4.2   a) $Z = (PQ + RR)'$:

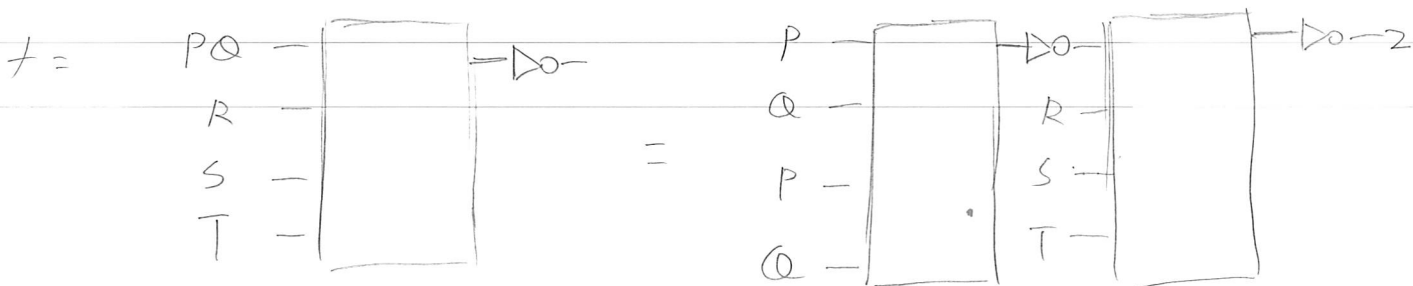   1 Gate , 1 Package

   b) $Z = \left(\big((P+Q)S + (R+T)S'\big)'\right)'$

$Z =$

   cf) $(A+B)' = (AA + BB)'$ 1 Gate, $A' = (AA + AA)'$ 1 Gate

   Total 7 Gates,   4 Packages

   c) $PQR + ST = \left((PQ \cdot R + ST)'\right)'$
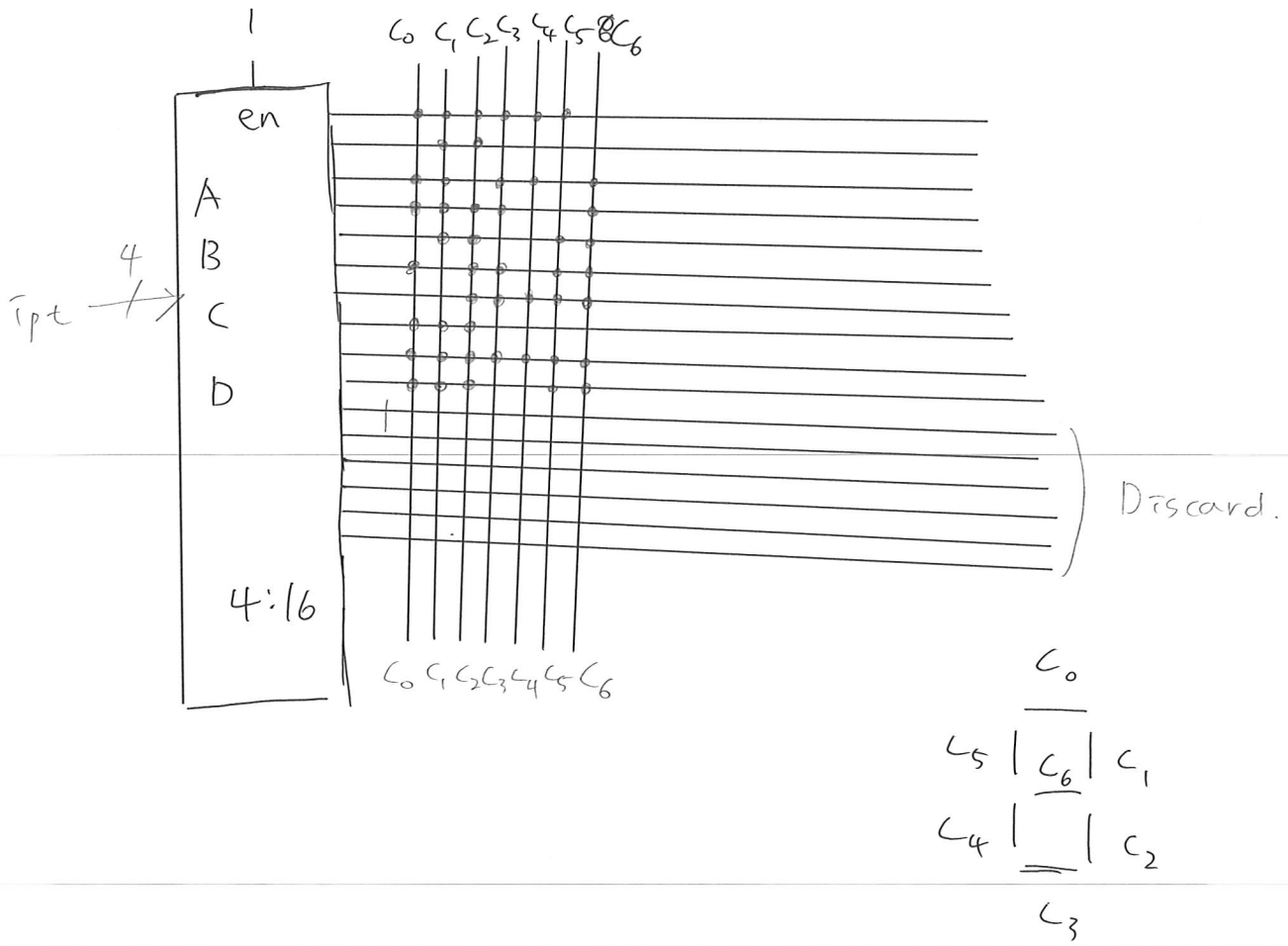
$Z =$

