21W-COMSCIM51A-1 Homework 5

CHARLES ZHANG

TOTAL POINTS

107 / 110

QUESTION 1

1 12 pts

1.1 a 4 / 4

✓ **- 0 pts Correct (please ignore the circles)**

![Screen_Shot_2021-02-05_at_4.24.56_PM.png](/files/a95d1951-c50d-4b5e-ae84-d6b842973164)

- **1 pts** Error in the 1st column
- **1 pts** Error in the 2nd column
- **1 pts** Error in the 3rd column
- **1 pts** Error in the 4th column

1.2 b 4 / 4

✓ **- 0 pts Correct; $$F = x_2'x_0' + x_2x_1'$$**

- **2 pts** Minor error
- **3 pts** Not the minimal SOP
- **4 pts** Blank

1.3 c 4 / 4

✓ **- 0 pts Correct; $$F = (x_2 + x_0')(x_2' + x_1')$$**

- **2 pts** Minor error
- **3 pts** Not the minimal POS
- **4 pts** Blank

QUESTION 2

2 24 pts

2.1 a 8 / 8

✓ **- 0 pts Correct (ignore the circles)**

![2a.PNG](/files/4fe82019-01a2-41c5-b4c0-cfaf71a3dc26)

- **2 pts** First row of K-map incorrect
- **2 pts** Second row of K-map incorrect
- **2 pts** Third row of K-map incorrect
- **2 pts** Fourth row of K-map incorrect

2.2 b 4 / 4

✓ **- 0 pts Correct**

![2b.PNG](/files/bd73466e-b326-48b7-bf83-64ca7a1b6d76)

- **1 pts** Minor error
- **2 pts** Error
- **3 pts** Major error
- **4 pts** Blank

2.3 c 3 / 4

- **0 pts** Correct

![2c.PNG](/files/b4aa252a-da3a-4a3c-91f0-01babb06558f)

✓ **- 1 pts Minor error**

- **2 pts** Error
- **3 pts** Major error
- **4 pts** Blank

2.4 d 4 / 4

✓ **- 0 pts Correct**

![2d.PNG](/files/e95b7856-41a3-4fa2-8500-706d34a28865)

- **1 pts** Minor error
- **2 pts** Error
- **2 pts** Incorrect due to part (b) being incorrect
- **3 pts** Major error
- **4 pts** Blank

2.5 e 2 / 4

- **0 pts** Correct

![2e.PNG](/files/2871961e-42d0-4fcf-ae50-00bed71a8631)

- **1 pts** Minor error
- **2 pts** Error
- ✓ **- 2 pts** **Incorrect due to part (c) being incorrect**
- **3 pts** Major error
- **4 pts** Blank

QUESTION 3

3 28 pts

3.1 a 8 / 8

- ✓ **- 0 pts** **Correct (cross and dash are both ok)**
![Screen_Shot_2021-02-05_at_4.29.58_PM.png](/files/63a337e5-3a7e-4cc0-b053-1df7b809cf47)
- **2 pts** Error in the 1st block
- **2 pts** Error in the 2nd block
- **2 pts** Error in the 3rd block
- **2 pts** Error in the 4th block

3.2 b 4 / 4

- ✓ **- 0 pts** **Correct (left: $$z_1$$; right: $$z_0$$; please ignore the circles; cross and dash are both ok;)**
![Screen_Shot_2021-02-05_at_4.31.44_PM.png](/files/b2271dc5-1f1d-42f1-9234-21a50fd0b06e)
- **1 pts** Error in 1st and 2nd rows of $$z_1$$
- **1 pts** Error in 3rd and 4th rows of $$z_1$$
- **1 pts** Error in 1st and 2nd rows of $$z_0$$
- **1 pts** Error in 3rd and 4th rows of $$z_0$$

3.3 c 4 / 4

- ✓ **- 0 pts** **Correct; $$z_1 = x_0$$, $$z_0 = x_3 + x_2x_0 + x_2x_1$$**
- **0.5 pts** Minor error in $$z_1$$
- **1 pts** $$z_1$$ is not in the minimal form
- **2 pts** $$z_1$$ is wrong
- **0.5 pts** Minor error in $$z_0$$
- **1 pts** $$z_0$$ is not in the minimal form
- **2 pts** $$z_0$$ is wrong
- **4 pts** Blank

3.4 d 4 / 4

- ✓ **- 0 pts** **Correct; $$z_1 = x_0$$, $$z_0 = (x_3 + x_2)(x_3 + x_1 + x_0)$$**
- **0.5 pts** Minor error in $$z_1$$
- **1 pts** $$z_1$$ is not in minimal form
- **2 pts** $$z_1$$ is wrong
- **0.5 pts** Minor error in $$z_0$$
- **1 pts** $$z_0$$ is not in minimal form
- **2 pts** $$z_0$$ is wrong
- **4 pts** Blank

3.5 e 4 / 4

- ✓ **- 0 pts** **Correct**
![Screen_Shot_2021-02-05_at_4.41.37_PM.png](/files/22a5f03f-b987-441c-93ee-361817746cc2)
- **1 pts** Minor error
- **2 pts** Major error
- **4 pts** Blank

3.6 f 4 / 4

- ✓ **- 0 pts** **Correct**
![Screen_Shot_2021-02-05_at_4.42.18_PM.png](/files/a7eec9ce-52b3-458e-ae62-344a07e6ca6d)
- **1 pts** Minor error
- **2 pts** Major error
- **4 pts** Blank

QUESTION 4

4 20 pts

4.1 a 5 / 5

- ✓ **- 0 pts** **Correct**

![4a.PNG](/files/8988d564-6bd8-40c1-9769-6fc97f7569a1)
- **2 pts** Incorrect K-map
- **1.5 pts** Incorrect sum of products
- **1.5 pts** Incorrect product of sums

- **4 pts** Whole question incorrect due to incorrect K-map
- **5 pts** Blank

4.2 b **5 / 5**

✓ **- 0 pts** **Correct (don't cares can be "x" or "-")**

![4b.PNG](/files/7fcc7c64-ac56-465b-93f6-1ddd04680ab7)

