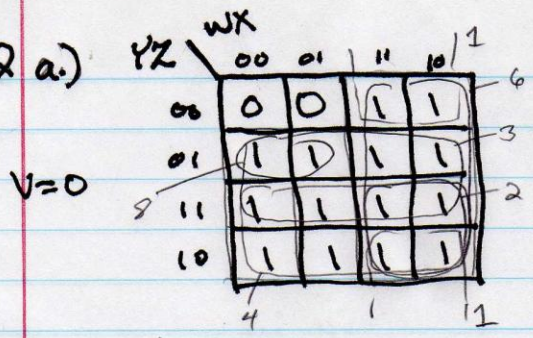
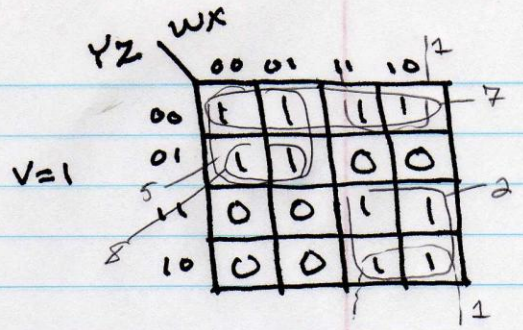
3.2 a.)



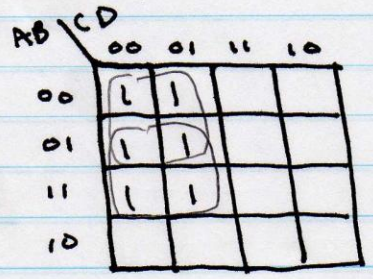




essential:
1: $W\bar{Z}$ 2: $WY$ 3: $\bar{V}Z$ 4: $\bar{V}Y$ 5: $V\bar{W}\bar{Y}$

prime: includes essentials plus 6: $\bar{V}W$ 7: $V\bar{Y}\bar{Z}$
8: $\bar{W}\bar{Y}Z$ are redundant.

Note on essential prime implicants: All essential primes must be part of the minimized expression as they are needed for any and all covers. So, unless your output $F = 0$, you will have at least one essential prime implicant.

b.)




prime & essential
$\bar{A}\bar{C} + B\bar{C}$

no redundants

3.2 c) column 1

00000

00100

10010

10011

10110

11001

10111

11101

column 2

00 -00 *

1001- ✓

10-10 ✓

10-11 ✓

101 1- ✓

11-01 *

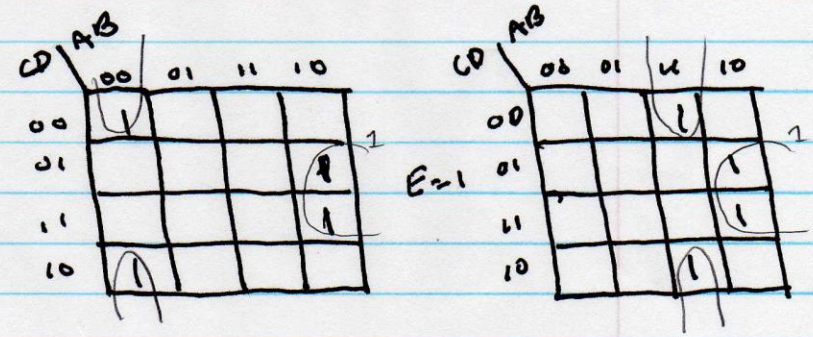
10-1- *

| | 0 | 4 | 18 | 19 | 22 | 23 | 25 | 29 |
|---|---|---|---|---|---|---|---|---|
| 00 -00 | x | x | | | | | | |
| 11 -01 | | | | | | | x | x |
| 10 -1- | | | x | x | x | x | | |

