

①

3.1.) (b.) $f(A, B, C, D) = \sum m(0, 1, 4, 5, 12, 13)$

AB \ CD	00	01	11	10
00	1	1	0	0
01	1	1	0	0
11	1	1	0	0
10	0	0	0	0

$$f = A'C' + BC'$$

#literals = 4

3.2.) Prime implicants are $A'C'$ and BC' .
Both are essential prime implicants.

3.3.) (b.) $f(A, B, C, D) = \sum m(0, 1, 4, 10, 11, 14) + \sum d(5, 15)$

AB \ CD	00	01	11	10
00	1	1	0	0
01	1	x	0	0
11	0	0	x	1
10	0	0	1	1

$$f = A'C' + AC$$

3.3.) (c.) $f(A, B, C, D) = \sum m(1, 2, 3, 5, 8, 13) + \sum d(0)$

AB \ CD	00	01	11	10
00	x	1	1	1
01	0	1	0	0
11	0	1	0	0
10	1	0	0	0

$$f = A'B' + A'C'D + BC'D + B'C'D'$$

3.4) Prime implicants for 3.3(b) — $A'C'$, AC
 Both are essential.
 2 don't cares are set to 1.

Prime implicants for 3.3(c) — $A'B'$, $A'C'D$, $BC'D$, $B'C'D'$
 Essential prime implicants — $A'B'$, $BC'D$, $B'C'D'$
 Redundant — $A'C'D$
 1 don't care is set to 1.

3.5) (a) $F(A, B, C) = \sum m(1, 2, 6, 7)$

A \ BC				
	00	01	11	10
0		1		1
1			1	1

$$F = A'B'C + BC' + AB$$

3.5) (b) $F(A, B, C, D) = \sum m(0, 1, 3, 9, 11, 12, 14, 15)$

AB \ CD				
	00	01	11	10
00	1	1	1	
01				
11	1		1	1
10		1	1	

$$F = B'D + A'B'C' + ABD' + ABC$$

(2)

3.5) (c) $F'(A, B, C, D) = \sum m(2, 4, 5, 6, 7, 8, 10, 13)$

AB \ CD				
	00	01	11	10
00	0	0	0	1
01	1	1	1	1
11	0	1	0	0
10	1	0	0	1

$$F = B'D + A'B'C' + ABC + ABD'$$

3.6) (a) $f(x, y, z) = \sum m(2, 3, 4, 5)$

010 ✓

100 ✓

01 - (2, 3)

10 - (4, 5)

011 ✓

101 ✓

		2	3	4	5
EPI	01 -	x	x		
EPI	10 -			x	x

$$f = x'y + xy'$$

(3)

$$3.6) (b) f(a, b, c, d) = \sum m(1, 5, 7, 8, 9, 13, 15) + \sum d(4, 12, 14)$$

0001 (1) ✓	0-01 (1, 5) ✓	
0100 (4) ✓	-001 (1, 9) ✓	
1000 (8) ✓	010- (4, 5) ✓	--01 (1, 5, 9, 13)
0101 (5) ✓	-100 (4, 12) ✓	-10- (4, 5, 12, 13)
1001 (9) ✓	100- (8, 9) ✓	1-0- (8, 9, 12, 13)
1100 (12) ✓	1-00 (8, 12) ✓	
0111 (7) ✓	01-1 (5, 7) ✓	-1-1 (5, 7, 13, 15)
1101 (13) ✓	-101 (5, 13) ✓	11-- (12, 13, 14, 15)
1110 (14) ✓	1-01 (9, 13) ✓	
1111 (15) ✓	110- (12, 13) ✓	
	11-0 (12, 14) ✓	
	-111 (7, 15) ✓	
	11-1 (13, 15) ✓	
	111- (14, 15) ✓	

		1 ✓	5 ✓	7 ✓	8 ✓	9 ✓	13 ✓	15 ✓
EPI	--01	x	x			x	x	
	-10-		x				x	
EPI	1-0-				x	x	x	
EPI	-1-1		x	x			x	x
	11--						x	x

$$f = c'd + ac' + bd$$

3.6) (c) $f(a, b, c, d) = \sum m(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)$

