.5 pts G column single error

- 0.5 pts H column single error

- 1 pts D column multiple errors

- 1 pts E column multiple errors

- 1 pts F column multiple errors

- 1 pts G column multiple errors

- 1 pts H column multiple errors

- 10 pts No answer

4.2 b 4 / 4

✓ **- 0 pts** Correct

- 0.5 pts G minor simplification error

- **0.5 pts** H minor simplification error

- **1 pts** G incorrectly simplified

- **1 pts** H incorrectly simplified

- **2 pts** G missing simplification

- **2 pts** H missing simplification

QUESTION 5

5 24 pts

5.1 a **4 / 4**

✓ - **0 pts** Correct; $$F=1$$

- **2 pts** Wrong answer, correct procedure

- **3 pts** Wrong answer, partially correct procedure

- **4 pts** Wrong answer, no procedure

5.2 b **4 / 4**

✓ - **0 pts** Correctl $$F=A+B+C+D+E$$

- **2 pts** Wrong answer, correct procedure

- **3 pts** Wrong answer, partially correct procedure

- **4 pts** Wrong answer, no procedure

5.3 c **4 / 4**

✓ - **0 pts** Correct; $$F = A' + B$$

- **2 pts** Wrong answer, correct procedure

- **3 pts** Wrong answer, partially correct procedure

- **4 pts** Wrong answer, no procedure

5.4 d **4 / 4**

✓ - **0 pts** Correct; $$F = AB'$$

- **2 pts** Wrong answer, correct procedure

- **3 pts** Wrong answer, partially correct procedure

- **4 pts** Wrong answer, no procedure

5.5 e **4 / 4**

✓ - **0 pts** Correct; $$F=A' + B + C'$$

- **2 pts** Wrong answer, correct procedure

- **3 pts** Wrong answer, partially correct procedure

- **4 pts** Wrong answer, no procedure

5.6 f **4 / 4**

✓ - **0 pts** Correct; $$F = A'BC$$

- **2 pts** Wrong answer, correct procedure

- **3 pts** Wrong answer, partially correct procedure

- **4 pts** Wrong answer, no procedure

QUESTION 6

6 6 **4 / 4**

✓ - **0 pts** Correct

- **1 pts** Minor Error

- **2 pts** Wrong minterms

- **2 pts** Not a sum of minterms

- **2 pts** Computed sum of minterms for 3 variables instead of 2

- **3 pts** Incorrect

- **4 pts** Blank

QUESTION 7

7 7 **4 / 4**

✓ - **0 pts** Correct; $$\Pi M(1,3,4,6)$$ or $$(A+B+C')(A+B'+C')(A'+B+C)(A'+B'+C)$$

- **4 pts** Wrong answer (no partial credit for this problem)

QUESTION 8

8 30 pts

8.1 a **6 / 6**

✓ - **0 pts** Correct

- **1.5 pts** Error in first 4 rows

- **1.5 pts** Error in second 4 rows

- **1.5 pts** Error in third 4 rows

- **1.5 pts** Error in last 4 rows

- **6 pts** Blank

8.2 b **4 / 4**

✓ - **0 pts** Correct

- **2 pts** Negated the 0s instead of 1s

- **2 pts** Used rows with 1s instead of 0s

- **1 pts** Missing maxterms

- **1 pts** Extra maxterms

- **0.5 pts** Minor error

- **1 pts** Gave minterms instead of maxterms

- **4 pts** Blank

8.3 c **4 / 4**

✓ **- 0 pts** Implements part b correctly.

- 0.5 pts Gate symbol design should write in terms of inputs and gates.

- 0.5 pts Minor error

- 1 pts No AND gate

- 1 pts Incorrect inputs to OR gate.

- 4 pts Blank

8.4 d **4 / 4**

✓ **- 0 pts** Correct

- 2 pts Used rows with 0s instead of 1.

- 1 pts Gave maxterms instead of minterms

- 1 pts Missing a minterm

- 1 pts Extra minterms

- 4 pts Blank

8.5 e **4 / 4**

✓ **- 0 pts** Correctly implements part e.

- 0.5 pts Minor error

- 4 pts Blank

8.6 f **4 / 4**

✓ **- 0 pts** Correct

- 1 pts Minor error(s)

- 1 pts Not simplest form but close

- 2 pts Incorrect

- 2 pts Not a boolean algebra expression
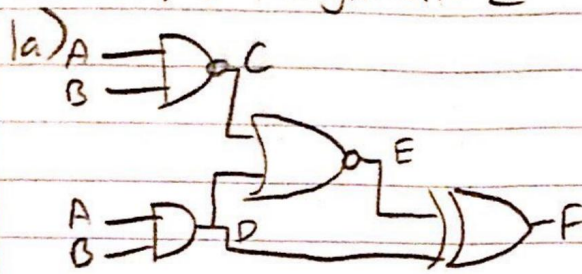
- 4 pts Blank

8.7 g **4 / 4**

✓ **- 0 pts** Correctly implements part f.

- 4 pts Blank

QUESTION 9

9 Academic Honesty Acknowledgement **0 / 0**

✓ **- 0 pts** Correct

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305-413-659

Academic Honesty: 3 3

CSMS1A Assignment 2

1a)

$D = AND$

$D = XOR$

$D = OR$

$C = (AB)'$, $D = (AB)$, $E = (C+D)'$
$F = (D \oplus E)$

AB	C	D	E	F
0 0	1	0	0	0
0 1	1	0	0	0
1 0	1	0	0	0
1 1	0	1	0	1

✓ 1b) $F = (DE' + D'E)$

$F = AB(C+D) + (AB)'(C+D)'$

$F = AB((AB)' + AB) + (AB)'((AB)' + AB)'$

$F = AB(1) + (AB)'((AB)(AB)')$

$F = AB + (AB)'(0)$

$\boxed{F = AB}$

2)

 = NAND

 = AND

 = NOR

 = NAND

3a)

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

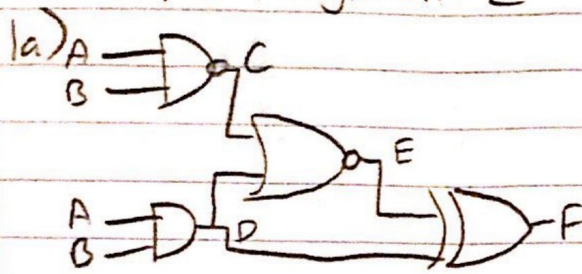ID: 305 413 659

1.1 a 8 / 8

✓ **+ 8 pts** Correct ![Screen_Shot_2021-01-15_at_8.49.29_PM.png](/files/0b2dec6d-3ab8-4268-813d-8bae76440e80)

   + 0 pts Placeholder: use point adjustment, 16*0.5 points

✓ **+ 8 pts** Correct ![Screen_Shot_2021-01-15_at_8.49.29_PM.png](/files/0b2dec6d-3ab8-4268-813d-8bae76440e80)

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Academic Honesty: 3Z

CSM51A Assignment 2

1a)

D = AND

)D = XOR

D = OR

$C = (AB)', \quad D = (AB), \quad E = (C+D)'$

$F = (D \oplus E)$

A B	C	D	E	F
0 0	1	0	0	0
0 1	1	0	0	0
1 0	1	0	0	0
1 1	0	1	0	1

✓ 1b) $F = (DE' + D'E)$

$F = AB(C+D) + (AB)'(C+D)'$

$F = AB((AB)' + AB) + (AB)'((AB)' + AB)'$

$F = AB(1) + (AB)'((AB)(AB)')$

$F = AB + (AB)'(0)$

$\boxed{F = AB}$

2)

 = NAND

 = AND

 = NOR

 = NAND

3a)

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

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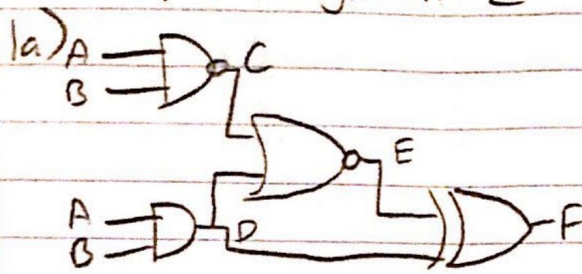
1.2 b 4 / 4

✓ **- 0 pts** Correct; $$F = AB$$

    - 2 pts Wrong answer, correct procedure

    - 3 pts Wrong answer, partially correct procedure

    - 4 pts Wrong answer, no procedure

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Academic Honesty: 3$

CSMS1A Assignment 2

1a)

$D = AND$

$D = OR$

$)D = XOR$

$C = (AB)'$, $D = (AB)$, $E = (C+D)'$
$F = (D \oplus E)$

A B	C	D	E	F
0 0	1	0	0	0
0 1	1	0	0	0
1 0	1	0	0	0
1 1	0	1	0	1

✓ 1b) $F = (DE' + D'E)$

$F = AB(C+D) + (AB)'(C+D)'$

$F = AB((AB)' + AB) + (AB)'((AB)' + AB)'$

$F = AB(1) + (AB)'((AB)(AB)')$

$F = AB + (AB)'(0)$

$\boxed{F = AB}$

2)