essential ; prime: $\bar{A}\bar{B}\bar{D}E$, $A\bar{B}D$, $AB\bar{D}E$

no redundants

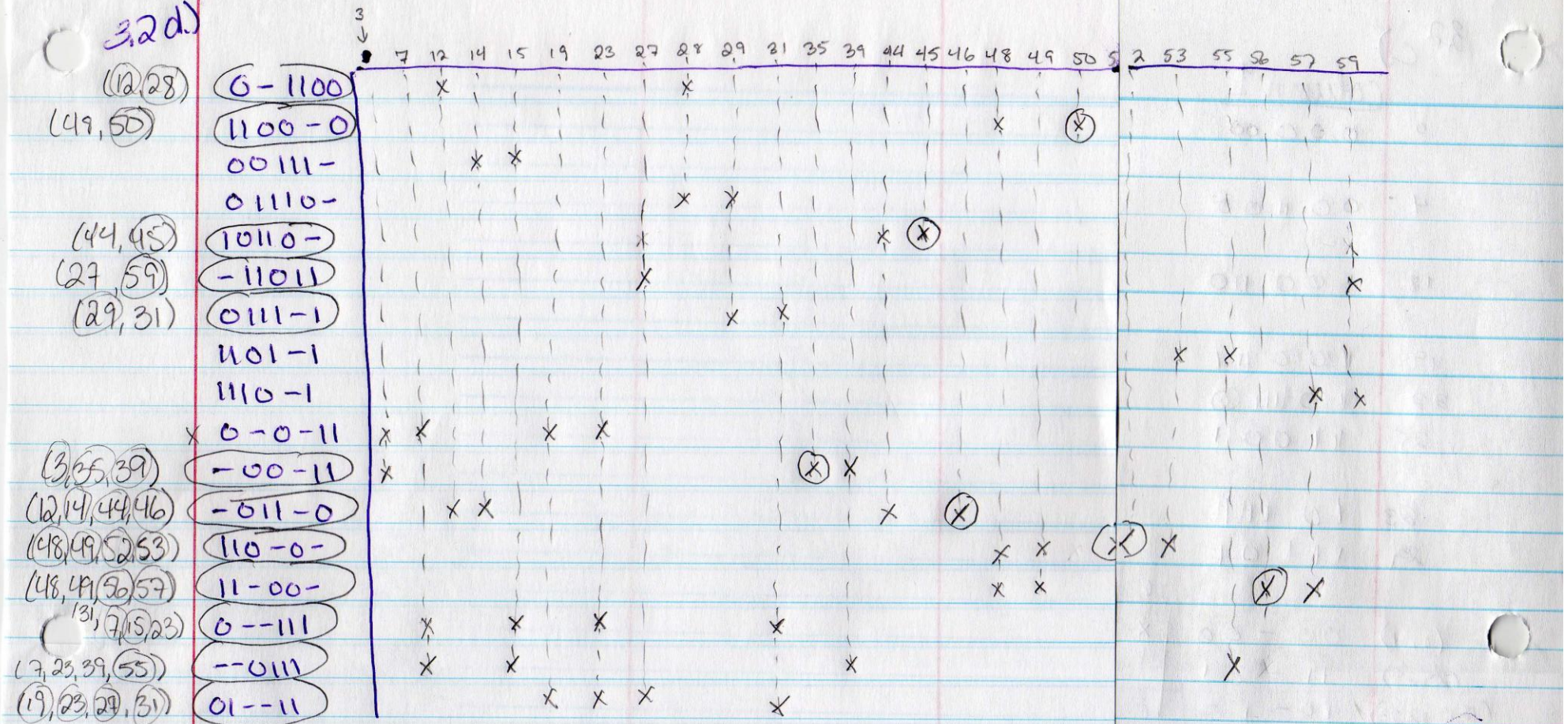
alternatively:



5.2d)

| column 1 | column 2 | column 3 |
|---|---|---|
| 0000 11 | 000 - 11 ✓ | 0 - 0 - 11 |
| 00 11 00 | 0 - 00 11 ✓ | - 00 - 11 |
| 11 0000 | - 0001 1 ✓ | |
| | 0011 - 0 ✓ | - 011 - 0 |
| 000 111 | ✓ 0 - 1100 * | |
| 00 1110 | - 01100 ✓ | 110 - 0 - |
| 0100 11 | 1100 0 — ✓ | 11 - 00 - |
| 0111 00 | ✓ 1100 - 0 * | |
| 1000 11 | 110 - 00 ✓ | |
| 10 1100 | 11 - 000 ✓ | |
| 11 0001 | | 0 - - 111 |
| 1100 10 | 00 - 111 ✓ | - - 0 111 |
| 1101 00 | 0 - 0111 ✓ | |
| 111 000 | - 00 111 ✓ | 01 - - 11 |
| | ✓ 00111 - * | |
| 60 1111 | - 0 1110 ✓ | |
| 0 10 111 | 010 - 11 ✓ | |
| 0 110 11 | 01 - 011 | |
| 0111 01 | ✓ 01110 - * | |
| 100 111 | 100 - 11 ✓ | |
| 10 1101 | ✓ 10110 - * | |
| 10 1110 | 1011 - 0 ✓ | |
| 110 101 | 110 - 01 ✓ | |
| 111 001 | 11 - 001 ✓ | |
| | 1101 0 - ✓ | |
| 0 1111 | 1 1100 - ✓ | |
| 110 111 | 0 - 1111 ✓ | |
| 111 011 | - 10111 ✓ | |
| | 011 - 11 ✓ | |
| | ✓ - 11011 * | |
| | ✓ 0111 - 1 * | |
| | 1 - 0 111 ✓ | |
| | ✓ 1101 - 1 * | |
| | ✓ 1110 - 1 * | |

3.2d)




essentials are circled: $\bar{A}C\bar{D}\bar{E}\bar{F}$, $AB\bar{C}\bar{D}\bar{F}$, $AB\bar{C}D\bar{E}$, $BC\bar{D}EF$, $\bar{A}BCDF$, $B\bar{C}EF$, $\bar{B}CDF$, $AB\bar{C}\bar{E}$, $AB\bar{D}\bar{E}$, $\bar{A}CDF$, $\bar{C}DEF$, $\bar{A}BEF$

primes include essentials plus: $\bar{A}\bar{B}CD\bar{E}$, $\bar{A}BCD\bar{E}$, $AB\bar{C}DF$, $ABC\bar{D}F$, $\bar{A}BEF$ (these are redundant)

3.6 a.)

| column 1 | column 2 |
|---|---|
| 010 | 01- |
| 100 | 10- |
| 011 | |
| 101 | |

| | 2 3 | 4 5 |
|---|---|---|
| (01-) | ⊗ ⊗ | |
| (10-) | | ⊗ ⊗ |

$f = \bar{X}Y + X\bar{Y}$

b.)

| column 1 | column 2 | column 3 |
|---|---|---|
| 0001 | 0-01 ✓ | --01 |
| d.c. → 0100 | -001 ✓ | -10- |
| 1000 | 010- ✓ | 1-0- |
| | -100 ✓ | -1-1 |
| 0101 | 100- ✓ | 11-- |
| 1001 | 1-00 ✓ | |
| d.c. → 1100 | | |
| | 01-1 ✓ | |
| 0111 | -101 ✓ | |
| 1101 | 1-01 ✓ | |
| d.c. → 1110 | 110- ✓ | |
| | 11-0 ✓ | |
| 1111 | | |
| | -111 ✓ | |
| | 11-1 ✓ | |
| | 111- ✓ | |

