**Question Bank with Solution for Late Bloomers, Average & Brilliant learners**

|  |  |
| --- | --- |
| **Q1. State & Prove Indempotence Law.**  Ans: Law states that : X+X=X  Proof: By truth table:  If X=0  X+X ⇨0+0⇨0  If X=1  X+X⇨1+1⇨1 hence proved | **Q1. State & Prove Indempotence Law.**  Law states that : X.X=X  Proof: By truth table:  If X=0  X.X ⇨0.0⇨0  If X=1  X.X⇨1.1⇨1 hence proved |
| **Q2. State & Prove Complementarity Law.**  Ans: Law states that : X+X’=1  Proof: By truth table:  If X=0  X+X’ ⇨0+1⇨1  If X=1  X+X’⇨1+0⇨1 hence proved | **Q2. State & Prove Complementarity Law.**  Law states that : X.X’=0  Proof: By truth table:  If X=0  X.X’ ⇨0.1⇨0  If X=1  X.X’⇨1.0⇨0 hence proved |
| **Q3. Draw a Logical Circuit Diagram for the following Boolean Expression:**  **A.(B+C’)**  **Ans:**  *boolean* | |
| **Q4. Write the equivalent Boolean Expression for the following Logic Circuit**    **Ans: *F(P,Q)=(P'+Q).(P+Q')*** | |
| **Q5. Write the equivalent Boolean Expression for the following Logic Circuit.**  b31  **Ans: *XY+(XY)’+X’*** | |
| **Q6: Convert the following Boolean expression into its equivalent Canonical Product of Sum form (POS):**  **A.B’.C + A’.B.C +A’.B.C’**  Ans: *A.B’.C + A’.B.C +A’.B.C’ = Π(0,1,4,6,7)*  *=(A+B+C).(A+B+C’).(A’+B+C).(A’+B’+C).(A’+B’+C’)* | |
| **Q7: Write the POS form of a Boolean function F, which is represented in a truth table as follows:**  U V W F  0 0 0 1  0 0 1 0  0 1 0 1  0 1 1 0  1 0 0 1  1 0 1 0  1 1 0 1  1 1 1 1  **Ans:** F(U,V,W) = (U+V+W’).(U+V’+W’).(U’+V+W’) | |
| **Q8: A Boolean function F defined on three input variable X,Y,Z is 1 if and only if the number of 1(One) input is odd (e.g. F is 1 if X=1,Y=0,Z=0). Draw the truth table for the above function and express it in canonical sum of product form.**  **Ans:**   |  |  |  |  | | --- | --- | --- | --- | | X | Y | Z | F | | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | | 0 | 1 | 0 | 1 | | 0 | 1 | 1 | 0 | | 1 | 0 | 0 | 1 | | 1 | 0 | 1 | 0 | | 1 | 1 | 0 | 0 | | 1 | 1 | 1 | 1 |   *Canonical SOP*  *XYZ’+XY’Z+XY’Z’+XYZ* | |
| **Q9:** Design (A+B).(C+D) using NAND Gate | |
| **Q12: If F(a,b,c,d)=∑(0,2,4,5,7,8,10,12,13,15), obtain the simplified form using K-Map.**  **Ans:**    The Final Expression is F=c’d’+bd+b’c’d | |

|  |  |
| --- | --- |
| Average learners | |
| **Q1. State & Prove Distributive Law.**  Ans: Law states that : X(Y+Z) = XY + XZ  Proof: By simplification  X(Y+Z) ⇨X.Y + X.Z ⇨XY+ XZ  hence proved | **Q1. State & Prove Distributive Law.**  Law states that : X+YZ=(X+Y) (X+Z)  Proof: By simplification  (X+Y) (X+Z) ⇨ X.X + X.Z + X.Y + Y.Z⇨ X + X.Y+X.Z+Y.Z  ⇨ X(1+Y) +X.Z + Y.Z ⇨X +X.Z + Y.Z ⇨X(1+Z) + Y.Z  ⇨X+Y.Z hence proved |