 $= NAND$ $= AND$

 $= NOR$ $= NAND$

3a)

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

ID: 305 413 659

2 2 2 / 4

- **0 pts** Correct
- **1 pts** 1st gate incorrect
- **1 pts** 2nd gate incorrect
✓ **- 1 pts** 3rd gate incorrect
✓ **- 1 pts** 4th gate incorrect

- **0 pts** Correct
- **1 pts** 1st gate incorrect
- **1 pts** 2nd gate incorrect

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Academic Honesty: 3z̷

CSMS1A Assignment 2

1a)

$D = $ AND

$D = $ XOR

$D = $ OR

$C = (AB)', \quad D = (AB), \quad E = (C+D)'$

$F = (D \oplus E)$

AB	C	D	E	F
0 0	1	0	0	0
0 1	1	0	0	0
1 0	1	0	0	0
1 1	0	1	0	1

✓ 1b) $F = (DE' + D'E)$

$F = AB(C+D) + (AB)'(C+D)'$

$F = AB((AB)' + AB) + (AB)'((AB)' + AB)'$

$F = AB(1) + (AB)' ((AB)(AB)')$

$F = AB + (AB)'(0)$

$\boxed{F = AB}$

2)

$= $ NAND

$= $ AND

$= $ NOR

$= $ NAND

3a)

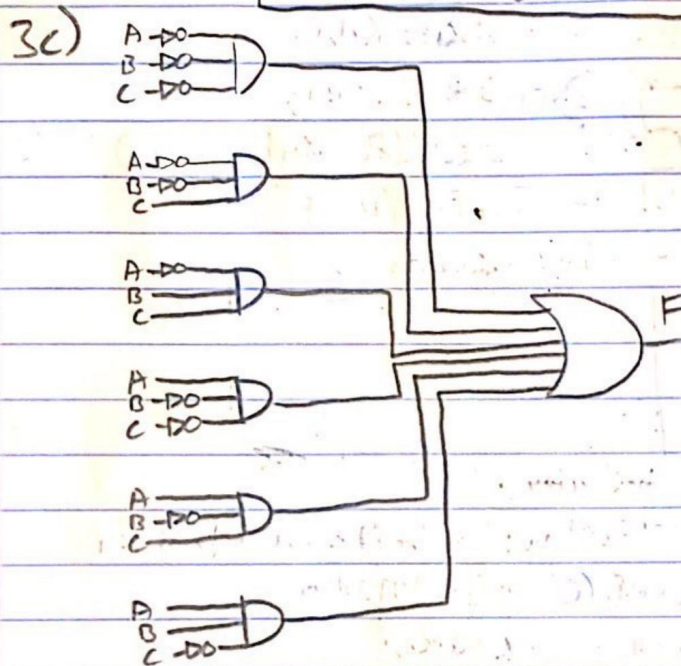| A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

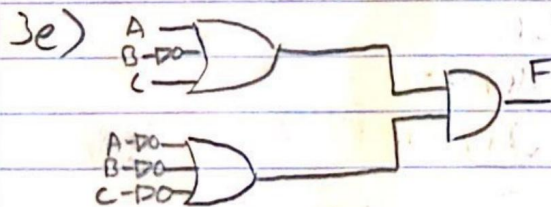$\boxed{\text{ID: 305 413 659}}$

3.1 a 2 / 2

✓ **- 0 pts** Correct (with a valid 9-bit UID or the table is filled out)

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3b) $F(A,B,C) = A'B'C' + A'B'C + A'BC + AB'C' + ABC + ABC'$

$= m_0 + m_1 + m_3 + m_4 + m_5 + m_6 = \Sigma(0,1,3,4,5,6)$

3c)

3d) $F(A,B,C) = (A+B'+C) \cdot (A'+B'+C') = M_2 \cdot M_7 = \Pi(2,7)$

3e)

4a)

A	B	C	D	E	F	G	H
0	0	0	1	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	1	0	1	0	0
0	1	1	1	1	0	0	1
1	0	0	0	0	1	0	0
1	0	1	1	0	1	0	0
1	1	0	0	0	1	0	0
1	1	1	1	1	1	1	1

$D = (AC')' = A' + C$

$E = BC$

$F = (A'C)' = A + C'$

$G = (DEF)$
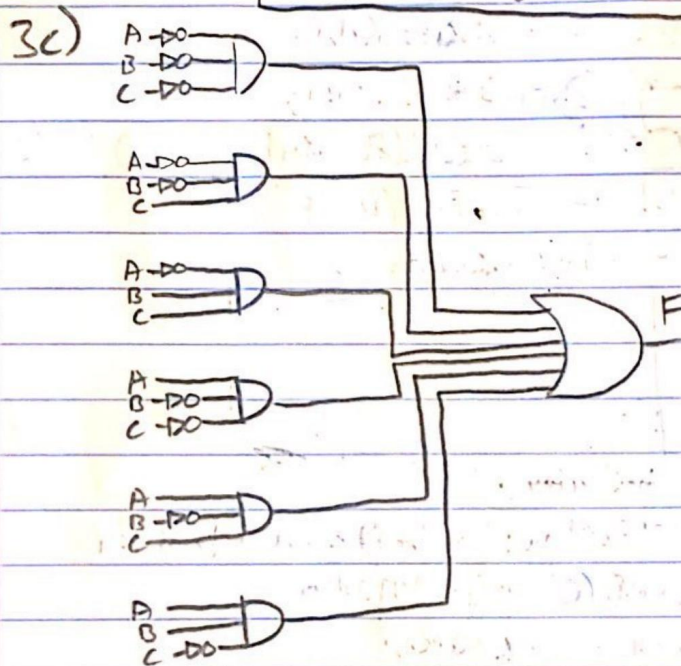
$H = (F \oplus G)' = F'G' + FG$

3.2 b **4 / 4**

✓ **- 0 pts** Correct; Pick F=1, and for valuation of (A, B, C): 0 is negative, 1 is positive; $$\Sigma m(\cdots)$$ or just the sum of minterms are both ok.
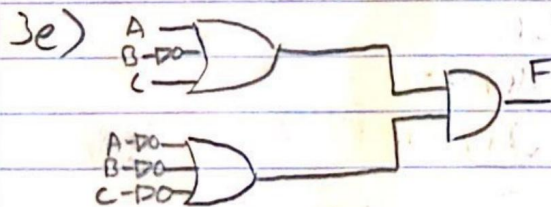
- 4 pts Wrong answer

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3b) $F(A,B,C) = A'B'C' + A'B'C + A'BC + AB'C' + ABC + ABC'$
$= m_0 + m_1 + m_3 + m_4 + m_5 + m_6 = \Sigma(0,1,3,4,5,6)$

3c)

3d) $F(A,B,C) = (A+B'+C) \cdot (A'+B'+C') = M_2 \cdot M_7 = \Pi(2,7)$

3e)

4a)

A	B	C	D	E	F	G	H
0	0	0	1	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	1	0	1	0	0
0	1	1	1	1	0	0	1
1	0	0	0	0	1	0	0
1	0	1	1	0	1	0	0
1	1	0	0	0	1	0	0
1	1	1	1	1	1	1	1

$D = (AC')' = A' + C$
$E = BC$
$F = (A'C)' = A + C'$
$G = (DEF)$
$H = (F \oplus G)' = F'G' + FG$
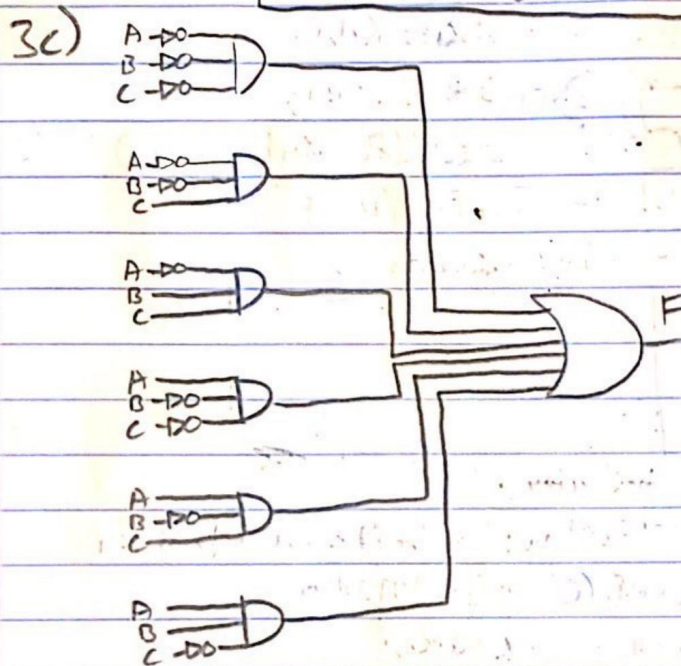
3.3 C 4 / 4

✓ - **0 pts** Correct; Implements part (b)
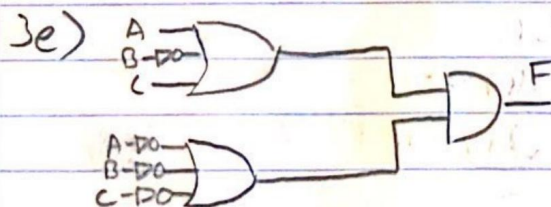
   - **0 pts** Correct; simplified gate design is correct.