- **2 pts** Incorrect K-map
- **1.5 pts** Incorrect sum of products
- **1.5 pts** Incorrect product of sums
- **4 pts** Whole question incorrect due to incorrect K-map
- **5 pts** Blank

4.3 c **5 / 5**

✓ **- 0 pts** **Correct**

![4c.PNG](/files/9d2e4b8e-6776-445b-93bf-13ae7ffee462)

- **2 pts** Incorrect K-map
- **1.5 pts** Incorrect sum of products
- **1.5 pts** Incorrect product of sums
- **4 pts** Whole question incorrect due to incorrect K-map
- **5 pts** Blank

4.4 d **5 / 5**

✓ **- 0 pts** **Correct**

![4d.PNG](/files/612a1a2a-e19d-4815-b613-ed538af7ca31)

- **2 pts** Incorrect K-map
- **1.5 pts** Incorrect sum of products
- **1.5 pts** Incorrect product of sums
- **4 pts** Whole question incorrect due to incorrect K-map
- **5 pts** Blank
- **0.5 pts** Incorrect term in SOP

QUESTION 5

5 24 pts

5.1 a **8 / 8**

✓ **- 0 pts** **Correct; $$z = \Sigma m(2,3,4,5,6,8,9) = \Pi M(0,1,7)$$**

- **2 pts** Minor error in sum of minterms
- **3 pts** Major error in sum of minterms
- **4 pts** Blank in sum of minterms
- **2 pts** Minor error in product of maxterms
- **3 pts** Major error in product of maxterms
- **4 pts** Blank in product of maxterms

5.2 b **8 / 8**

✓ **- 0 pts** **Correct; $$z = x_3 + x_2x_1' + x_1x_0' + x_2'x_1 = (x_3 + x_2+x_1)(x_2' + x_1'+x_0')$$**

- **2 pts** Minor error in SOP
- **3 pts** SOP is not in minimal form
- **4 pts** Blank in SOP
- **2 pts** Minor error in POS
- **3 pts** POS is not in minimal form
- **4 pts** Blank in POS

5.3 c **8 / 8**

✓ **- 0 pts** **Correct**

![Screen_Shot_2021-02-05_at_4.47.48_PM.png](/files/20a8fc1e-0c32-4059-ba76-adb8a1130a86)

- **2 pts** Minor error in SOP design
- **3 pts** Major error in SOP design
- **4 pts** Blank in SOP design
- **2 pts** Minor error in POS design
- **3 pts** Major error in POS design
- **4 pts** Blank in POS design

QUESTION 6

6 6 **2 / 2**

✓ **- 0 pts** **Correct, lists one of the following:**

Less transistors

Cheaper

More efficient

Only uses one type of gate (easy to manufacture)

- **2 pts** Incorrect

- 2 pts Blank

Charles Zhang
305413659

Academic Honesty: 

MSIA HW#5

1a)

x_2 \ x_0	0	1	3	2
0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

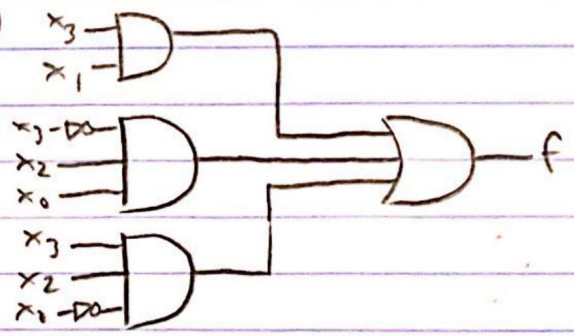
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



1.1 a **4 / 4**

✓ **- 0 pts** **Correct (please ignore the circles)**

![Screen_Shot_2021-02-05_at_4.24.56_PM.png](/files/a95d1951-c50d-4b5e-ae84-d6b842973164)

- 1 pts Error in the 1st column

- 1 pts Error in the 2nd column

- 1 pts Error in the 3rd column

- 1 pts Error in the 4th column

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0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

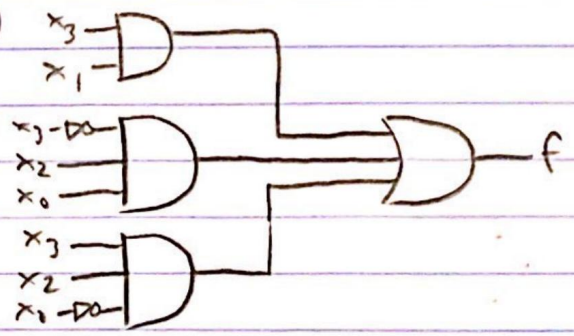
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



1.2 b **4 / 4**

✓ **- 0 pts** **Correct; $$F = x_2'x_0' + x_2x_1'$$**

- 2 pts Minor error

- 3 pts Not the minimal SOP

- 4 pts Blank

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1a)

x_2 \ x_0	0	1	3	2
0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

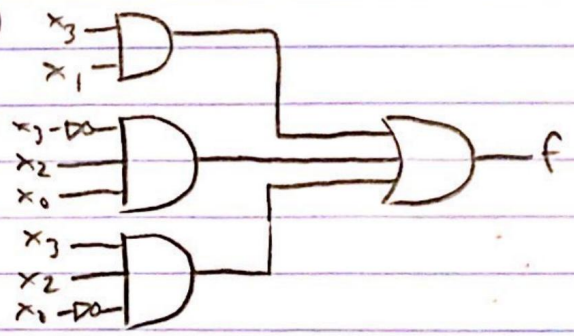
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



1.3 C **4 / 4**

✓ **- 0 pts** **Correct; $$F = (x_2 + x_0')(x_2' + x_1')$$**

- 2 pts Minor error

- 3 pts Not the minimal POS

- 4 pts Blank

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Academic Honesty: 