   Total 4 Gates, 2 packages

   d) $Z = (PQ + PRST)' = \big(PQ + (PR)(ST)\big)'$

$Z =$

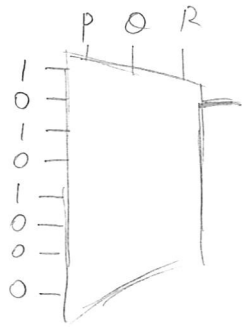   cf) $AB = \left((AB + AB)'\right)'$ 2 gates   or $(A' + B')'$ 1 gate

        Total 5 Gates,   3 Packages (or 3 Gates, 2 Packages)

4.3

en

c_0 c_1 c_2 c_3 c_4 c_5 & c_6
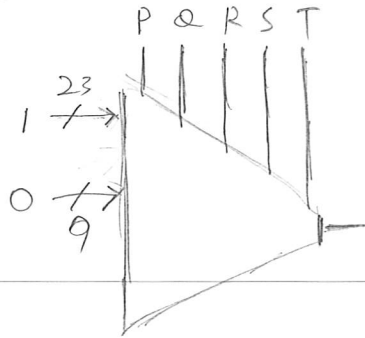
A

B

$\xrightarrow{4}$ ipt

C

D

4:16

c_0 c_1 c_2 c_3 c_4 c_5 c_6

) Discard.

$$\begin{array}{c|c|c} & \overline{c_0} & \\ c_5 & \underline{c_6} & c_1 \\ c_4 & \underline{} & c_2 \\ & c_3 & \end{array}$$

4.7

a)

P Q R

1
0
0
0
1
0
0
0

b)

R
T
P
Q
S
0
1

c)

I S T P Q

16

X ↛ (don't care)
0 ↛³
R →
0 ↛³
R ↛³
0
R →
I ↛³
  4

00000
00001
00010
⋮
11111

d)