   - **4 pts** Wrong answer (no partial credit for this problem)

✓ - **0 pts** Correct; Implements part (b)

   - **0 pts** Correct; simplified gate design is correct.

3b) $F(A,B,C) = A'B'C' + A'B'C + A'BC + AB'C' + ABC + ABC'$

$= m_0 + m_1 + m_3 + m_4 + m_5 + m_6 = \Sigma(0,1,3,4,5,6)$

3c)

3d) $F(A,B,C) = (A+B'+C) \cdot (A'+B'+C') = M_2 \cdot M_7 = \Pi(2,7)$

3e)

4a)

A	B	C	D	E	F	G	H
0	0	0	1	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	1	0	1	0	0
0	1	1	1	1	0	0	1
1	0	0	0	0	1	0	0
1	0	1	1	0	1	0	0
1	1	0	0	0	1	0	0
1	1	1	1	1	1	1	1

$D = (AC')' = A' + C$

$E = BC$

$F = (A'C)' = A + C'$
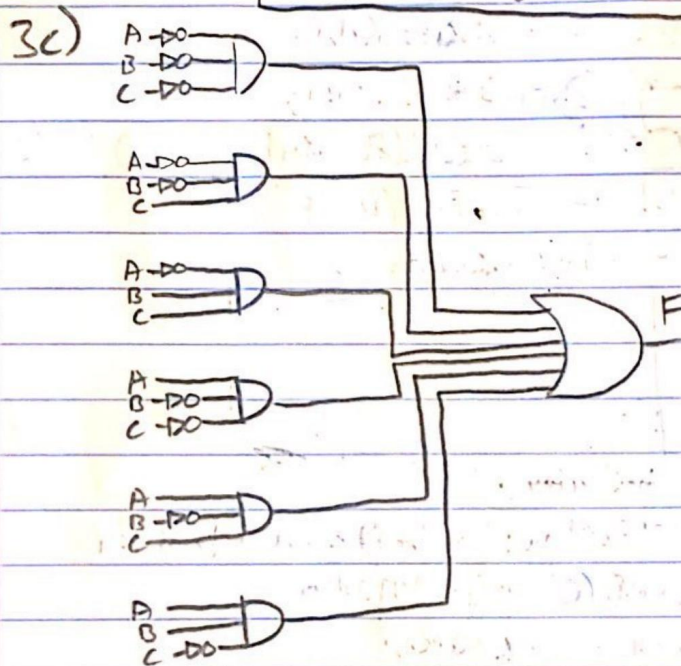
$G = (DEF)$

$H = (F \oplus G)' = F'G' + FG$

3.4 d **4 / 4**

✓ **- 0 pts** Correct; Pick F=0, and for valuation of (A, B, C): 1 is negative, 0 is positive, $$\Pi M(\cdots)$$ or just the product of maxterms are all ok.
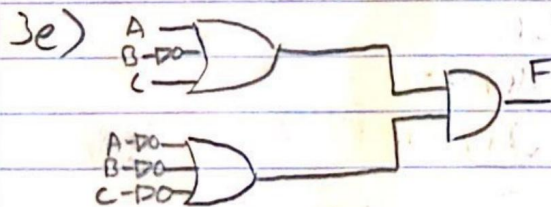
  - 4 pts Wrong answer

3b) $F(A,B,C) = A'B'C' + A'B'C + A'BC + AB'C' + ABC + ABC'$

$= m_0 + m_1 + m_3 + m_4 + m_5 + m_6 = \Sigma(0,1,3,4,5,6)$

3c)

3d) $F(A,B,C) = (A+B'+C) \cdot (A'+B'+C') = M_2 \cdot M_7 = \Pi(2,7)$

3e)

4a)

A	B	C	D	E	F	G	H
0	0	0	1	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	1	0	1	0	0
0	1	1	1	1	0	0	1
1	0	0	0	0	1	0	0
1	0	1	1	0	1	0	0
1	1	0	0	0	1	0	0
1	1	1	1	1	1	1	1

$D = (AC')' = A' + C$

$E = BC$

$F = (A'C)' = A + C'$

$G = (DEF)$

$H = (F \oplus G)' = F'G' + FG$

3.5 e 4 / 4

✓ **- 0 pts** Correct; Implements part (d)

- 4 pts Wrong answer

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3b) $F(A,B,C) = A'B'C' + A'B'C + A'BC + AB'C' + ABC + ABC'$

$= m_0 + m_1 + m_3 + m_4 + m_5 + m_6 = \Sigma(0,1,3,4,5,6)$

3c)

3d) $F(A,B,C) = (A+B'+C) \cdot (A'+B'+C') = M_2 \cdot M_7 = \Pi(2,7)$

3e)

4a)

A	B	C	D	E	F	G	H
0	0	0	1	0	1	0	0
0	0	1	1	0	0	0	1
0	1	0	1	0	1	0	0
0	1	1	1	1	0	0	1
1	0	0	0	0	1	0	0
1	0	1	1	0	1	0	0
1	1	0	0	0	1	0	0
1	1	1	1	1	1	1	1

$D = (AC')' = A' + C$

$E = BC$

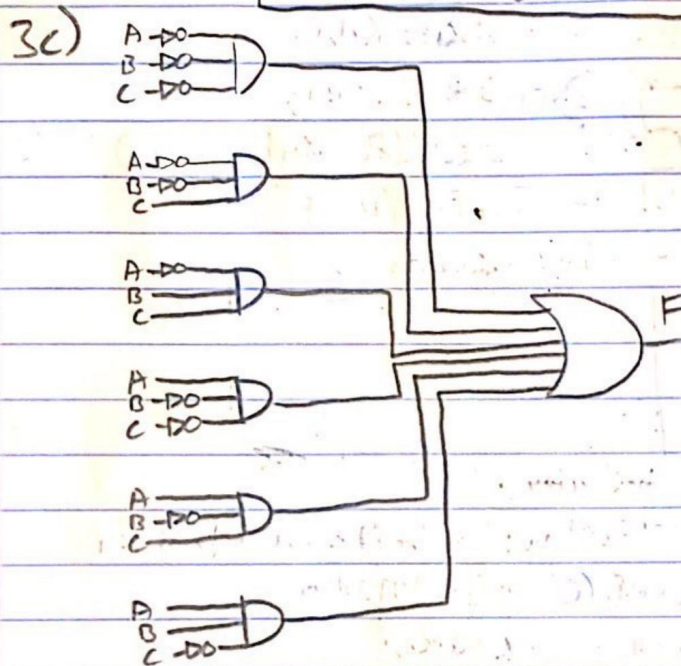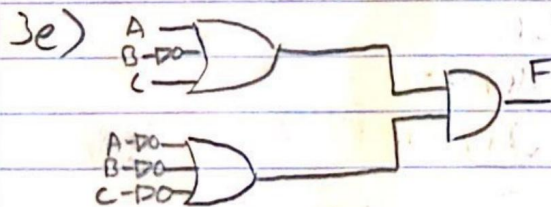$F = (A'C)' = A + C'$

