**Question 1**

R1= (DC)

R2= (B.C)

R3= (A+R1)C

= (A+DC)C

= (AC.D) De Morgan’s law

R4= (R1+R2)

= ((B.C)+(DC))

R5= (R1.R3)C

= ((A+DC)C.(DC))C

= ((A+DC)C C +(DC)C) De Morgan’s law

= ((A+DC)+D) Double Negation Law

= (A+1) Excluded Middle Law

= 1 Domination Law

X= (R4.R5)

= ((B.C)+(DC)) . 1

= (1.(B.C) + 1.DC) Distributive Law

= ((B.C) + DC)

Y= (R3.R4)

= ( (AC.D). ((B.C)+(DC)))

= (AC.D).(B.C) + (AC.D).(DC) Distributive Law

= (AC.D.B.C) + (AC.D.DC) Associative Law

= (AC.D.B.C) + AC.0 Contradiction Law

= (AC.D.B.C) + 0 Domination Law

= (AC.D.B.C) Identity Law

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 |

**$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$**

**Question 2**

R1= (C+D)

R2= BC

R3= (C.D)

R4= (R1)C

= (C+D)C

= (CC.DC) De Morgan’s Law

R5= (B.R4)

= (B.((C+D)C))

= (B.(CC.DC)) De Morgan’s Law

= (B.CC.DC) Associative Law

R6= (R1.R2)

= ((C+D).(BC))

= (BC.C)+(BC.D) Distributive Law

R7= (B.R1)

= (B.(C+D))

= ((B.C)+(B.D))

W= (A+R7)

= (A+(B.(C+D)))

= (A+(B.C)+(B.D)) Distributive Law

X= (R5+R6)

= (((C+D).(BC)) + (B.((C+D)C)))

= (((C+D).(BC)) + (B.(CC.DC))) De Morgan’s Law

= (((C+D).(BC)) + (B.CC.DC))

= ((BC.C)+(BC.D)+(B.CC.DC)) Distributive Law

Y= (R3+R4)

= ((C.D)+((C+D)C))

= ((C.D)+(CC.DC)) De Morgan’s Law

Z= DC

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 |

**$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$**

**Question 3**

R1= AC

R2= CC

R3= DC

R4= EC

R5= FC

R6= (A.R2.E)

= (A.CC.E)

R7= (A.R2.F)

= (A.CC.F)

R8= (A.R3.E)

= (A.DC.E)

R9= (A.R3.F)

= (A.DC.F)

R10= (B.C.D.R4.R5)

= (B.C.D.EC.FC)

R11= (R1.B.C.D)

= (AC.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.CC.E) + (A.CC.F) + (A.DC.E) + (A.DC.F) + (B.C.D.EC.FC)**)**

H= **(**R11+R12+R13+R14+R15**)**

= **(** (AC.B.C.D)+(A.B.E)+(A.B.F)+(B.C.E)+(B.C.F) **)**