P Q R S T

1 ↛²³
0 ↛⁹
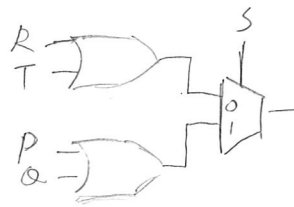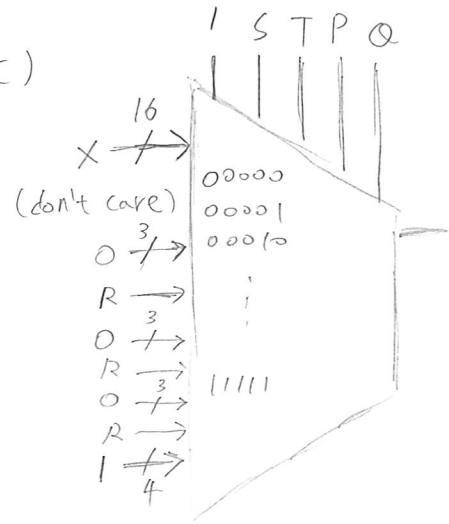
4.11   X:

cd \ ab	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	0	1	1	1
10	0	0	1	1

X = abd + bcd + ac

bd(a + c) + ac.

b d c

0
a
a
a
0
a
a
1
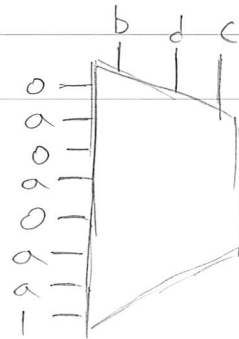
Y:

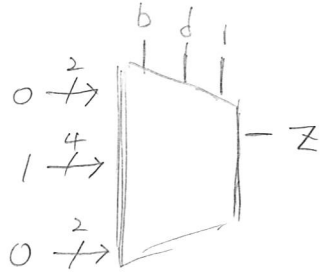| cd \ ab	00	01	11	10
00	0	0	1	1
01	0	1	0	1
11	1	0	1	0
10	1	1	0	0

Y = ac'd' + ab'c' + a'b'c
   + a'cd' + a'bc'd + abcd

b d c

a
a'
a
a'
a
a'
a
a
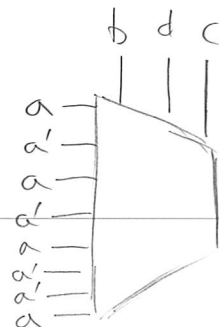
4.11 z

cd\ab	00	01	11	10
00	0	1	1	0
01	1	0	0	1
11	1	0	0	1
10	0	1	1	0

$Z = bd' + b'd$

4.14   a)

b)

c)

d)
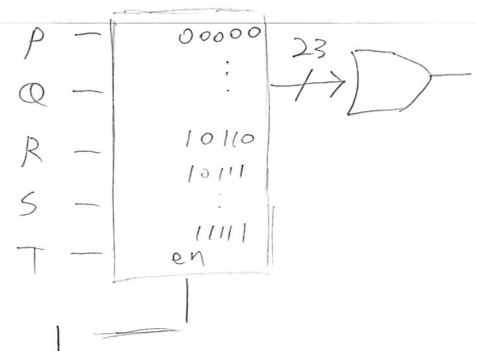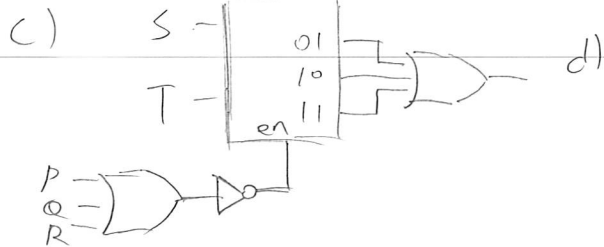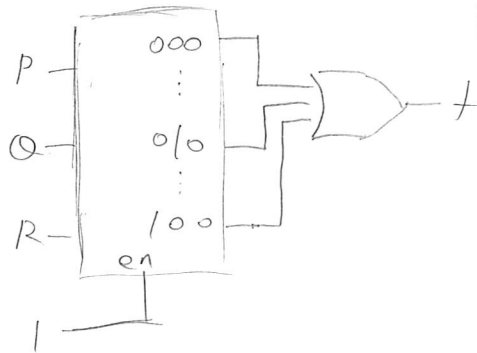
4.21   X.