| **Q2. State & Prove DeMorgan’s Law.**  Ans: Law states that : (X+Y)’=X’Y’  Proof: By simplification LET IT IS TRUE  So ( )+( )= 1 [ A+ =1  ⇨ ( )+(X +Y )=1  ⇨ ( + X) . ( + Y) =1 {Hint change central operator from (+) to (.) and individual operator of each term to (+). No need to memorize any law**.(for slow learner**)  ⇨1+1=1 [ A+ =1  Hence proved | **Q2. State & Prove DeMorgan’s Law.**  Law states that : (+ )=( )  Proof: By simplification LET IT IS TRUE  So ( + ).( )= 0 [ A. =0  ⇨ ( + ).(X.Y )=0  ⇨ ( . X) + ( . Y) =0 {Hint change central operator from (.) to (+) and individual operator of each term to (.). No need to memorize any law**.(for slow learner**)  ⇨0.0=0 [ A. =0  Hence proved |
| **Q3: Draw logic circuit diagram for the following expression:**  **Y= ( . + *A.B* + .*C )’***  **Ans:**  AND  AND  AND | |
| **Q4: Write the equivalent Boolean Expression F for the following circuit diagram :**  b2  *Ans: X’(Y’+Z)* | |
| **Q5: Write the equivalent Boolean Expression F for the following circuit diagram :**  **Ans:** *(A+C)(A’+B)*b3 | |
| **Q6. Convert the following Boolean expression into its equivalent Canonical Sum of Product Form((SOP) (X’+Y+Z’).(X’+Y+Z).(X’+Y’+Z).(X’+Y’+Z’)**  **Ans:** *F( X , Y , Z ) = ∏ (4 , 5 , 6 , 7)*  *= Σ (0 , 1 , 2 , 3)*  *= X’. Y’. Z’ + X’. Y’. Z + X’. Y. Z’ + X’. Y. Z* | |
| **Q7. Prove algebraically XY+YZ+YZ’=Y. [2002 OD**  **Ans.** XY+YZ+YZ’  ⇨ XY+Y(Z+Z’)  ⇨ XY +Y  ⇨ Y(X+1) ⇨ Y | |
| **Q8. Prove algebraically X+X’Y=X+Y.**  **Ans:** X+X’Y ⇨ X.1+X’Y ⇨ X(1+Y) + X’Y  ⇨ X+XY+ X’Y ⇨ X+ Y( X+X’) ⇨X + Y  Hence proved | |
| **Q9:** Obtain a simplified form for a boolean expression using K-Map  F(U,V,W,Z)= ∏ (0,1,3,5,6,7,10,14,15)  Ans:  The POS form is (U+Z’).(V’+W’).(U+V+W).(U’+W’+Z) | |
| **Q10: Reduce the following Boolean expression using K-Map:**  **F(A,B,C,D)=Σ(0,1,2,4,5,8,9,10,11)**  **Ans:**    *F(A,B,C,D)= A’.C’+A.B’ + B’.D’* | |

|  |
| --- |
| Brilliant learners |
| **Q1:** Prove (x+y)(x+z) = x+yz algebraically.  L.H.S. = (x+y).(x+z)  =Xx+xz+xy+yz  BECAUSE XX = X (FROM IDEMPOTENCE LAW) SO  =X+XZ+XY+YZ  =X+XY+XZ+YZ  =X(1+Y)+Z(X+Y)  BECASE 1+Y = 1 (PROPERTY OF 0 AND 1) SO  =X.1+Z(X+Y)  BECASE 1.X = X (PROPERTY OF 0 AND 1) SO  =X+XZ+YZ  BECASE 1+X = 1 (PROPERTY OF 0 AND 1) SO  =X(1+Z)+YZ  =X.1+YZ  BECAUSE X.1 = X (PROPERTY OF 0 AND 1) SO  =X+YZ |
| **Q2: Prove x’.y’+y.z = x’yz+x’yz’+xyz+x’yz algebraically.**  **Ans:** *L.H.S.= x’y +y.z*  *=x’y.1+1.y.z =x’y(z+z’)+(x+x’)y.z*  *=x’yz+x’yz’+xyz+x’yz =RHS* |
| **Q3: Write the equivalent Boolean Expression for the following Logic Circuit.**  Y  X  OR  AND  **Ans: X’+X.Y+(X.Y)’** |