MSIA HW#5

1a)

x_2 \ x_0	0	1	3	2
0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

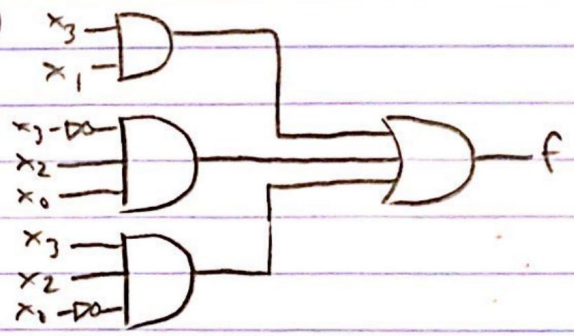
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



2.1 a **8 / 8**

✓ **- 0 pts** **Correct (ignore the circles)**

![2a.PNG](/files/4fe82019-01a2-41c5-b4c0-cfaf71a3dc26)

- 2 pts First row of K-map incorrect

- 2 pts Second row of K-map incorrect

- 2 pts Third row of K-map incorrect

- 2 pts Fourth row of K-map incorrect

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Academic Honesty: 

MSIA HW#5

1a)

x_2 \ x_0	0	1	3	2
0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

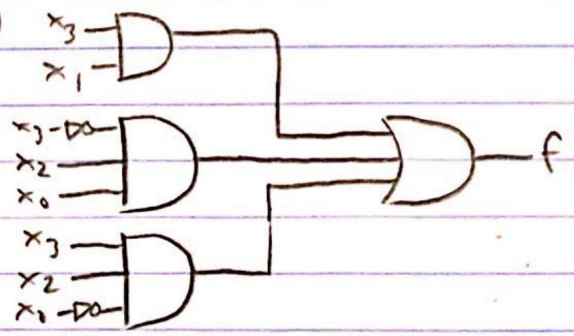
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



2.2 b **4 / 4**

✓ **- 0 pts** **Correct**

![2b.PNG](/files/bd73466e-b326-48b7-bf83-64ca7a1b6d76)

- 1 pts Minor error

- 2 pts Error

- 3 pts Major error

- 4 pts Blank

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Academic Honesty: 

MSIA HW#5

1a)

x_2 \ x_0	0	1	3	2
0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

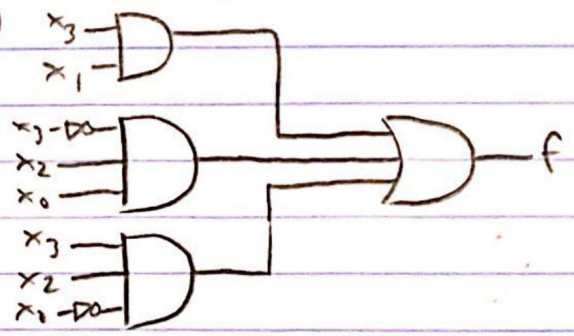
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



2.3 C **3 / 4**

- **0 pts** Correct

![2c.PNG](/files/b4aa252a-da3a-4a3c-91f0-01babb06558f)

✓ - **1 pts** **Minor error**

- **2 pts** Error
- **3 pts** Major error
- **4 pts** Blank

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Academic Honesty: 

MSIA HW#5

1a)

x_2 \ x_0	0	1	3	2
0	1	0	0	1
1	1	1	0	0

(x_1)

1b) $F = x_2x_1' + x_2'x_0'$

1c) $F = (x_2 + x_0')(x_2' + x_1')$

2a)

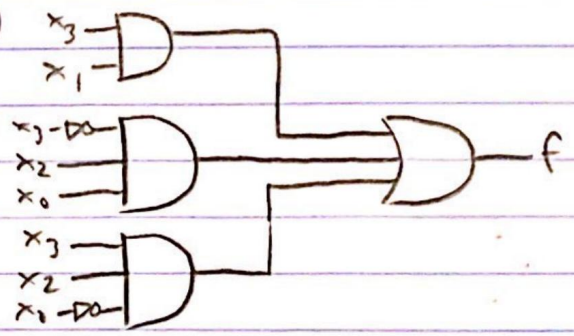
x_3 \ x_0	0	1	3	2
0	0	0	0	0
1	0	1	1	0
3	1	0	1	1
2	0	0	1	1

(x_2 on the right; x_1 on the bottom)

2b) $f = x_3x_1 + x_3'x_2x_0 + x_3x_2x_0'$

2c) $f = (x_3' + x_1 + x_0')(x_3 + x_2' + x_0)(x_3 + x_2)(x_2 + x_1)$

2d)



2.4 d **4 / 4**

✓ **- 0 pts** **Correct**

![2d.PNG](/files/e95b7856-41a3-4fa2-8500-706d34a28865)

- 1 pts Minor error

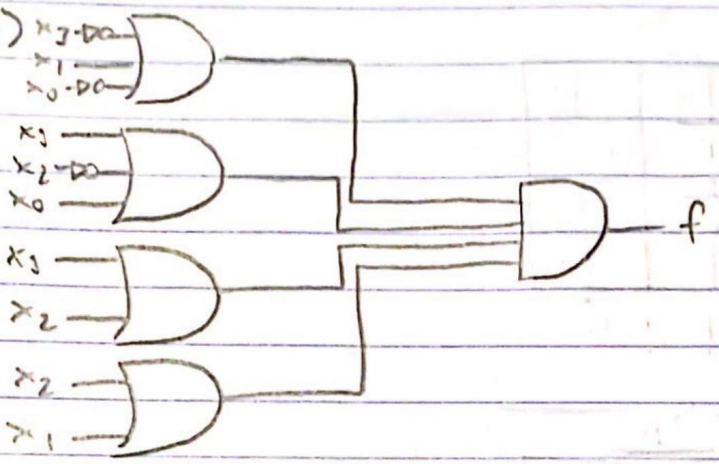
- 2 pts Error

- 2 pts Incorrect due to part (b) being incorrect

- 3 pts Major error

- 4 pts Blank

2c)



