Question 1

R1 $= D^c$

R2 $= B.C$

R3 $= (R1 + A)^c$

$= (D^c + A)^c$

Using De Morgan's law: $(X.Y)^c = X^c + Y^c$

$= (D^c)^c.A^c$

$= D.A^c$

R4 $= R1 + R2 = D^c + B.C$

R5 $= (R1.R3)^c$

$= (D^c.(D.A^c))^c$

Using Associative law: $X.(Y.Z) = (X.Y).Z$

$= ((D^c.D).A)^c$

$= (0.A^c)^c$

$= (0)^c$

$= 1$

X $= R4.R5 = 1.(D^c + B.C)$

$= D^c + B.C$

Y $= R3.R4$

$= (D.A^c).(D^c + B.C)$

$= D.A^c.D^c + D.A^c.B.C$

Using Cumulative law : $X + Y = Y + X$

$= D^c.D.A^c + D.A^c.B.C$

Using Associative law: $X.(Y.Z) = (X.Y).Z$

$= (D^c.D).A^c + D.A^c.B.C$

$= 0.A^c + D.A^c.B.C$

$= 0 + D.A^c.B.C$

$= D.A^c.B.C$

A	B	C	D	R1	R2	R3	R4	R5	X	Y
0	0	0	0	1	0	0	1	1	1	0
0	0	0	1	0	0	1	0	1	0	0
0	0	1	0	1	0	0	1	1	1	0
0	0	1	1	0	0	1	0	1	0	0
0	1	0	0	1	0	0	1	1	1	0
0	1	0	1	0	0	1	0	1	0	0
0	1	1	0	1	1	0	1	1	1	0
0	1	1	1	0	1	1	1	1	1	1
1	0	0	0	1	0	0	1	1	1	0
1	0	0	1	0	0	0	0	1	0	0
1	0	1	0	1	0	0	1	1	1	0
1	0	1	1	0	0	0	0	1	0	0
1	1	0	0	1	0	0	1	1	1	0
1	1	0	1	0	0	0	0	1	0	0
1	1	1	0	1	1	0	1	1	1	0
1	1	1	1	0	1	0	1	1	1	0

R1 = C + D

R2 = B^c

R3 = C.D

R4 = $R1^c$

    = $(C + D)^c$

    Using De Morgan's law: $(X.Y)^c = X^c + Y^c$

    = $C^c.D^c$

R5 = B.R4

    = $B.C^c.D^c$

R6 = R1.R2

    = $(C + D).B^c$

    Using Distributive law: X.(Y + Z) = X.Y + X.Z

    = $C.B^c + D.B^c$

R7 = B.R1

    = B.(C + D)

    Using Distributive law: X.(Y + Z) = X.Y + X.Z

    = B.C + B.D

W   = A + R7

    = A + B.C + B.D

X   = R5 + R6

    = $B.C^c.D^c + C.B^c + D.B^c$

Y   = R3 + R4

    = $C.D + C^c.D^c$

Z   = D^c

A	B	C	D	R1	R2	R3	R4	R5	R6	R7	W	X	Y	Z
0	0	0	0	0	1	0	1	0	0	0	0	0	1	1
0	0	0	1	1	1	0	0	0	1	0	0	1	0	0
0	0	1	0	1	1	0	0	0	1	0	0	1	0	1
0	0	1	1	1	1	1	0	0	1	0	0	1	1	0
0	1	0	0	0	0	0	1	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0	0	0	1	1	0	0	0
0	1	1	0	1	0	0	0	0	0	1	1	0	0	1
0	1	1	1	1	0	1	0	0	0	1	1	0	1	0
1	0	0	0	0	1	0	1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0	0	1	0	1	1	0	0
1	0	1	0	1	1	0	0	0	1	0	1	1	0	1
1	0	1	1	1	1	1	0	0	1	0	1	1	1	0
1	1	0	0	0	0	0	1	1	0	0	1	1	1	1
1	1	0	1	1	0	0	0	0	0	1	1	0	0	0
1	1	1	0	1	0	0	0	0	0	1	1	0	0	1
1	1	1	1	1	0	1	0	0	0	1	1	0	1	0

R1   = A^c

R2   = C^c

R3   = D^c

R4   = E^c

R5   = F^c

R6   = A.R2.E

       = $A.C^c.E$

R7   = A.R2.F

       = $A.C^c.F$

R8   = A.R3.E

       = $A.D^c.E$

R9   = A.R3.F

       = $A.D^c.F$

R10   = D.C.D.R4.R5

       = $B.C.D.E^c.F^c$

R11   = R1.B.C.D

       = $A^c.B.C.D$

R12   = A.B.E

R13   = A.B.F

R14   = B.C.E

R15   = B.C.F

G   = R6 + R7 + R8 + R9 + R10

       = $A.C^c.E + A.C^c.F + A.D^c.E + A.D^c.F + B.C.D.E^c.F^c$

H   = R11 + R12 + R13 + R14 + R15

       = $A^c.B.C.D + A.B.E + A.B.F + B.C.E + B.C.F$