$G = (DEF)$

$H = (F \oplus G)' = F'G' + FG$

4.1 a 10 / 10

✓ **- 0 pts** Correct

- **0.5 pts** D column single error

- **0.5 pts** E column single error

- **0.5 pts** F column single error

- **0.5 pts** G column single error

- **0.5 pts** H column single error

- **1 pts** D column multiple errors

- **1 pts** E column multiple errors

- **1 pts** F column multiple errors

- **1 pts** G column multiple errors

- **1 pts** H column multiple errors

- **10 pts** No answer

✓ **- 0 pts** Correct

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√ 4b) $G = DEF$

$\quad G = (A'+C)(BC)(A+C')$ - Substitute

$\quad G = (A'BC + BCC)(A+C')$ - Distributivity

$\quad G = (A'BC + BC)(A+C')$ - Idempotency

$\quad G = BC(A'+1)(A+C')$ - Distributivity

$\quad G = BC(1)(A+C')$ - Identity

$\quad G = ABC + ABCC'$ - Distributivity

$\quad \boxed{G = ABC}$ - Complement

$\quad H = F'G' + FG$

$\quad H = F'(ABC)' + F(ABC)$

$\quad H = (A+C')(ABC)' + (A+C')(ABC)$ } Substitute

$\quad H = (A+C'+ABC)' + AABC + ABCC'$ - De Morgan's + Distributivity

$\quad H = (A+C')' + AABC + ABCC'$ - Absorption

$\quad H = (A+C')' + ABC + 0$ - Idempotency

$\quad H = A'C + ABC$ - De Morgan's

$\quad H = C(A' + AB)$ - Distributivity

$\quad \boxed{H = A'C + BC}$ - Simplification

√ 5a) $F = AB + ABC + A' + D' + BC$

$\quad F = AB + A' + D' + BC$ - Absorption

$\quad F = A' + B + D' + BC$ - Simplification

$\quad \boxed{F = 1}$ - Complement

√ 5b) $F = A + A'B + A'B'C + A'B'C'D + A'B'C'D'E$

$\quad F = A + B + A'B'C + A'B'C'D + A'B'C'D'E$ - Simplification

$\quad F = A + B + C + A'B'C'D + A'B'C'D'E$ - Simplification

$\quad \boxed{F = A + B + C + D + E}$ - Simplification

√ 5c) $F = A'B' + AB + A'B$

$\quad F = A'B' + B(A + A')$ - Distributivity

$\quad F = A'B' + B$ - Complement

$\quad \boxed{F = A' + B}$ - Simplification

4.2 b 4 / 4

✓ **- 0 pts** Correct

- 0.5 pts G minor simplification error

- 0.5 pts H minor simplification error

- 1 pts G incorrectly simplified

- 1 pts H incorrectly simplified

- 2 pts G missing simplification

- 2 pts H missing simplification

ıll gradescope

√ 4b) $G = DEF$

$G = (A'+C)(BC)(A+C')$ - Substitute

$G = (A'BC + BCC)(A+C')$ - Distributivity

$G = (A'BC + BC)(A+C')$ - Idempotency

$G = BC(A'+1)(A+C')$ - Distributivity

$G = BC(1)(A+C')$ - Identity

$G = ABC + ABCC'$ - Distributivity

$\boxed{G = ABC}$ - Complement

$H = F'G' + FG$

$H = F'(ABC)' + F(ABC)$

$H = (A+C')'(ABC)' + (A+C')(ABC)$ } Substitute

$H = (A+C'+ABC)' + AABC + ABCC'$ - De Morgan's + Distributivity

$H = (A+C')' + AABC + ABCC'$ - Absorption

$H = (A+C')' + ABC + 0$ - Idempotency

$H = A'C + ABC$ - De Morgan's

$H = C(A'+AB)$ - Distributivity

$\boxed{H = A'C + BC}$ - Simplification

√ 5a) $F = AB + ABC + A' + D' + BC$

$F = AB + A' + B' + BC$ - Absorption

$F = A' + B + B' + BC$ - Simplification

$\boxed{F = 1}$ - Complement

√ 5b) $F = A + A'B + A'B'C + A'B'C'D + A'B'C'D'E$

$F = A + B + A'B'C + A'B'C'D + A'B'C'D'E$ - Simplification

$F = A + B + C + A'B'C'D + A'B'C'D'E$ - Simplification

$\boxed{F = A + B + C + D + E}$ - Simplification

√ 5c) $F = A'B' + AB + A'B$

$F = A'B' + B(A + A')$ - Distributivity

$F = A'B' + B$ - Complement

$\boxed{F = A' + B}$ - Simplification

5.1 a 4 / 4

✓ **- 0 pts** Correct; $$F=1$$

    - 2 pts Wrong answer, correct procedure

    - 3 pts Wrong answer, partially correct procedure

    - 4 pts Wrong answer, no procedure

gradescope

√ 4b) $G = DEF$

$G = (A' + C)(BC)(A + C')$ — Substitute

$G = (A'BC + BCC)(A + C')$ — Distributivity

$G = (A'BC + BC)(A + C')$ — Idempotency

$G = BC(A' + 1)(A + C')$ — Distributivity

$G = BC(1)(A + C')$ — Identity

$G = ABC + ABCC'$ — Distributivity

$\boxed{G = ABC}$ — Complement

$H = F'G' + FG$

$H = F'(ABC)' + F(ABC)$

$H = (A + C')(ABC)' + (A + C')(ABC)$ ⎤ Substitute

$H = (A + C' + ABC)' + AABC + ABCC'$ — De Morgan's + Distributivity

$H = (A + C')' + AABC + ABCC'$ — Absorption

$H = (A + C')' + ABC + 0$ — Idempotency

$H = A'C + ABC$ — De Morgan's

$H = C(A' + AB)$ — Distributivity

$\boxed{H = A'C + BC}$ — Simplification

√ 5a) $F = AB + ABC + A' + D' + BC$

$F = AB + A' + D' + BC$ — Absorption

$F = A' + B + D' + BC$ — Simplification

$\boxed{F = 1}$ — Complement

√ 5b) $F = A + A'B + A'B'C + A'B'C'D + A'B'C'D'E$

$F = A + B + A'B'C + A'B'C'D + A'B'C'D'E$ — Simplification

$F = A + B + C + A'B'C'D + A'B'C'D'E$ — Simplification

$\boxed{F = A + B + C + D + E}$ — Simplification

√ 5c) $F = A'B' + AB + A'B$

$F = A'B' + B(A + A')$ — Distributivity

$F = A'B' + B$ — Complement

$\boxed{F = A' + B}$ — Simplification

5.2 b 4 / 4

✓ **- 0 pts** Correct! $$F=A+B+C+D+E$$

   - 2 pts Wrong answer, correct procedure

   - 3 pts Wrong answer, partially correct procedure

   - 4 pts Wrong answer, no procedure

ıll gradescope

√ 4b) $G = DEF$

$\qquad G = (A' + C)(BC)(A + C')$ — Substitute

$\qquad G = (A'BC + BCC)(A + C')$ — Distributivity

$\qquad G = (A'BC + BC)(A + C')$ — Idempotency

$\qquad G = BC(A' + 1)(A + C')$ — Distributivity

$\qquad G = BC(1)(A + C')$ — Identity

$\qquad G = ABC + ABCC'$ — Distributivity

$\qquad \boxed{G = ABC}$ — Complement

$\qquad H = F'G' + FG$

$\qquad H = F'(ABC)' + F(ABC)$

$\qquad H = (A + C')'(ABC)' + (A + C')(ABC)$ $\left.\right\}$ Substitute

$\qquad H = (A + C' + ABC)' + AABC + ABCC'$ — De Morgan's + Distributivity

$\qquad H = (A + C')' + AABC + ABCC'$ — Absorption

$\qquad H = (A + C')' + ABC + 0$ — Idempotency

$\qquad H = A'C + ABC$ — De Morgan's

$\qquad H = C(A' + AB)$ — Distributivity

$\qquad \boxed{H = A'C + BC}$ — Simplification

√ 5a) $F = AB + ABC + A' + D' + BC$

$\qquad F = AB + A' + B' + BC$ — Absorption

$\qquad F = A' + B + B' + BC$ — Simplification

$\qquad \boxed{F = 1}$ — Complement

√ 5b) $F = A + A'B + A'B'C + A'B'C'D + A'B'C'D'E$

$\qquad F = A + B + A'B'C + A'B'C'D + A'B'C'D'E$ — Simplification

$\qquad F = A + B + C + A'B'C'D + A'B'C'D'E$ — Simplification

$\qquad \boxed{F = A + B + C + D + E}$ — Simplification

√ 5c) $F = A'B' + AB + A'B$

$\qquad F = A'B' + B(A + A')$ — Distributivity

$\qquad F = A'B' + B$ — Complement

$\qquad \boxed{F = A' + B}$ — Simplification

5.3 C 4 / 4

✓ **- 0 pts** Correct; $$F = A' + B$$

   - 2 pts Wrong answer, correct procedure

   - 3 pts Wrong answer, partially correct procedure

   - 4 pts Wrong answer, no procedure

