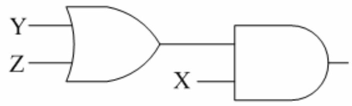
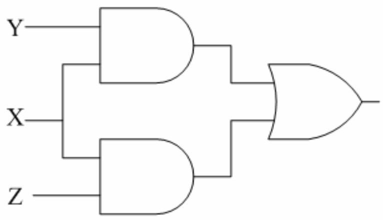
2.2

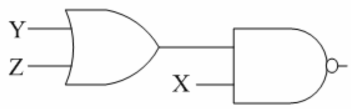
(a) X(Y+Z)



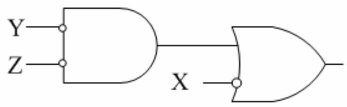
(b) XY+XZ



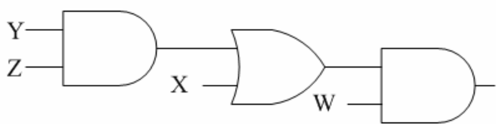
(c) $\overline{X(Y+Z)}$



(d) X’+Y’Z’



(e) W(X+YZ)



2.8

(a) Truth table is:

X	Y	Z	XY+YZ+XZ'	YZ+XZ'
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	1	1
1	0	0	1	1
1	0	1	0	0
1	1	0	1	1
1	1	1	1	1

According to the truth table, for any input combination (X, Y, Z), the logic value of XY+YZ+XZ' equals the logic value of YZ+XZ'. So, XY+YZ+XZ' =YZ+XZ'.

(b)

Truth table

A	B	(A+B')B	AB
0	0	0	0
0	1	0	0
1	0	0	0
1	1	1	1

(c)

Truth table

A	B	C	(A+B)(A'+C)	AC+A'B
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	1	1
1	0	0	0	0
1	0	1	1	1
1	1	0	0	0
1	1	1	1	1

(d)

Truth table

A	B	C	ABC+A'BC+A'B'C+A'BC'+A'B'C'	BC+A'B'+A'C'
0	0	0	1	1
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	0	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

2.9

BC+A'B'+A'C'

= 1BC + A'B'1 + A'1C'

= (A+A')BC + A'B'(C+C')+A'(B+B')C'

= ABC + A'BC + A'B'C + A'B'C'+A'BC'+A'B'C'

= ABC + A'BC + A'B'C + A'BC' + A'B'C'+A'B'C'

= ABC + A'BC + A'B'C + A'BC' + A'B'C'

= ABC + A'C(B+B')+A'C'(B+B')

= ABC + A'C1+A'C'1

= ABC + A'C + A'C'

= ABC + A'(C+C')

= ABC + A'1
= ABC + A'

2.10
(a) (A(B+CD))' = A'+(B+CD)' = A'+B'(CD)'=A'+B'(C'+D') = A'+B'C' + B'D'

(b) (ABC+B(C'+D'))' = (ABC)'(B(C'+D'))'=(A'+B'+C')(B'+(C'+D')')
=(A'+B'+C')(B'+CD) = A'B'+A'CD+B'B'+B'CD+C'B'+C'CD
=A'B'+A'CD+B'+B'CD+B'C'+0D=A'B'+B'+B'CD+B'C'+A'CD=B'(A'+1+CD+C')+A'CD
=B'+A'CD

(c) (X'+Y')'=XY

(d) (X+YZ')'= X'(YZ')'=X'(Y'+Z)=X'Y'+X'Z

(e)((X+Y)Z)'=(X+Y)'+Z'=X'Y'+Z'

(f) (X+(YZ)')' = X'(YZ)=X'YZ

(g) (X(Y+ZW'+V'S))' = X'+(Y+ZW'+V'S)'=X'+Y'(ZW')'(V'S)'=X'+Y'(Z'+W)(V+S')
=X'+(Y'Z'+Y'W)(V+S')=X'+Y'Z'V+Y'Z'S'+Y'WV+Y'WS'

2.12

f(X,Y) = ((X(XY)')'(Y(XY)')')' = X(XY)'+Y(XY)'= X(X'+Y') + Y(X'+Y')
= XX'+XY'+ X'Y + YY'=0+XY'+X'Y+0 = XY'+X'Y = $X \oplus Y$

2.17
(a) XY + XY’

= X (Y + Y’)	(distributive law)
= X 1	(theorem of complementarity)
= X	(operation with 1)

(b) (X+Y)(X+Y')

= X + YY'	(distributive law)
= X + 0	(theorem of complementarity)
= X	(operation with 0)

(c) Y’Z + X’YZ + XYZ

= (Y’ + X’Y + XY) Z	(distributive law)
= (Y’ + (X’ + X) Y) Z	(distributive law)
= (Y’ + 1 Y) Z	(theorem of complementarity)
= (Y’ + Y) Z	(operation with 1)
= 1Z	(theorem 0f complementarity)

= Z (operation with 1)

(d) (X + Y) (X'+Y+Z) (X' + Y + Z')
= (XX' + XY + XZ + YX' + YY + YZ) (X' + Y + Z') (distributive law)
= (0 + (XY + YX') +XZ + Y1 + YZ) (X'+Y+Z') (theorem of complementarity, associative law, Idempotent Law, commutative law)
= (Y(X+X') + XZ+Y(1+Z))(X'+Y+Z') (operation with 0, distributive law)
= (Y1 + XZ + Y1)(X'+Y+Z') (theorem of complementarity, operation with 1)
=(Y + XZ) (X' + Y + Z') (operation with 1, Idempotent law)
= YX' + YY + YZ' + XZX' + XZY + XZZ' (distributive law)
= YX' + Y +YZ' +(XX')Z +XZY + X(ZZ') (idempotent law, commutative law, associative law)
= YX' + Y1 + YZ' + 0Z + XZY + X0 (operation with 1, theorem of complementarity)
= Y(X' + 1 + Z' + XZ) (operation with 0, distributive law)
= Y 1 (operation with 1)
= Y (operation with 1)

(e) X + XYZ + X'YZ +X'Y + WX + WX'
= X + (X+X')YZ+X'Y + W(X+X') (distributive law)
= X + 1YZ + X'Y + W1 (theorem of complementarity)
= (X 1 + X'Y) + YZ + W (operation with 1, associative law, commutative law)
= (X+Y)(X'+1) + YZ + W (theorem of multiplying and factoring)
= (X+Y)1 + YZ + W (operation with 1)
= X + Y + YZ + W (operation with 1)
= X + Y(1+Z) + W (distributive law, operation with 1)
= X + Y 1+ W (operation with 1)
= X+Y+W (operation with 1)