COSC 2P12 Assignment 1

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1.

a) 1001001000011110 base 2 to base 3

$1001001000011110_2 = (1\times2^{14}) + (1\times2^{11}) + (0\times2^{8}) + (1\times2^{3}) + (1\times2^{2}) + (1\times2^{1})$

$= 18702_{10}$

3 | 18702			LSD
	6234	r0	
	2078	r0	
	692	r2	
	230	r2	
	76	r2	
	25	r1	
	8	r1	
	2	r2	
	0	r2	↓MSD

$\therefore 1001001000011110_2 = 221122003$

b) $0xC72_{16}$ to base 2

$C_{16} + 7_{16} + 2_{16}$ $\quad C_{16} = 1100_2$ $\quad 7_{16} = 0111$ $\quad 2_{16} = 0010$

$\therefore 0xC72_{16} = 1100\,|\,0111\,|\,0010_2$

C | 7 | 2

2.

a) $145 - 129 = 16$

positive sign →

145	9999
9871	−129
10016	9870
	+1
	9871

b) 129 - 145 = -16

```
  0129          9999          9999
+ 9855        - 9984        - 145
------        ------        ------
 19984          0015          9854
                +1            +1
                ----          ----
                0016          9855
```

Negative sign

3.

a) 000111 - 001100 = 000101
+7 - +12 = -5

must find 2's complement of -12

```
  001100
  110011   bit flip
+     1
-------
  110100 = -12
```

```
  000111
+ 110100
--------
  111011 → # is in 2's compliment form
```

```
  111011
  000100
+     1
--------
  000101 ← -5
```

b) 000111 - 101011 = 011011
+7 - -20 = +27
+7 + 20

```
  000111
+ 010100
--------
  011011
```

010100 = 20
101011 = -#
∴ 101011 = -20

4.

a) AC + C(A' + AB)
= AC + C(A' + B) Absorption Law #11 on slides
= AC + A'C + BC Distribution Law #12 on slides
= C(A + A') + BC Distributive Law in reverse #12 on slides
= C(1) + BC Complement Law #6 on slides
= C + BC Identity Law #4 on slides
= C Absorption Law #11 on slides

b) $(A+B)''(C+D+E)'+(A+B)'$

$= A'B'(C+D+E)'+(A+B)'$ Demorgan's Law

$= A'B'C'D'E'+(A+B)'$ Demorgan's Law

$= A'B'C'D'E'+A'B'$ Demorgan's Law

$= A'B'$ Absorption Law #10 on slides

5. On logic circuit

6.

a)

D	C	B	A	a	b	c	d	e	f	g
0	0	0	0	1	0	1	0	1	1	1
0	0	0	1	1	1	1	0	0	1	0
0	0	1	0	1	0	0	1	0	0	1
0	0	1	1	0	1	1	0	1	1	0
0	1	0	0	0	0	1	1	1	1	1
0	1	0	1	1	1	0	0	1	1	0
0	1	1	0	0	0	0	0	0	0	0
0	1	1	1	0	0	1	1	1	0	1
1	0	0	0	1	1	0	0	0	1	1
1	0	0	1	1	1	1	1	0	1	1
1	0	1	0	1	1	1	1	1	0	0
1	0	1	1	X	X	X	X	X	X	X
1	1	0	0	X	X	X	X	X	X	X
1	1	0	1	X	X	X	X	X	X	X
1	1	1	0	X	X	X	X	X	X	X
1	1	1	1	X	X	X	X	X	X	X

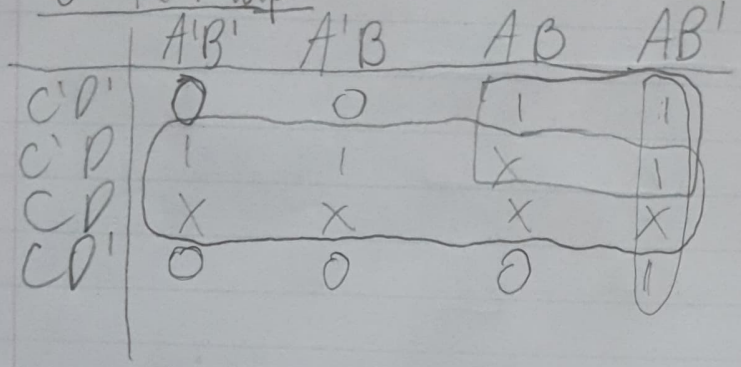
* checks were placed to help with K-Map drawing (disregard them)