3a)

x_3	x_2	x_1	x_0	z_1	z_0
0	0	0	0	0	0
0	0	0	1	1	0
0	0	1	0	0	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	1	1	1
1	0	0	0	0	1
1	0	0	1	1	1
1	0	1	0	x	x
1	0	1	1	x	x
1	1	0	0	x	x
1	1	0	1	x	x
1	1	1	0	x	x
1	1	1	1	x	x

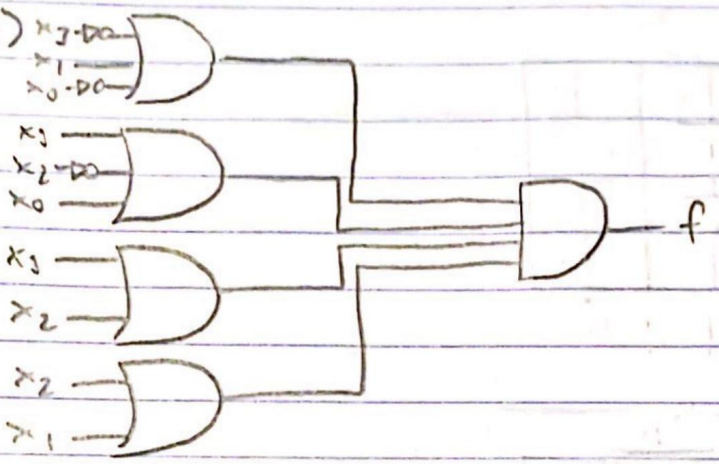
2.5 e **2 / 4**

- **0 pts** Correct

![2e.PNG](/files/2871961e-42d0-4fcf-ae50-00bed71a8631)

- **1 pts** Minor error
- **2 pts** Error
- ✓ **- 2 pts** **Incorrect due to part (c) being incorrect**
- **3 pts** Major error
- **4 pts** Blank

2c)



3a)

x_3	x_2	x_1	x_0	z_1	z_0
0	0	0	0	0	0
0	0	0	1	1	0
0	0	1	0	0	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	1	1	1
1	0	0	0	0	1
1	0	0	1	1	1
1	0	1	0	x	x
1	0	1	1	x	x
1	1	0	0	x	x
1	1	0	1	x	x
1	1	1	0	x	x
1	1	1	1	x	x

3.1 a **8 / 8**

✓ **- 0 pts** **Correct (cross and dash are both ok)**

![Screen_Shot_2021-02-05_at_4.29.58_PM.png](/files/63a337e5-3a7e-4cc0-b053-1df7b809cf47)

- 2 pts Error in the 1st block

- 2 pts Error in the 2nd block

- 2 pts Error in the 3rd block

- 2 pts Error in the 4th block

3b) z_1:

x_3 \ x_0	0	1	1	0
	0	1	1	0
	X	X	X	X
	0	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

z_0:

x_3 \ x_0	0	0	0	0
	0	1	1	1
	X	X	X	X
	1	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

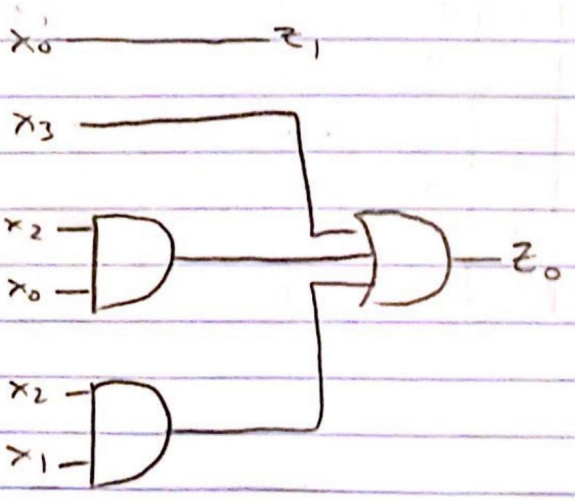
3c) $z_1 = x_0$

$z_0 = x_3 + x_2x_0 + x_2x_1$

3d) $z_1 = x_0$

$z_0 = (x_3 + x_2)(x_3 + x_1 + x_0)$

3e)



3.2 b **4 / 4**

✓ **- 0 pts** **Correct (left: $$z_1$$; right: $$z_0$$; please ignore the circles; cross and dash are both ok;)**

![Screen_Shot_2021-02-05_at_4.31.44_PM.png](/files/b2271dc5-1f1d-42f1-9234-21a50fd0b06e)

- **1 pts** Error in 1st and 2nd rows of $$z_1$$
- **1 pts** Error in 3rd and 4th rows of $$z_1$$
- **1 pts** Error in 1st and 2nd rows of $$z_0$$
- **1 pts** Error in 3rd and 4th rows of $$z_0$$

3b) z_1:

x_3 \ x_0	0	1	1	0
	0	1	1	0
	X	X	X	X
	0	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

z_0:

x_3 \ x_0	0	0	0	0
	0	1	1	1
	X	X	X	X
	1	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

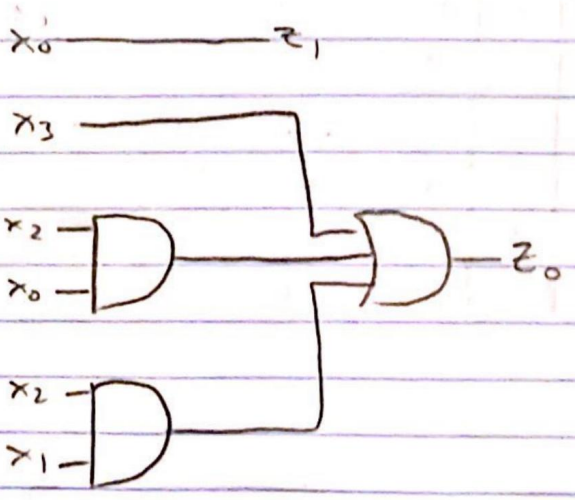
3c) $z_1 = x_0$

$z_0 = x_3 + x_2x_0 + x_2x_1$

3d) $z_1 = x_0$

$z_0 = (x_3 + x_2)(x_3 + x_1 + x_0)$

3e)