ılı gradescope

✓ 5b) $F = (AB' + C')(B' + C)(A + BC')$

$F = (AB' + C')(A + BC'')(B' + C)$ — Associativity

$F = (AB' + C')(A + (B' + C)')(B' + C)$ — De Morgan's Law

$F = (AB' + C')(B' + C)((B' + C)' + A)$ — Associativity

$F = (AB' + C')(B' + C)A$ — Simplification

$F = (AB' + C')(AB' + AC)$ — Distributivity

$F = AB'(C'AC)$ — Distributivity

$\boxed{F = AB'}$ — Complement

✓ 5c) $F = A' + A(A'B + B'C)'$

$F = A' + A((A'B)'(B'C)')$ — De Morgan's

$F = A' + A((A+B')(B+C'))$ — De Morgan's

$F = A' + A(A+B')(B+C')$ — Associativity

$F = A' + (A + AB')(B+C')$ — Distributivity + Idempotency

$F = A' + A(B+C')$ — Absorption

$F = A' + (AB + C'$ — Distributivity

$\boxed{F = A' + B + C'}$ — Simplification

✓ 5f) $F = (A'B' + C)(A+B)(B' + AC)'$

$F = (A'B' + C)(A+B)(B(AC)')$ — De Morgan's

$F = ((A+B)' + C)(A+B)(B(AC)')$ — De Morgan's

$F = C(A+B)(B(AC)')$ — Simplification

$F = (AC + BC)(B(A' + C'))$ — Distributivity + De Morgan's

$F = (AC + BC)(A'B + BC')$ — Distributivity

$F = C(A+B)B(A' + B')$ — Distributivity

$F = BC(A+B)(A' + B')$ — Associativity

$F = BC(A' + B')$ — Absorption

$F = A'BC + B'BC$ — Distributivity

$\boxed{F = A'BC}$ — Complement

5.4 d 4 / 4

✓ **- 0 pts** Correct; $$F = AB'$$

   - 2 pts Wrong answer, correct procedure

   - 3 pts Wrong answer, partially correct procedure

   - 4 pts Wrong answer, no procedure

gradescope

✓ 5d) $F = (AB' + C')(D' + C)(A + BC')$

$F = (AB' + C')(A + BC'')(B' + C)$ — Associativity

$F = (AB' + C')(A + (B' + C)')(D' + C)$ — De Morgan's Law

$F = (AB' + C')(B' + C)((D + C)' + A)$ — Associativity

$F = (AB' + C')(B' + C)A$ — Simplification

$F = (AB' + C')(AB' + AC)$ — Distributivity

$F = AB'(C'AC)$ — Distributivity

$\boxed{F = AB'}$ — Complement

✓ 5e) $F = A' + A(A'B + B'C)'$

$F = A' + A((A'B)'(B'C)')$ — De Morgan's

$F = A' + A((A + B')(B + C'))$ — De Morgan's

$F = A' + A(A + B')(B + C')$ — Associativity

$F = A' + (A + AB')(B + C')$ — Distributivity + Idempotency

$F = A' + A(B + C')$ — Absorption

$F = A' + (AB + C')$ — Distributivity

$\boxed{F = A' + B + C'}$ — Simplification

✓ 5f) $F = (A'B' + C)(A + B)(B' + AC)'$

$F = (A'B' + C)(A + B)(B(AC)')$ — De Morgan's

$F = ((A + B)' + C)(A + B)(B(AC)')$ — De Morgan's

$F = C(A + B)(B(AC)')$ — Simplification

$F = (AC + BC)(B(A' + C'))$ — Distributivity + De Morgan's

$F = (AC + BC)(A'B + BC')$ — Distributivity

$F = C(A + B)B(A' + B')$ — Distributivity

$F = BC(A + B)(A' + B')$ — Associativity

$F = BC(A' + B')$ — Absorption

$F = A'BC + B'BC$ — Distributivity

$\boxed{F = A'BC}$ — Complement

5.5 e 4 / 4

✓ **- 0 pts** Correct; $$F=A' + B + C'$$

   - 2 pts Wrong answer, correct procedure

   - 3 pts Wrong answer, partially correct procedure

   - 4 pts Wrong answer, no procedure

gradescope

✓ 5d) $F = (AB' + C')(D' + C)(A + BC')$

$F = (AB' + C')(A + BC'')(B' + C)$ — Associativity

$F = (AB' + C')(A + (B' + C)')(D' + C)$ — De Morgan's Law

$F = (AB' + C')(B' + C)((D' + C)' + A)$ — Associativity

$F = (AB' + C')(B' + C)A$ — Simplification

$F = (AB' + C')(AB' + AC)$ — Distributivity

$F = AB'(C'AC)$ — Distributivity

$\boxed{F = AB'}$ — Complement

✓ 5e) $F = A' + A(A'B + B'C)'$

$F = A' + A((A'B)'(B'C)')$ — De Morgan's

$F = A' + A((A + B')(B + C'))$ — De Morgan's

$F = A' + A(A + B')(B + C')$ — Associativity

$F = A' + (A + AB')(B + C')$ — Distributivity + Idempotency

$F = A' + A(B + C')$ — Absorption

$F = A' + (AB + C')$ — Distributivity

$\boxed{F = A' + B + C'}$ — Simplification

✓ 5f) $F = (A'B' + C)(A + B)(B' + AC)'$

$F = (A'B' + C)(A + B)(B(AC)')$ — De Morgan's

$F = ((A + B)' + C)(A + B)(B(AC)')$ — De Morgan's

$F = C(A + B)(B(AC)')$ — Simplification

$F = (AC + BC)(B(A' + C'))$ — Distributivity + De Morgan's

$F = (AC + BC)(A'B + BC')$ — Distributivity

$F = C(A + B)B(A' + B')$ — Distributivity

$F = BC(A + B)(A' + B')$ — Associativity

$F = BC(A' + B')$ — Absorption

$F = A'BC + B'BC$ — Distributivity

$\boxed{F = A'BC}$ — Complement

5.6 f 4 / 4

✓ **- 0 pts** Correct; $$F = A'BC$$

  - 2 pts Wrong answer, correct procedure

  - 3 pts Wrong answer, partially correct procedure

  - 4 pts Wrong answer, no procedure

√ 6) $E(A,B) = (A+B')(A'+B')$

$E(A,B) = (A(A'+B') + B'(A'+B'))$ - Distributivity

$E(A,B) = (AA' + AB' + A'B' + B'B')$ - Distributivity

$E(A,B) = (AB' + A'B' + B')$ - Complement

$E(A,B) = AB' + A'B' + (A+A')B'$

$E(A,B) = AB' + A'B' + AB' + A'B'$

$\boxed{E(A,B) = AB' + A'B'}$ = $\boxed{M_0 + M_2 = \Sigma(0,2)}$

√ 7) $E(A,B,C) = A'B'C' + A'BC' + AB'C + ABC$

$E(A,B,C) = A'C'(B'+B) + AC(B'+B)$ - Distributivity

$E(A,B,C) = A'C' + AC$ - Complement

$E(A,B,C) = (A'C'+A)(A'C'+C)$ - Distributivity

$E(A,B,C) = (A+C')(A'+C)$ - Simplification

$E(A,B,C) = (A+BB'+C')(A'+BB'+C)$

$\boxed{E(A,B,C) = (A+B+C')(A+B'+C')(A'+B+C)(A'+B'+C)}$

$\boxed{E(A,B,C) = M_1 \cdot M_3 \cdot M_4 \cdot M_6 = \Pi(1,3,4,6)}$

8a)

A_1	A_0	B_1	B_0	F	$A \geq B$
0	0	0	0	1	
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	0	
0	1	0	0	1	
0	1	0	1	1	
0	1	1	0	0	
0	1	1	1	0	
1	0	0	0	1	
1	0	0	1	1	
1	0	1	0	1	
1	0	1	1	0	
1	1	0	0	1	
1	1	0	1	1	
1	1	1	0	1	
1	1	1	1	1	

6 6 **4 / 4**

✓ **- 0 pts** Correct

- **1 pts** Minor Error

- **2 pts** Wrong minterms

- **2 pts** Not a sum of minterms

- **2 pts** Computed sum of minterms for 3 variables instead of 2

- **3 pts** Incorrect

- **4 pts** Blank

gradescope

√ 6) $E(A,B) = (A+B')(A'+B')$

$E(A,B) = (A(A'+B') + B'(A'+B'))$ - Distributivity

$E(A,B) = (AA' + AB' + A'B' + B'B')$ - Distributivity

$E(A,B) = (AB' + A'B' + B')$ - Complement

$E(A,B) = AB' + A'B' + (A+A')B'$

$E(A,B) = AB' + A'B' + AB' + A'B'$

$\boxed{E(A,B) = AB' + A'B'}$ = $\boxed{M_0 + M_2 = \Sigma(0,2)}$

√ 7) $E(A,B,C) = A'B'C' + A'BC' + AB'C + ABC$

$E(A,B,C) = A'C'(B'+B) + AC(B'+B)$ - Distributivity

$E(A,B,C) = A'C' + AC$ - Complement

$E(A,B,C) = (A'C'+A)(A'C'+C)$ - Distributivity

$E(A,B,C) = (A+C')(A'+C)$ - Simplification

$E(A,B,C) = (A+BB'+C')(A'+BB'+C)$

$\boxed{E(A,B,C) = (A+B+C')(A+B'+C')(A'+B+C)(A'+B'+C)}$

$\boxed{E(A,B,C) = M_1 \cdot M_3 \cdot M_4 \cdot M_6 = \Pi(1,3,4,6)}$

8a)

A_1	A_0	B_1	B_0	F	$A \geq B$
0	0	0	0	1	
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	0	
0	1	0	0	1	
0	1	0	1	1	
0	1	1	0	0	
0	1	1	1	0	
1	0	0	0	1	
1	0	0	1	1	
1	0	1	0	1	
1	0	1	1	0	
1	1	0	0	1	
1	1	0	1	1	
1	1	1	0	1	
1	1	1	1	1	

