

Problem 1.

a) $T1=B'C$; $T2=A'B$; $T3=A+T1=A+B'C$;

$$T4=T2 \oplus D = T2'D + T2D' = (A'B)'D + (A'B)D' = (A+B')D + A'BD'$$

$$= AD + B'D + A'BD'$$

$$F1 = T3 + T4 = A + B'C + AD + B'D + A'BD' = A + B'C + B'D + A'BD'$$

$$F2 = T2 + D = A'B + D$$

b)

A	B	C	D	T1	T2	T3	T4	F1	F2
0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1	1	1
0	0	1	0	1	0	1	0	1	0
0	0	1	1	1	0	1	1	1	1
0	1	0	0	0	1	0	1	1	1
0	1	0	1	0	1	0	0	0	1
0	1	1	0	0	1	0	1	1	1
0	1	1	1	0	1	0	0	0	1
1	0	0	0	0	0	1	0	1	0
1	0	0	1	0	0	1	1	1	1
1	0	1	0	1	0	1	0	1	0
1	0	1	1	1	0	1	1	1	1
1	1	0	0	0	0	1	0	1	0

1	1	0	1	0	0	1	1	1	1
1	1	1	0	0	0	1	0	1	0
1	1	1	1	0	0	1	1	1	1

c)

F1

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

$$F1 = A + CD' + BD' + B'D$$

F2

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

$$F2 = D + A'B$$

Problem 2.

	A	B	C	D	W	X	Y	Z
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	1
2	0	0	1	1	0	0	1	0
3	0	0	1	0	0	0	1	1
4	0	1	1	0	0	1	0	0
5	0	1	1	1	0	1	0	1
6	0	1	0	1	0	1	1	0
7	0	1	0	0	0	1	1	1
8	1	1	0	0	1	0	0	0
9	1	1	0	1	1	0	0	1
10	1	1	1	1	1	0	1	0
11	1	1	1	0	1	0	1	1
12	1	0	1	0	1	1	0	0
13	1	0	1	1	1	1	0	1
14	1	0	0	1	1	1	1	0
15	1	0	0	0	1	1	1	1

W:

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

$$W=A$$

X

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

$$X=A'B+AB'=A\oplus B$$

Y

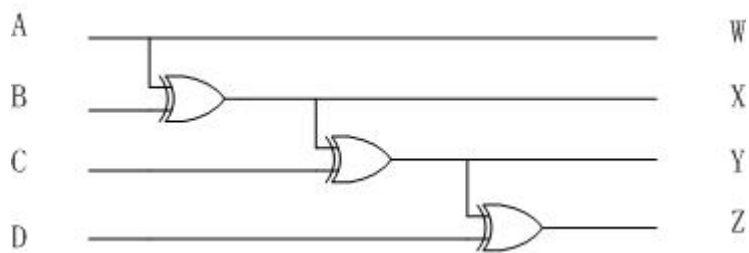
CD AB	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	0	0	1	1
10	1	1	0	0

$$Y=A\oplus B\oplus C$$

Z

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

$$Z=A\oplus B\oplus C\oplus D$$



Problem 3.

Truth table.

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

a:

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

$$a = A'C + A'BD + A'B'D' + AB'C'$$

b:

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

$$b = A'B' + A'C'D' + A'CD + AB'C'$$

c:

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

$$c = A'D + A'B + B'C'$$

d:

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

$$d = A'B'D' + A'B'C + A'CD' + AB'C' + A'BC'D$$

e:

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

$$e = A'CD' + B'C'D'$$

f:

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

$$f = A'C'D' + A'BC' + A'BD' + AB'C'$$

g:

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

$$g = A'B'C + A'CD' + A'BC' + AB'C'$$

Only the truth table and K-map are provided here. Because the question doesn't put any constraint on gates, try any implementation that you come across. If it is implemented according to the K-map simplified sum of product, common terms can be reused to make it simpler.