3.3 C **4 / 4**

✓ **- 0 pts Correct; $$z_1 = x_0$$, $$z_0 = x_3 + x_2x_0 + x_2x_1$$**

- 0.5 pts Minor error in $$z_1$$

- 1 pts $$z_1$$ is not in the minimal form

- 2 pts $$z_1$$ is wrong

- 0.5 pts Minor error in $$z_0$$

- 1 pts $$z_0$$ is not in the minimal form

- 2 pts $$z_0$$ is wrong

- 4 pts Blank

3b) z_1:

x_3 \ x_0	0	1	1	0
	0	1	1	0
	X	X	X	X
	0	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

z_0:

x_3 \ x_0	0	0	0	0
	0	1	1	1
	X	X	X	X
	1	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

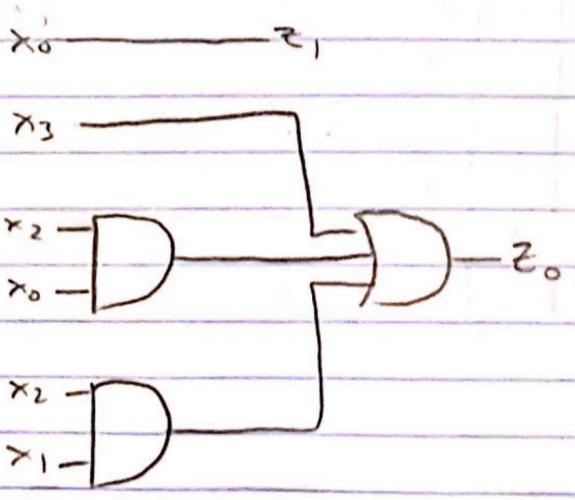
3c) $z_1 = x_0$

$z_0 = x_3 + x_2x_0 + x_2x_1$

3d) $z_1 = x_0$

$z_0 = (x_3 + x_2)(x_3 + x_1 + x_0)$

3e)



3.4 d **4 / 4**

✓ **- 0 pts** **Correct; $$z_1 = x_0$$, $$z_0 = (x_3 + x_2)(x_3 + x_1 + x_0)$$**

- 0.5 pts Minor error in $$z_1$$

- 1 pts $$z_1$$ is not in minimal form

- 2 pts $$z_1$$ is wrong

- 0.5 pts Minor error in $$z_0$$

- 1 pts $$z_0$$ is not in minimal form

- 2 pts $$z_0$$ is wrong

- 4 pts Blank

3b) z_1:

x_3 \ x_0	0	1	1	0
	0	1	1	0
	X	X	X	X
	0	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

z_0:

x_3 \ x_0	0	0	0	0
	0	1	1	1
	X	X	X	X
	1	1	X	X

(x_2 spans the two middle rows; x_1 spans the middle two columns)

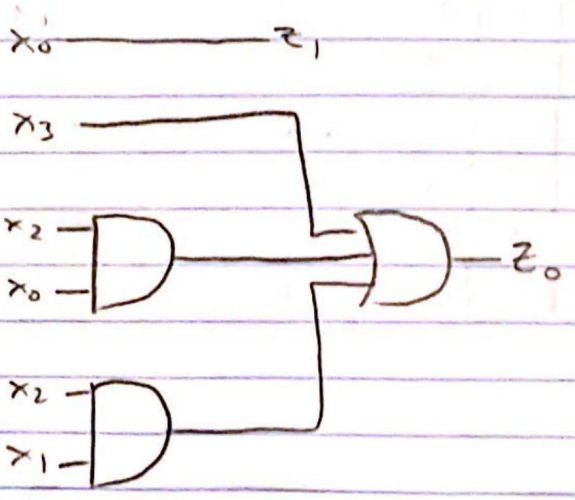
3c) $z_1 = x_0$

$z_0 = x_3 + x_2x_0 + x_2x_1$

3d) $z_1 = x_0$

$z_0 = (x_3 + x_2)(x_3 + x_1 + x_0)$

3e)



3.5 e **4 / 4**

✓ **- 0 pts** **Correct**

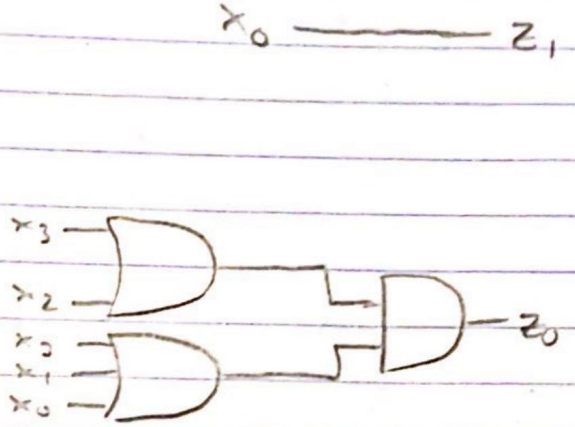
![Screen_Shot_2021-02-05_at_4.41.37_PM.png](/files/22a5f03f-b987-441c-93ee-361817746cc2)

- 1 pts Minor error

- 2 pts Major error

- 4 pts Blank

4f)



4a) $F(x_3, x_2, x_1, x_0) = \Pi M(1,3,4,7,10,13,14,15)$

x_3 \ x_2 \ x_1 \ x_0	00	01	11	10
00	1	0	0	1
01	0	1	0	1
11	1	0	0	0
10	1	1	1	0

SOP: $x_3'x_2x_1'x_0 + x_3'x_1x_0' + x_3'x_2'x_0' + x_3x_1'x_0' + x_3x_2'x_0 = F$

POS: $F = (x_3 + x_2' + x_1 + x_0)(x_3 + x_2 + x_0')(x_2' + x_1' + x_0')(x_3' + x_2' + x_0')$
$(x_3' + x_1' + x_0)$