7 **7** **4 / 4**

✓ **- 0 pts** Correct; $$\Pi M(1,3,4,6)$$ or $$(A+B+C')(A+B'+C')(A'+B+C)(A'+B'+C)$$

- 4 pts Wrong answer (no partial credit for this problem)

gradescope

6) $E(A,B) = (A+B')(A'+B')$

$E(A,B) = (A(A'+B') + B'(A'+B'))$ - Distributivity

$E(A,B) = (AA' + AB' + A'B' + B'B')$ - Distributivity

$E(A,B) = (AB' + A'B' + B')$ - Complement

$E(A,B) = AB' + A'B' + (A+A')B'$

$E(A,B) = AB' + A'B' + AB' + A'B'$

$\boxed{E(A,B) = AB' + A'B'} = \boxed{M_0 + M_2 = \Sigma(0,2)}$

7) $E(A,B,C) = A'B'C' + A'BC' + AB'C + ABC$

$E(A,B,C) = A'C'(B'+B) + AC(B'+B)$ - Distributivity

$E(A,B,C) = A'C' + AC$ - Complement

$E(A,B,C) = (A'C'+A)(A'C' + C)$ - Distributivity

$E(A,B,C) = (A+C')(A'+C)$ - Simplification

$E(A,B,C) = (A+BB'+C')(A'+BB'+C)$

$\boxed{E(A,B,C) = (A+B+C')(A+B'+C')(A'+B+C)(A'+B'+C)}$

$\boxed{E(A,B,C) = M_1 \cdot M_3 \cdot M_4 \cdot M_6 = \Pi(1,3,4,6)}$

8a)

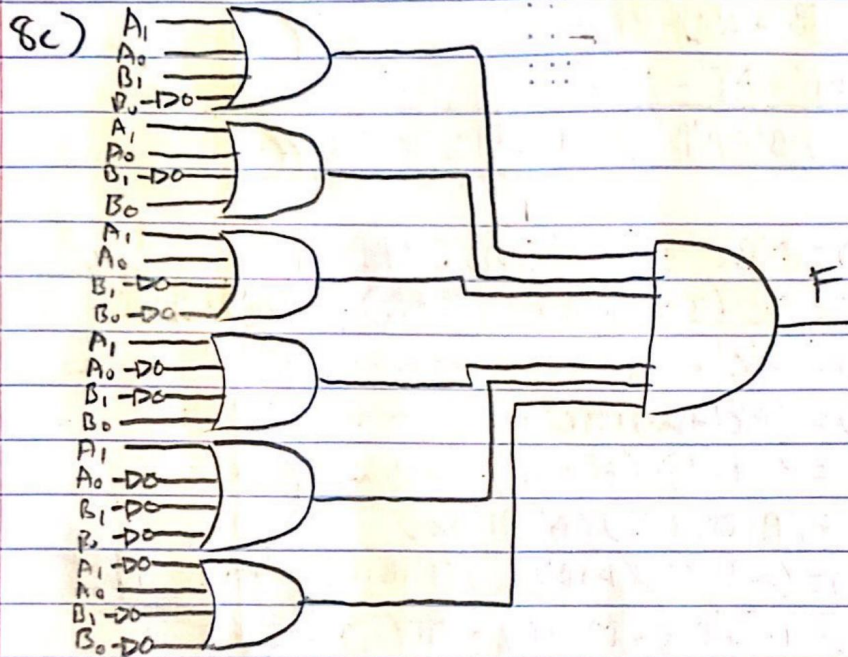| A_1	A_0	B_1	B_0	F	$A \geq B$
0	0	0	0	1	
0	0	0	1	0	
0	0	1	0	0	
0	0	1	1	0	
0	1	0	0	1	
0	1	0	1	1	
0	1	1	0	0	
0	1	1	1	0	
1	0	0	0	1	
1	0	0	1	1	
1	0	1	0	1	
1	0	1	1	0	
1	1	0	0	1	
1	1	0	1	1	
1	1	1	0	1	
1	1	1	1	1	

8.1 a 6 / 6

✓ **- 0 pts** Correct

  - 1.5 pts Error in first 4 rows

  - 1.5 pts Error in second 4 rows

  - 1.5 pts Error in third 4 rows

  - 1.5 pts Error in last 4 rows

  - 6 pts Blank

ıl gradescope

8b) $F = (A_1 + A_0 + B_1 + B_0')(A_1 + A_0 + B_1' + B_0)(A_1 + A_0 + B_1' + B_0')$
$\quad (A_1 + A_0' + B_1' + B_0)(A_1 + A_0' + B_1' + B_0')(A_1' + A_0 + B_1 + B_0')$

$F = M_1 \cdot M_2 \cdot M_3 \cdot M_6 \cdot M_7 \cdot M_{11} = \Pi(1,2,3,6,7,11)$

8c)

8d) $F = (A_1' A_0' B_1' B_0') + (A_1' A_0 B_1' B_0') + (A_1' A_0 B_1' B_0) + (A_1 A_0' B_1' B_0') +$
$\quad (A_1 A_0' B_1' B_0) + (A_1 A_0' B_1 B_0') + (A_1 A_0 B_1' B_0') + (A_1 A_0 B_1' B_0) +$
$\quad (A_1 A_0 B_1 B_0') + (A_1 A_0 B_1 B_0)$

$F = m_0 + m_4 + m_5 + m_8 + m_9 + m_{10} + m_{12} + m_{13} + m_{14} + m_{15}$
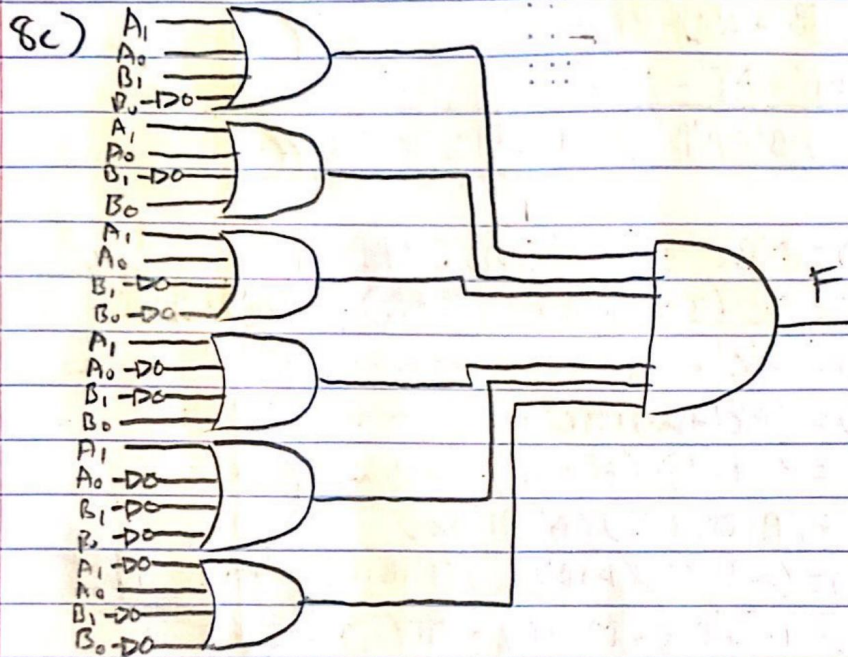
$F = \Sigma(0,4,5,8,9,10,12,13,14,15)$

8.2 b **4 / 4**

✓ **- 0 pts** Correct

    - 2 pts Negated the 0s instead of 1s

    - 2 pts Used rows with 1s instead of 0s

    - 1 pts Missing maxterms

    - 1 pts Extra maxterms

    - 0.5 pts Minor error

    - 1 pts Gave minterms instead of maxterms

    - 4 pts Blank

gradescope

8b)
$$F = (A_1 + A_0 + B_1 + B_0')(A_1 + A_0 + B_1' + B_0)(A_1 + A_0 + B_1' + B_0')$$
$$(A_1 + A_0' + B_1' + B_0)(A_1 + A_0' + B_1' + B_0')(A_1' + A_0 + B_1' + B_0')$$
$$F = M_1 \cdot M_2 \cdot M_3 \cdot M_6 \cdot M_7 \cdot M_{11} = \Pi(1, 2, 3, 6, 7, 11)$$

8c)

