Exercises

3.1 Demonstrate by means of truth tables the validity of the following theorems of Boolean algebra.

(a) The associative laws.

(b) DeMorgan's theorems for three variables.

3.2 Using DeMorgan's theorems, convert the following expressions to one that has only single variable inversion.

(a) $F = ((A + B)C')'$

(b) $F = (RS'T + Q')'$

3.3 Obtain the truth table of the functions.

(a) $F = XY + XY' + Y'Z$

(b) $F = (X + Y')(X' + Y)(Y' + Z)$

3.4 Find the complement of the following Boolean functions.

(a) $F = (BC' + A'D)(AB' + CD')$

(b) $F = B'D + A'BC' + ACD + A'BC$

(c) $F = ((AB)'A)((AB)'B)$

(d) $F = AB' + C'D'$

3.5 Implement the following functions with logic gates:

(a) $F = xy + xy' + y'z$

(b) $F = (x + y')(x' + y)(y' + z)$

(c) $F = y(wz' + wz) + xy$

(d) $F = ((yz)' + w)' + w + yz + wx$

(e) $F = A'BC(A + D')$

(f) $F = AC + BC' + A'BC$

3.6 Expand the following function to their canonical forms.

(a) $F(A, B, C, D) = BC + AC' + AB + BCD$

(b) $F(A, B, C, D) = (A + C + D)(A + C + D')(A + C' + D)(A + B')$

3.7 Express the following functions in a canonical sum of products and a canonical product of sums form.

(a) $F(A,B,C,D) = D(A'+B) + B'D$

(b) $F(w,x,y,z) = y'z + wxy' + wxz' + w'x'z$

(c) $F(A,B,C,D) = (A+B'+C)(A+B')(A+C'+D')(A'+B+C+D')(B+C'+D')$

(d) $F(A,B,C) = (A'+B)(B'+C)$

(e) $F(x,y,z) = 1$

(f) $F(x,y,z) = (xy+z)(y+xz)$

3.8 Convert the following to the other canonical form.

(a) $F(x,y,z) = \sum(1,3,7)$

(b) $F(A,B,C,D) = \sum(0,2,6,11,13,14)$

(c) $F(x,y,z) = \prod(0,3,6,7)$

(d) $F(A,B,C,D) = \prod(0,1,2,3,4,6,12)$

3.12 Write the canonical sum of products and canonical product of sums function using short notation for the function described in the following truth table.

$A\ B\ C\ D$	F
0 0 0 0	0
0 0 0 1	0
0 0 1 0	1
0 0 1 1	1
0 1 0 0	0
0 1 0 1	x
0 1 1 0	0
0 1 1 1	1
1 0 0 0	x
1 0 0 1	x
1 0 1 0	1
1 0 1 1	1
1 1 0 0	0
1 1 0 1	0
1 1 1 0	1
1 1 1 1	0