| **Q4. Interpret the following logical circuit as Boolean expression**  b311  **Ans: *ab+b’c+c’e’*** |
| **Q5: Express the F(X,Z)=X+X’Z into canonical SOP form.**  Ans: *F(X,Z)=X+X’Z =X(Y+Y’)+X’(Y+Y’)Z*  *=XY+XY’+X’YZ+X’Y’Z*  *=XY(Z+Z’)+XY’(Z+Z’)+X’YZ+X’Y’Z*  *=XYZ+XYZ’+XY’Z+XY’Z’+X’YZ+X’Y’Z* |
| **Q6:** Write the POS and the SOP form of a Boolean function F, which is represented in a truth table as follows:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | W | X | Y | Z | F | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 1 | 1 | | 0 | 0 | 1 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | | 0 | 1 | 0 | 0 | 1 | | 0 | 1 | 0 | 1 | 0 | | 0 | 1 | 1 | 0 | 1 | | 0 | 1 | 1 | 1 | 1 | | 1 | 0 | 0 | 0 | 0 | | 1 | 0 | 0 | 1 | 1 | | 1 | 0 | 1 | 0 | 0 | | 1 | 0 | 1 | 1 | 1 | | 1 | 1 | 0 | 0 | 1 | | 1 | 1 | 0 | 1 | 0 | | 1 | 1 | 1 | 0 | 0 | | 1 | 1 | 1 | 1 | 1 |   **Ans :**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | W | X | Y | Z | F | MINTERM | MAXTERM | | 0 | 0 | 0 | 0 | 0 |  | W+X+Y+Z | | 0 | 0 | 0 | 1 | 1 | W’X’Y’Z |  | | 0 | 0 | 1 | 0 | 0 |  | W+X+Y+Z’ | | 0 | 0 | 1 | 1 | 1 | W’X’YZ |  | | 0 | 1 | 0 | 0 | 1 | W’XY’Z’ |  | | 0 | 1 | 0 | 1 | 0 |  | W+X’+Y+Z’ | | 0 | 1 | 1 | 0 | 1 | W’XYZ’ |  | | 0 | 1 | 1 | 1 | 1 | W’XYZ |  | | 1 | 0 | 0 | 0 | 0 |  | W’+X+Y+Z | | 1 | 0 | 0 | 1 | 1 | WX’Y’Z |  | | 1 | 0 | 1 | 0 | 0 |  | W’+X+Y’+Z | | 1 | 0 | 1 | 1 | 1 | WX’YZ |  | | 1 | 1 | 0 | 0 | 1 | WXY’Z’ |  | | 1 | 1 | 0 | 1 | 0 |  |  | | 1 | 1 | 1 | 0 | 0 |  | W’+X’+Y’+Z | | 1 | 1 | 1 | 1 | 1 | WXYZ |  |   SOP :  W’X’Y’Z + W’X’YZ+W’XY’Z’+ W’XYZ’+ W’XYZ+ WX’Y’Z+ WX’YZ+ WXY’Z’+ WXYZ  POS :  (W+X+Y+Z).( W+X+Y+Z’).( W+X’+Y+Z’ ).( W’+X+Y+Z).(W’+X+Y’+Z).(W’+X’+Y’+Z) |
| **Q7: Prove that (a’+b’)(a’+b)(a+b’)=a’b’.**  **Ans:** *LHS=(a’+b’)(a’+b)(a+b’)*  *=(a’a’+a’b+a’b’+b’b)(a+b’)*  *=(a’+a’b+a’b’+0)(a+b’)*  *=aa’+a’b’+aa’b+a’bb’+a’ab’+a’b’b’*  *=0+a’b’+0+0+0+0+a’b’=a’b’=RHS* |
| **Q8: Simplify the following Boolean Expression using Boolean postulates and laws of Boolean Algebra.**  **Z=(a’+a).b’.c+a.b’.c’+a.b.(c+c’)**  **Ans:** *Z=(a’+a).b’.c+a.b’.c’+a.b.(c+c’)*  *RHS=(a’+a).b’.c+a.b’.c’+a.b.(c+c’)*  *=a’bc+ab’c+ab’c’+ab.1*  *=a’bc+ab’c’+ab’c*  *=ab’(c+c’)+ab’c*  *=ab’+ab’c*  *=ab’(1+c)*  *=ab’* |
| **Q9:** **Reduce the following Boolean Expression using K-Map**  **F(UVWZ) = ∏ (0,1,2,4,5,6,8,10)**  ***Ans:*** *=∑(3,7,9,11,12,13,14,15)*  *After that Draw the K map and solve using SOP form* |
| **Q10: Reduce the following Boolean expression using K – Map**  **F (A, B, C, D) =Σ (0,2,3,4,6,7,8,10,12)**  **Ans:**  *F= C’.D’ + A’.C + B’.D’* |
| **Q11: If F(a,b,c,d) = ∑ (0,1,3,4,5,7,8,9,11,12,13,15), obtain the simplified form using K-Map**  **Ans:**  C’D’+CD+BD+AD |
|  |