8d)
$$F = (A_1'A_0'B_1'B_0') + (A_1'A_0B_1'B_0') + (A_1'A_0B_1'B_0) + (A_1A_0'B_1'B_0') +$$
$$(A_1A_0'B_1'B_0) + (A_1A_0'B_1B_0') + (A_1A_0B_1'B_0') + (A_1A_0B_1'B_0) +$$
$$(A_1A_0B_1B_0') + (A_1A_0B_1B_0)$$
$$F = m_0 + m_4 + m_5 + m_8 + m_9 + m_{10} + m_{12} + m_{13} + m_{14} + m_{15}$$
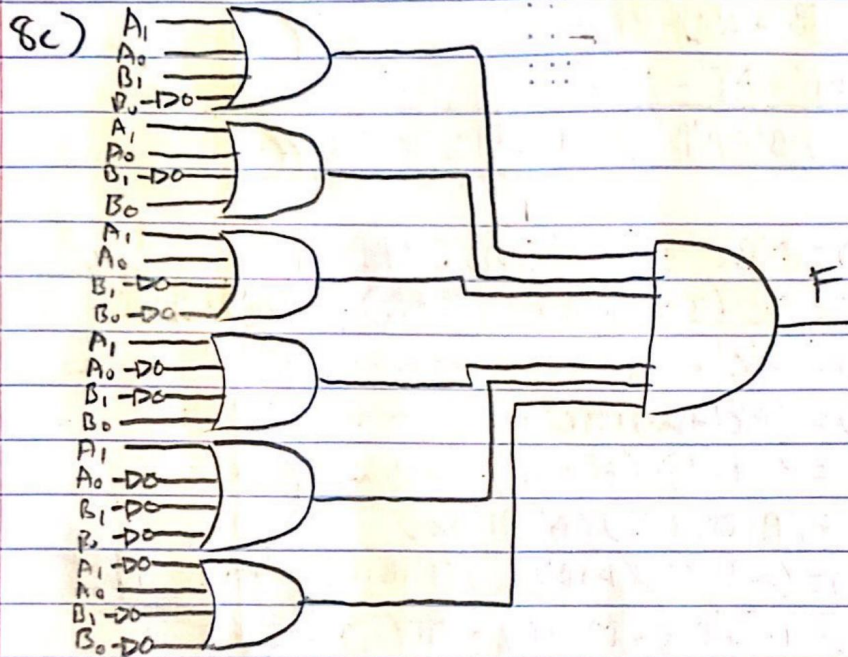$$F = \Sigma(0, 4, 5, 8, 9, 10, 12, 13, 14, 15)$$

8.3 C 4 / 4

✓ **- 0 pts** Implements part b correctly.

- 0.5 pts Gate symbol design should write in terms of inputs and gates.

- 0.5 pts Minor error

- 1 pts No AND gate

- 1 pts Incorrect inputs to OR gate.

- 4 pts Blank

✓ **- 0 pts** Implements part b correctly.

gradescope

8b) $F = (A_1 + A_0 + B_1 + B_0')(A_1 + A_0 + B_1' + B_0)(A_1 + A_0 + B_1' + B_0')$
$(A_1 + A_0' + B_1' + B_0)(A_1 + A_0' + B_1' + B_0')(A_1' + A_0 + B_1' + B_0')$

$F = M_1 \cdot M_2 \cdot M_3 \cdot M_6 \cdot M_7 \cdot M_{11} = \Pi(1, 2, 3, 6, 7, 11)$

8c)

8d) $F = (A_1'A_0'B_1'B_0') + (A_1'A_0B_1'B_0') + (A_1'A_0B_1'B_0) + (A_1A_0'B_1'B_0') +$
$(A_1A_0'B_1'B_0) + (A_1A_0'B_1B_0') + (A_1A_0B_1'B_0') + (A_1A_0B_1'B_0) +$
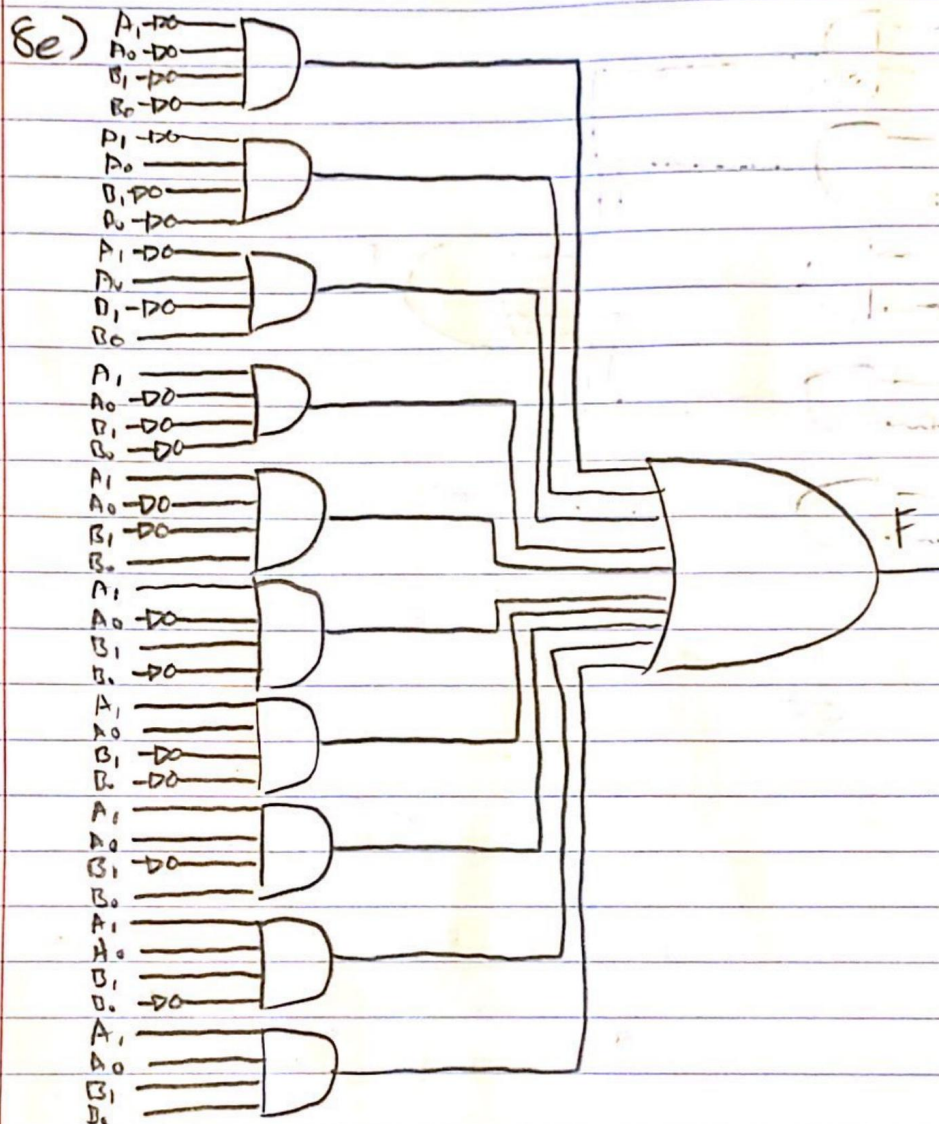$(A_1A_0B_1B_0') + (A_1A_0B_1B_0)$

$F = m_0 + m_4 + m_5 + m_8 + m_9 + m_{10} + M_{12} + M_{13} + M_{14} + M_{15}$

$F = \Sigma(0, 4, 5, 8, 9, 10, 12, 13, 14, 15)$

8.4 d 4 / 4

✓ **- 0 pts** Correct

- **2 pts** Used rows with 0s instead of 1.

- **1 pts** Gave maxterms instead of minterms

- **1 pts** Missing a minterm

- **1 pts** Extra minterms

- **4 pts** Blank

8.4 d 4 / 4

✓ **- 0 pts** Correct

- **2 pts** Used rows with 0s instead of 1.

ıl gradescope

8e)

8f) $F = (A_1 + A_0 + B_1 + B_0')(A_1 + A_0 + B_1' + B_0)(A_1 + A_0 + B_1' + B_0')$
$(A_1 + A_0' + B_1' + B_0)(A_1 + A_0' + B_1' + B_0')(A_1' + A_0 + B_1' + B_0')$

$F = (A_1 + A_0 + B_1 + B_0')(B_0 B_0' + (A_1 + A_0 + B_1'))(B_0 B_0' + (A_1 + A_0' + B_1'))$
$(A_1' + A_0 + B_1' + B_0')$