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

$X = D + A'B'C$

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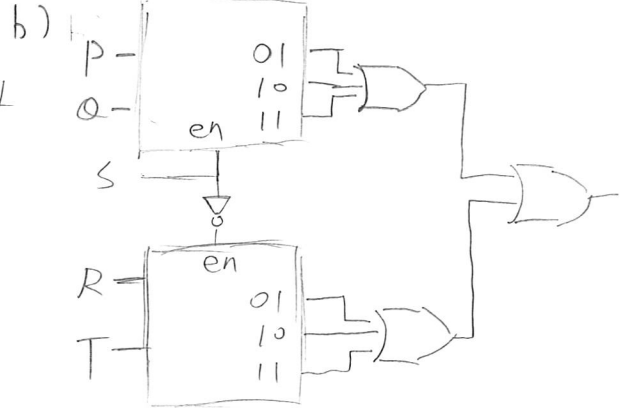
CD\AB	00	01	11	10
00	1	0	0	0
01	1	0	1	1
11	0	0	1	1
10	0	0	0	0

$Y = AD + A'B'C'$

Z

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

$Z = A'B' + A'D$

a) 6 ($D, A'B'C, AD, A'D, A'B'C', A'B'$)
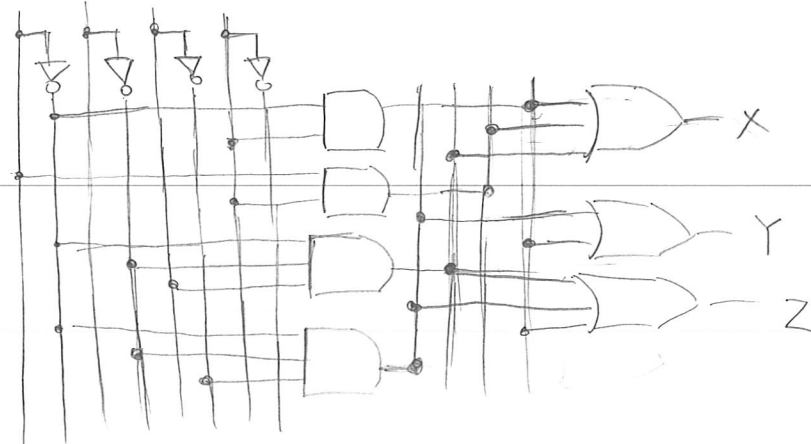
b) $X = A'D + AD + A'B'C$

$Y = AD + A'B'C'$

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

Ans: 4 ($A'D, AD, A'B'C, A'B'C'$)

c)   A   B   C   D

4.28 a) C_0.

CD\AB | 00 | 01 | 11 | 10

$$C_0 = B'D' + AD' + A'C + BC + A'BD + AB'C'$$

C_1 CD\AB 00 01 11 10

$$C_1 = B'D' + \cancel{BC} \;\; A'B' + A'C'D' + AC'D + A'CD$$

C_2 CD\AB 00 01 11 10

$$C_2 = A'C' + A'D + C'D + A'B + AB'$$

C_3 CD\AB 00 01 11 10

$$C_3 = B'D' + CD' + BC'D + B'C + AD'$$
$$\cancel{+ AC' \; or}$$
$$\cancel{(AD' + A'B)}$$

C_4 CD\AB 00 01 11 10

$$C_4 = B'D' + AB + AC + CD'$$

L_5 CD\AB

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

$L_5 = C'D' + \cancel{A'B=BC} + AB'D$

$+ A'BC' + BD' + ACD$

L_6 CD\AB

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

$L_6 = A'BC' + AB' + AD$
$+ B'C + CD'$

L_5' AD\AB

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

$L_5 = C'D' + BD' + A'BC'$
$+ AB'D + ACD$

(b)