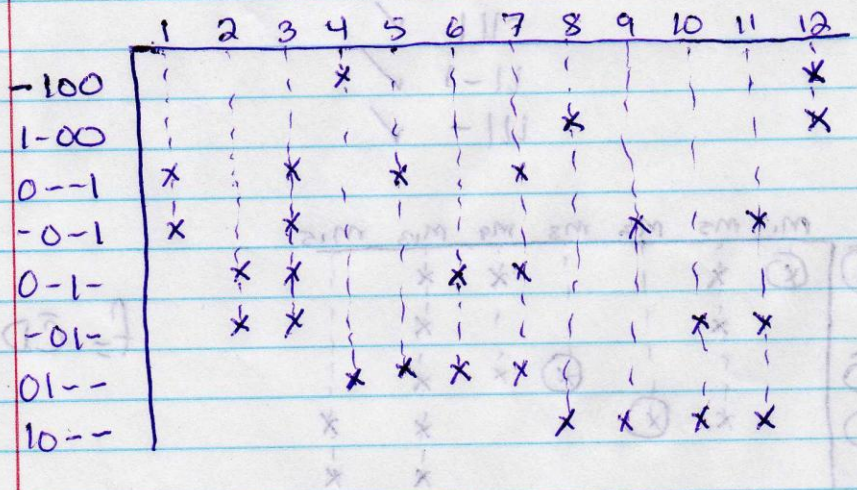
| | | $m_1$ | $m_5$ | $m_7$ | $m_8$ | $m_9$ | $m_{13}$ | $m_{15}$ |
|---|---|---|---|---|---|---|---|---|
| (1,5,9,13) | (--01) | ⊗ | x | | | x | x | |
| | -10- | | x | | | | x | |
| (8,9,13) | (1-0-) | | | | ⊗ | x | x | |
| (5,7,13, 15) | (-1-1) | | x | ⊗ | | | x | x |
| | 11-- | | | | | | x | x |

↑ Everything's covered!

$f = \bar{C}D + A\bar{C} + B\bar{D}$

3.6 c.)

| column 1 | column 2 | column 3 |
|---|---|---|
| 0001 | 00-1 ✓ | 0--1 |
| 0010 | 0-01 ✓ | -0-1 |
| 0100 | -001 ✓ | 0-1- |
| 1000 | 001- ✓ | -01- |
| | 0-10 ✓ | 01-- |
| 0011 | -010 ✓ | 10-- |
| 0101 | 010- ✓ | |
| 0110 | 01-0 ✓ | |
| 1001 | -100 * | |
| 1010 | 100- ✓ | |
| 1100 | 10-0 ✓ | |
| --11 | 1-00 * | |
| 011 | | |
| 1011 | 0-11 ✓ | |
| | -011 ✓ | |
| | 01-1 ✓ | |
| | 011- ✓ | |
| | 10-1 ✓ | |
| | 101- ✓ | |




2 options: $A\bar{C}\bar{D} + \bar{B}D + \bar{B}C + \bar{A}B$ -OR- $B\bar{C}\bar{D} + AB + \bar{A}C + \bar{A}D$

3.6 d.)

| | column 1 | column 2 | column 3 |
|---|---|---|---|
| d.c→ | 0000 | 000 - ✓ | 00 - - |
| | | 00 - 0 ✓ | - 0 - 1 |
| | 0001 | 0 - 00 * | - 01 - |
| | 0010 | | 1 - - 1 |
| | 0100 | 00 - 1 ✓ | 1 - 1 - |
| | | - 001 ✓ | 11 - - |
| | 0011 | 001 - ✓ | |
| | 1001 | - 010 ✓ | |
| | 1010 | - 100 * | |
| | 1100 | | |
| | | - 011 ✓ | |
| | 1011 | 10 - 1 ✓ | |
| d.c. → | 1101 | 1 - 01 ✓ | |
| d.c. → | 1110 | 101 - ✓ | |
| | | 1 - 10 ✓ | |
| d.c. → | 1111 | 110 - ✓ | |
| | | 11 - 0 ✓ | |
| | | 1 - 11 ✓ | |
| | | 11 - 1 ✓ | |
| | | 111 - ✓ | |

| | 1 | 2 | 3 | 4 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|
| 0-00 | | | | * | | | | |
| (4,12) -100 | | | | * | | | | * |
| 00-- | * | * | * | | | | | |
| (1,3,9,11) -0-1 | * | | * | | * | | * | |
| (2,3,10,11) -01- | | * | * | | | * | * | |
| 1--1 | | | | | * | | * | |
| 1-1- | | | | | | * | * | |
| 11-- | | | | | | | | * |

$f = B\bar{C}\bar{D} + \bar{B}D + BC$