$F = (A_1 + A_0 + B_1 + B_0')(A_1' + A_0 + B_1' + B_0')(A_1 + A_0 + B_1')(A_1 + A_0' + B_1')$

$F = (A_1 + A_0 + B_1 + B_0')(A_1' + A_0 + B_1' + B_0')(A_0 A_0' + (A_1 + B_1'))$

$F = (A_1 + A_0 + B_1 + B_0')(A_1' + A_0 + B_1' + B_0')(A_1 + B_1')$
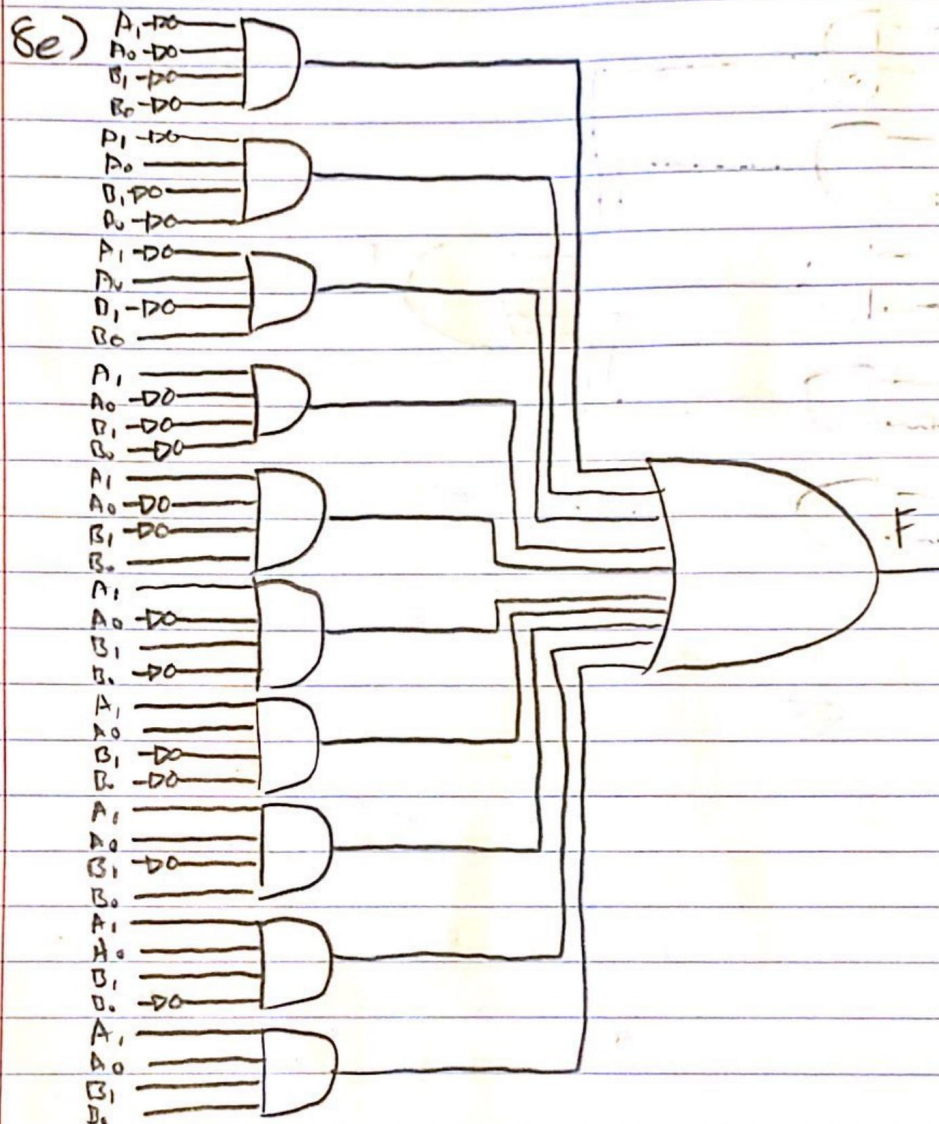
$F = [(A_0 + B_0') + (A_1 + B_1)(A_1' + B_1')](A_1 + B_1')$

$F = (A_0 + B_0')(A_1 + B_1') + (A_1 + B_1)(A_1' + B_1')(A_1 + B_1')$

$F = A_0 A_1 + A_0 B_1' + A_1 B_0' + B_0' B_1' + (A_1 A_1' + A_1' B_1 + A_1 B_1' + B_1 B_1')(A_1 + B_1')$

$\boxed{F = A_0 A_1 + A_0 B_1' + A_1 B_0' + B_0' B_1' + (A_1 B_1')}$

8.5 e **4 / 4**

✓ **- 0 pts** Correctly implements part e.

- 0.5 pts Minor error

- 4 pts Blank

8.5 e **4 / 4**

✓ **- 0 pts** Correctly implements part e.

- 0.5 pts Minor error

8e) Circuit diagram

8f)
$$F = (A_1 + A_0 + B_1 + B_0')(A_1 + A_0 + B_1' + B_0)(A_1 + A_0 + B_1' + B_0')$$
$$(A_1 + A_0' + B_1' + B_0)(A_1 + A_0' + B_1' + B_0')(A_1' + A_0 + B_1' + B_0')$$

$$F = (A_1 + A_0 + B_1 + B_0')(B_0 B_0' + (A_1 + A_0 + B_1'))(B_0 B_0' + (A_1 + A_0' + B_1'))$$
$$(A_1' + A_0 + B_1' + B_0')$$

$$F = (A_1 + A_0 + B_1 + B_0')(A_1' + A_0 + B_1' + B_0')(A_1 + A_0 + B_1')(A_1 + A_0' + B_1')$$

$$F = (A_1 + A_0 + B_1 + B_0')(A_1' + A_0 + B_1' + B_0')(A_0 A_0' + (A_1 + B_1'))$$

$$F = (A_1 + A_0 + B_1 + B_0')(A_1' + A_0 + B_1' + B_0')(A_1 + B_1')$$

$$F = [(A_0 + B_0') + (A_1 + B_1)(A_1' + B_1')](A_1 + B_1')$$

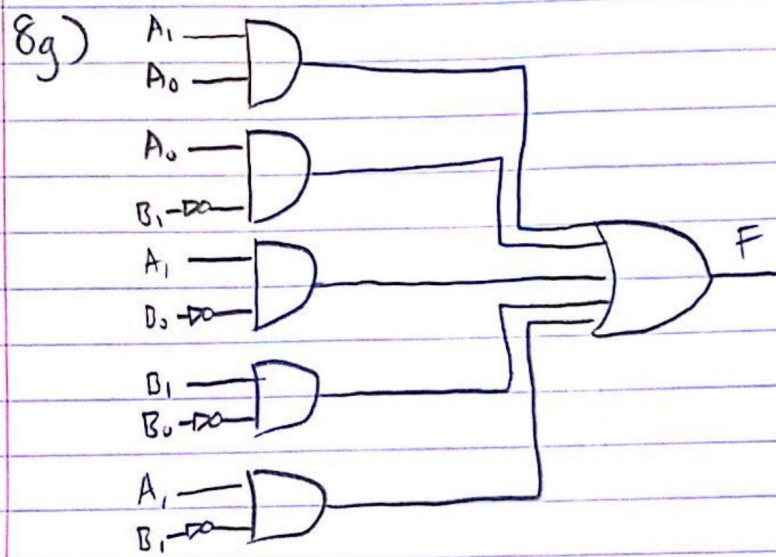$$F = (A_0 + B_0')(A_1 + B_1') + (A_1 + B_1)(A_1' + B_1')(A_1 + B_1')$$

$$F = A_0 A_1 + A_0 B_1' + A_1 B_0' + B_0' B_1' + (A_1 A_1' + A_1' B_1 + A_1 B_1' + B_1 B_1')(A_1 + B_1')$$

$$\boxed{F = A_0 A_1 + A_0 B_1' + A_1 B_0' + B_0' B_1' + (A_1 B_1')}$$

8.6 f 4 / 4

✓ **- 0 pts** Correct

    - 1 pts Minor error(s)

    - 1 pts Not simplest form but close

    - 2 pts Incorrect

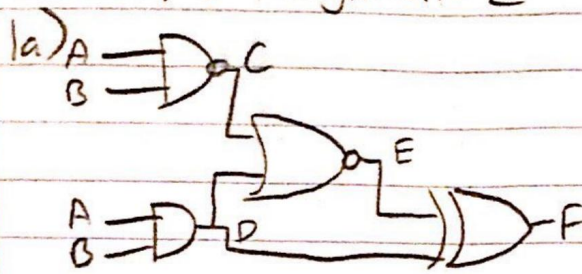   **- 2 pts** Not a boolean algebra expression

    - 4 pts Blank

8.6 f 4 / 4

✓ **- 0 pts** Correct

    - 1 pts Minor error(s)

8g)

A_1
A_0

A_0
$B_1 - \text{Do}$

A_1
$D_0 - \text{Do}$

B_1
$B_0 - \text{Do}$

A_1
$B_1 - \text{Do}$

F

8.7 g 4 / 4

✓ **- 0 pts** Correctly implements part f.

   - 4 pts Blank

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Academic Honesty: 3̶8̶

CSMS1A Assignment 2

1a)

A, B → C

D = AND

)D = XOR

D = OR

$C = (AB)'$, $D = (AB)$, $E = (C+D)'$
$F = (D \oplus E)$

A B	C	D	E	F
0 0	1	0	0	0
0 1	1	0	0	0
1 0	1	0	0	0
1 1	0	1	0	1

✓ 1b) $F = (DE' + D'E)$

$F = AB(C+D) + (AB)'(C+D)'$

$F = AB((AB)' + AB) + (AB)'((AB)'+AB)'$

$F = AB(1) + (AB)'((AB)(AB)')$

$F = AB + (AB)'(0)$

$\boxed{F = AB}$

2)

= NAND   = AND

= NOR   = NAND

3a)

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

ID: 305 413 659

9 Academic Honesty Acknowledgement **0 / 0**

  ✓ **- 0 pts** Correct