4b) $F(x_3, x_2, x_1, x_0) = \sum m(0,4,5,9,11,14,15), dc(x_3, x_2, x_1, x_0) = \{m(2), m(8)\}$

x_3 \ x_2 \ x_1 \ x_0	00	01	11	10
00	1	0	0	X
01	1	1	0	0
11	0	0	1	1
10	X	1	1	0

SOP: $F = x_3x_2'x_0 + x_3x_2x_1 + x_3'x_2x_1' \quad x_3'x_1'x_0'$

POS: $F = (x_3 + x_1')(x_3 + x_2 + x_0')(x_3' + x_2' + x_1)(x_3' + x_2 + x_0)$

3.6 f **4 / 4**

✓ **- 0 pts** Correct

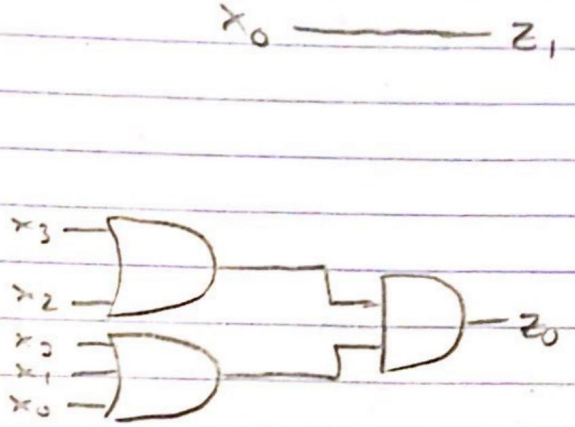
![Screen_Shot_2021-02-05_at_4.42.18_PM.png](/files/a7eec9ce-52b3-458e-ae62-344a07e6ca6d)

- 1 pts Minor error

- 2 pts Major error

- 4 pts Blank

4f)



4a) $F(x_3, x_2, x_1, x_0) = \Pi M(1,3,4,7,10,13,14,15)$

x_3 \ x_2 \ x_1 \ x_0	00	01	11	10
00	1	0	0	1
01	0	1	0	1
11	1	0	0	0
10	1	1	1	0

SOP: $x_3'x_2x_1'x_0 + x_3'x_1x_0' + x_3'x_2'x_0' + x_3x_1'x_0' + x_3x_2'x_0 = F$

POS: $F = (x_3 + x_2' + x_1 + x_0)(x_3 + x_2 + x_0')(x_2' + x_1' + x_0')(x_3' + x_2' + x_0')$
$(x_3' + x_1' + x_0)$

4b) $F(x_3, x_2, x_1, x_0) = \sum m(0,4,5,9,11,14,15), dc(x_3, x_2, x_1, x_0) = \{m(2), m(8)\}$

x_3 \ x_2 \ x_1 \ x_0	00	01	11	10
00	1	0	0	X
01	1	1	0	0
11	0	0	1	1
10	X	1	1	0

SOP: $F = x_3x_2'x_0 + x_3x_2x_1 + x_3'x_2x_1' \quad x_3'x_1'x_0'$

POS: $F = (x_3 + x_1')(x_3 + x_2 + x_0')(x_3' + x_2' + x_1)(x_3' + x_2 + x_0)$

4.1 a **5 / 5**

✓ **- 0 pts** **Correct**

![4a.PNG](/files/8988d564-6bd8-40c1-9769-6fc97f7569a1)

- 2 pts Incorrect K-map

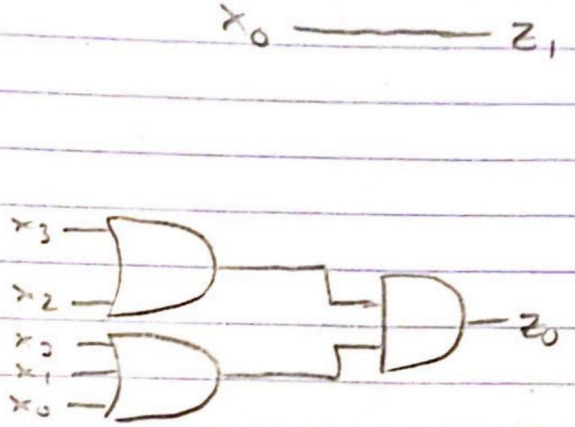
- 1.5 pts Incorrect sum of products

- 1.5 pts Incorrect product of sums

- 4 pts Whole question incorrect due to incorrect K-map

- 5 pts Blank

4f)



4a) $F(x_3, x_2, x_1, x_0) = \Pi M(1,3,4,7,10,13,14,15)$

x_3 \ x_2 \ x_1 \ x_0	00	01	11	10
00	1	0	0	1
01	0	1	0	1
11	1	0	0	0
10	1	1	1	0

SOP: $x_3'x_2x_1'x_0 + x_3'x_1x_0' + x_3'x_2'x_0' + x_3x_1'x_0' + x_3x_2'x_0 = F$

POS: $F = (x_3 + x_2' + x_1 + x_0)(x_3 + x_2 + x_0')(x_2' + x_1' + x_0')(x_3' + x_2' + x_0')$
$(x_3' + x_1' + x_0)$

4b) $F(x_3, x_2, x_1, x_0) = \sum m(0,4,5,9,11,14,15), dc(x_3, x_2, x_1, x_0) = \{m(2), m(8)\}$

x_3 \ x_2 \ x_1 \ x_0	00	01	11	10
00	1	0	0	X
01	1	1	0	0
11	0	0	1	1
10	X	1	1	0

SOP: $F = x_3x_2'x_0 + x_3x_2x_1 + x_3'x_2x_1' \quad x_3'x_1'x_0'$

POS: $F = (x_3 + x_1')(x_3 + x_2 + x_0')(x_3' + x_2' + x_1)(x_3' + x_2 + x_0)$

4.2 b **5 / 5**

✓ **- 0 pts** **Correct (don't cares can be "x" or "-")**

![4b.PNG](/files/7fcc7c64-ac56-465b-93f6-1ddd04680ab7)