b) a K-Map

	A'B'	A'B	AB	AB'
C'D'	1	1	0	1
C'D	1	1	X	1
CD	X	X	X	X
CD'	0	0	0	1

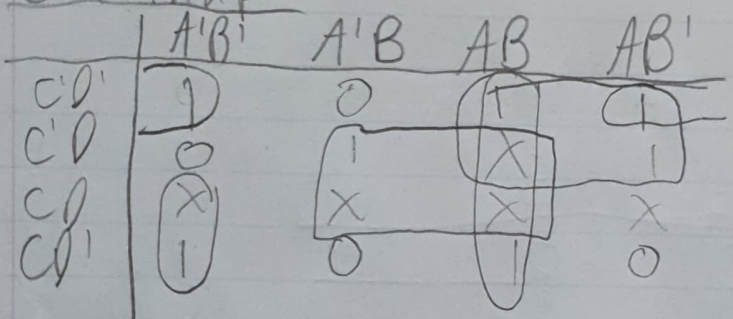
$AB'+A'C'$

b K-Map



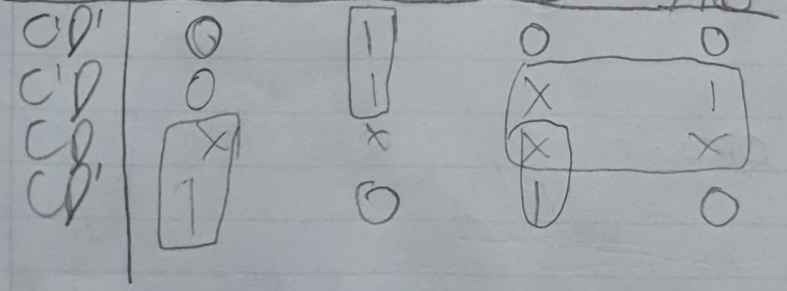
$AB' + AC' + D$

c K-Map



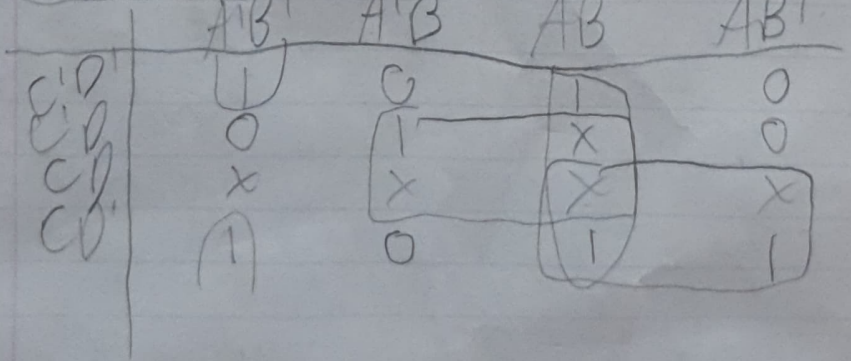
$B'C'D' + A'B'C + AB + AC' + BD$

d K-Map



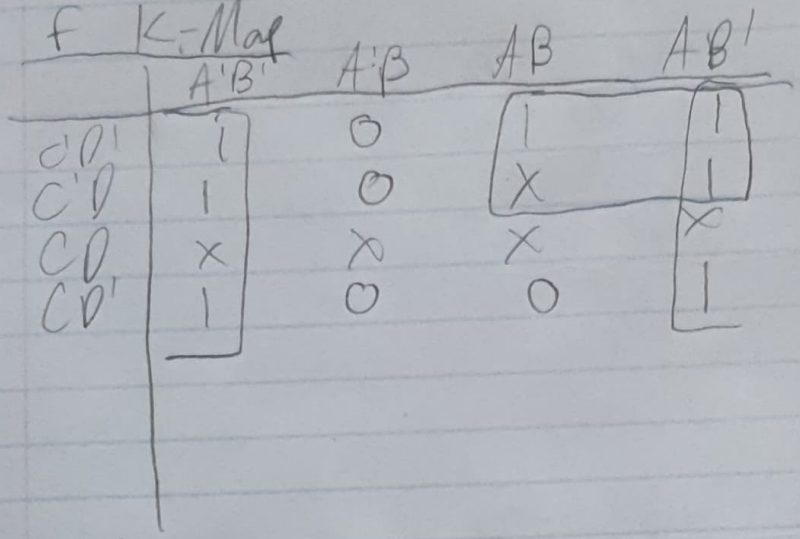
$A'BC' + A'B'C + ABC + AD$

e K-Map



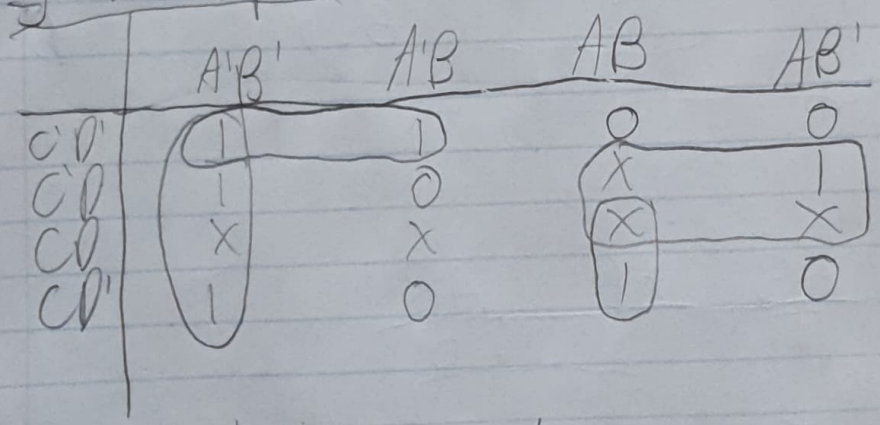
$A'B'D' + AB + BD + AC$

f K-Map



$AC' + B'$

g K-Map



$A'C'D' + ABC + A'B' + AD$

c) On logic circuit