0001 (1) ✓

0010 (2) ✓

0100 (4) ✓

1000 (8) ✓

0011 (3) ✓

0101 (5) ✓

0110 (6) ✓

1001 (9) ✓

1010 (10) ✓

1100 (12) ✓

0111 (7) ✓

1011 (11) ✓

~~1101 (10)~~

00-1 (1,3) ✓

0-01 (1,5) ✓

-001 (1,9) ✓

001- (2,3) ✓

0-10 (2,6) ✓

-010 (2,10) ✓

010- (4,5) ✓

01-0 (4,6) ✓

-100 (4,12) ✗

100- (8,9) ✓

10-0 (8,10) ✓

1-00 (8,12) ✗

0-11 (3,7) ✓

-011 (3,11) ✓

01-1 (5,7) ✓

011- (6,7) ✓

10-1 (9,11) ✓

101- (10,11) ✓

0--1 (1,3,5,7)

-0-1 (1,3,9,11)

0-1- (2,3,6,7)

-01- (2,3,10,11)

01-- (4,5,6,7)

10-- (8,9,10,11)

	✓ 1	✓ 2	✓ 3	✓ 4	✓ 5	✓ 6	✓ 7	✓ 8	✓ 9	✓ 10	✓ 11	✓ 12
✓ 0--1	x		x		x		x					
-0-1	x		x						x		x	
✓ 0-1-		x	x			x	x					
-01-		x	x							x	x	
01--				x	x	x	x					
✓ 10--									x	x	x	x
✓ -100				x								x
1-00									x			x

No EPIs.

$$f^0 = a'd + a'c + ab' + bc'd'$$

(4)

3.6 (d) $f(a, b, c, d) = \sum m(1, 2, 3, 4, 9, 10, 11, 12) + \sum d(0, 13, 14, 15)$

0000 (0) ✓	000- (0, 1) ✓	00-- (0, 1, 2, 3)
0001 (1) ✓	00-0 (0, 2) ✓	
0010 (2) ✓	0-00 (0, 4) ✗	
0100 (4) ✓		
0011 (3) ✓	00-1 (1, 3) ✓	
1001 (9) ✓	-001 (1, 9) ✓	-0-1 (1, 3, 9, 11)
1010 (10) ✓	001- (2, 3) ✓	-01- (2, 3, 10, 11)
1100 (12) ✓	-010 (2, 10) ✓	
	-100 (4, 12) ✗	
1011 (11) ✓	-011 (3, 11) ✓	1--1 (9, 11, 13, 15)
1101 (13) ✓	10-1 (9, 11) ✓	1-1- (10, 11, 14, 15)
1110 (14) ✓	1-01 (9, 13) ✓	11-- (12, 13, 14, 15)
1111 (15) ✓	101- (10, 11) ✓	
	1-10 (10, 14) ✓	
	110- (12, 13) ✓	
	11-0 (12, 14) ✓	
	1-11 (11, 15) ✓	
	11-1 (13, 15) ✓	
	111- (14, 15) ✓	

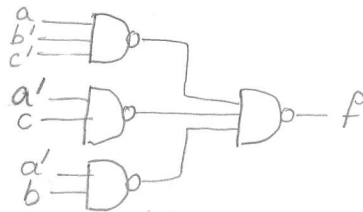
	1	2	3	4	9	10	11	12
00--	X	X	X					
✓-0-1	X		X		X		X	
✓-01-		X	X			X	X	
1--1					X		X	
1-1-						X	X	
11--								X
0-00				X				
✓-100				X				X

No EPIs.

$$f = b'd + b'c + bc'd'$$

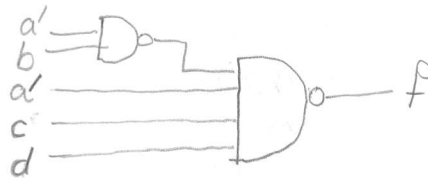
3.9) (a) $ab'c' + a'c + a'b$

$$= [(ab'c')' \cdot (a'c)' \cdot (a'b)']'$$



3.9) (c) $a'b + a + c' + d'$

$$= [(a'b)' \cdot (a)' \cdot (c')' \cdot (d')']'$$



3.9) (e) $(ab + a'c')'$

$$= (ab)' \cdot (a'c')'$$