- 2 pts Incorrect K-map

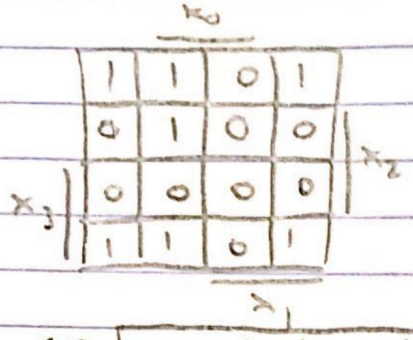
- 1.5 pts Incorrect sum of products

- 1.5 pts Incorrect product of sums

- 4 pts Whole question incorrect due to incorrect K-map

- 5 pts Blank

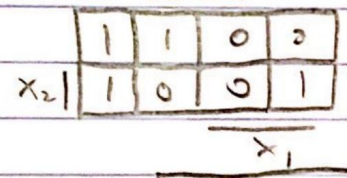
4c) $F(x_3, x_2, x_1, x_0) = \Sigma m(0,1,2,5,8,9,10)$



SOP: $F = x_2'x_0' + x_2'x_1' + x_3'x_1'x_0$

POS: $F = (x_1' + x_0')(x_3' + x_2')(x_2' + x_0)$

4d) $F(x_2, x_1, x_0) = \Sigma m(0,1,4,6)$



SOP: $F = x_2'x_1' + x_2x_0'$

POS: $F = (x_2 + x_1')(x_2' + x_0')$

5a)

x_3	x_2	x_1	x_0	z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1

$\Sigma m(2,3,4,5,6,8,9)$

$\Pi M(0,1,7)$

4.3 C **5 / 5**

✓ **- 0 pts** **Correct**

![4c.PNG](/files/9d2e4b8e-6776-445b-93bf-13ae7ffee462)

- 2 pts Incorrect K-map

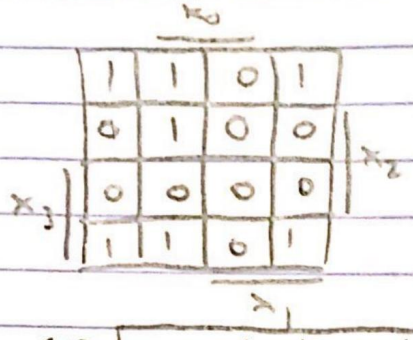
- 1.5 pts Incorrect sum of products

- 1.5 pts Incorrect product of sums

- 4 pts Whole question incorrect due to incorrect K-map

- 5 pts Blank

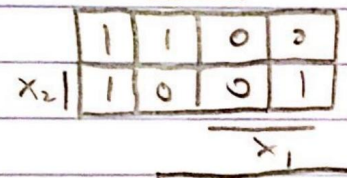
4c) $F(x_3, x_2, x_1, x_0) = \Sigma m(0,1,2,5,8,9,10)$



SOP: $F = x_2'x_0' + x_2'x_1' + x_3'x_1'x_0$

POS: $F = (x_1' + x_0')(x_3' + x_2')(x_2' + x_0)$

4d) $F(x_2, x_1, x_0) = \Sigma m(0,1,4,6)$



SOP: $F = x_2'x_1' + x_2x_0'$

POS: $F = (x_2 + x_1')(x_2' + x_0')$

5a)

x_3	x_2	x_1	x_0	z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1

$\Sigma m(2,3,4,5,6,8,9)$

$\Pi M(0,1,7)$

4.4 d 5 / 5

✓ **- 0 pts** **Correct**

![4d.PNG](/files/612a1a2a-e19d-4815-b613-ed538af7ca31)

- 2 pts Incorrect K-map

- 1.5 pts Incorrect sum of products

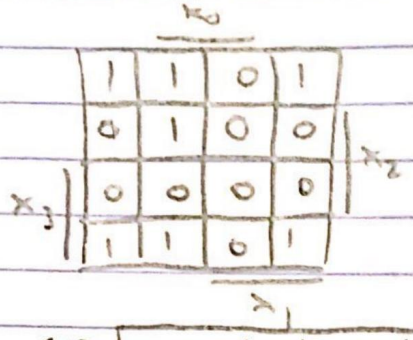
- 1.5 pts Incorrect product of sums

- 4 pts Whole question incorrect due to incorrect K-map

- 5 pts Blank

- 0.5 pts Incorrect term in SOP

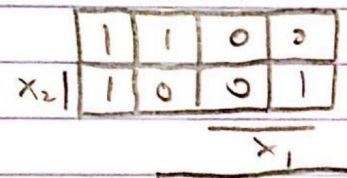
4c) $F(x_3, x_2, x_1, x_0) = \Sigma m(0,1,2,5,8,9,10)$



SOP: $F = x_2'x_0' + x_2'x_1' + x_3'x_1'x_0$

POS: $F = (x_1' + x_0')(x_3' + x_2')(x_2' + x_0)$

4d) $F(x_2, x_1, x_0) = \Sigma m(0,1,4,6)$



SOP: $F = x_2'x_1' + x_2x_0'$

POS: $F = (x_2 + x_1')(x_2' + x_0')$

5a)

x_3	x_2	x_1	x_0	z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1

$\Sigma m(2,3,4,5,6,8,9)$

$\Pi M(0,1,7)$

5.1 a **8 / 8**

✓ **- 0 pts** **Correct; $$z = \Sigma m(2,3,4,5,6,8,9) = \Pi M(0,1,7)$$**

- 2 pts Minor error in sum of minterms

- 3 pts Major error in sum of minterms

- 4 pts Blank in sum of minterms

- 2 pts Minor error in product of maxterms

- 3 pts Major error in product of maxterms

- 4 pts Blank in product of maxterms

5b)

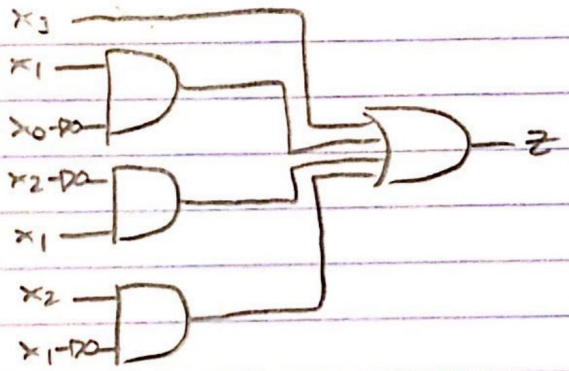
x_3 \ x_0	0	0	1	1
	1	1	0	1
x_2	X	X	X	X
	1	1	X	X

(x_1)

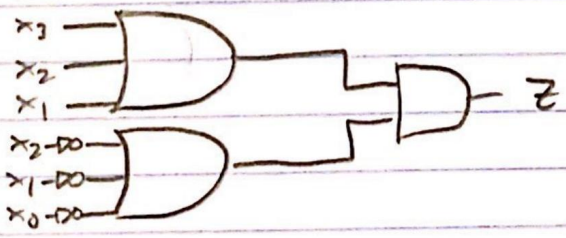
SOP: $z = x_3 + x_1x_0' + x_2'x_1 + x_2x_1'$

POS: $(x_3 + x_2 + x_1)(x_2' + x_1' + x_0') = z$

5c) SOP:



POS:



6) NAND gates cost less transistors to implement than AND/OR gates, so the use of a NAND-NAND networks is more cost-efficient, as less transistors are required.

5.2 b **8 / 8**

✓ **- 0 pts** **Correct; $$z = x_3 + x_2x_1' + x_1x_0' + x_2'x_1 = (x_3 + x_2+x_1)(x_2' + x_1'+x_0')$$**

- 2 pts Minor error in SOP

- 3 pts SOP is not in minimal form

- 4 pts Blank in SOP

- 2 pts Minor error in POS

- 3 pts POS is not in minimal form

- 4 pts Blank in POS

5b)

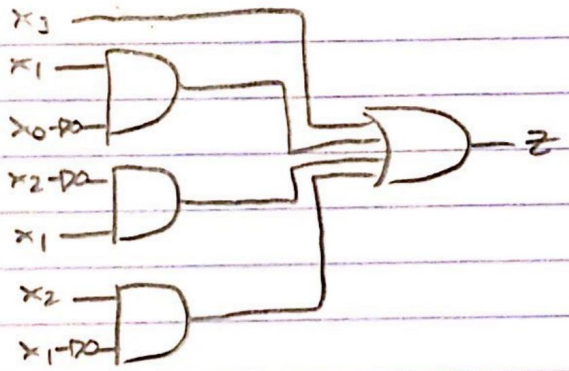
x_3 \ x_0	0	0	1	1
	1	1	0	1
x_2	X	X	X	X
	1	1	X	X

(x_1)

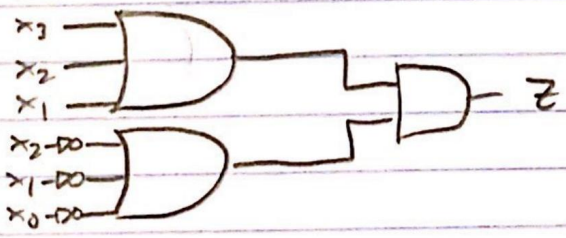
SOP: $z = x_3 + x_1x_0' + x_2'x_1 + x_2x_1'$

POS: $(x_3 + x_2 + x_1)(x_2' + x_1' + x_0') = z$

5c) SOP:



POS:



6) NAND gates cost less transistors to implement than AND/OR gates, so the use of a NAND-NAND networks is more cost-efficient, as less transistors are required.

5.3 C **8 / 8**

✓ **- 0 pts** Correct

![Screen_Shot_2021-02-05_at_4.47.48_PM.png](/files/20a8fc1e-0c32-4059-ba76-adb8a1130a86)

- 2 pts Minor error in SOP design

- 3 pts Major error in SOP design

- 4 pts Blank in SOP design

- 2 pts Minor error in POS design

- 3 pts Major error in POS design

- 4 pts Blank in POS design

5b)

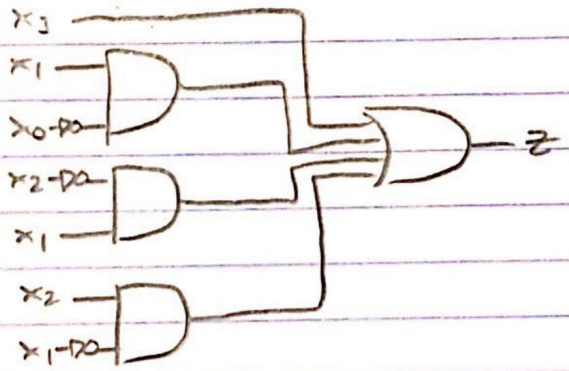
x_3 \ x_0	0	0	1	1
	1	1	0	1
x_2	X	X	X	X
	1	1	X	X

(x_1)

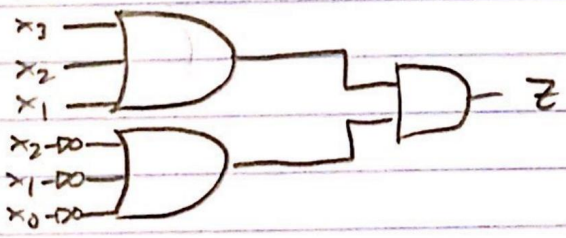
SOP: $z = x_3 + x_1x_0' + x_2'x_1 + x_2x_1'$

POS: $(x_3 + x_2 + x_1)(x_2' + x_1' + x_0') = z$

5c) SOP:



POS:



6) NAND gates cost less transistors to implement than AND/OR gates, so the use of a NAND-NAND networks is more cost-efficient, as less transistors are required.

6 6 **2 / 2**

✓ **- 0 pts** **Correct, lists one of the following:**

Less transistors

Cheaper

More efficient

Only uses one type of gate (easy to manufacture)

- 2 pts Incorrect

- 2 pts Blank