EE6301 DIGITAL LOGIC CIRCUITS
TWO MARK QUESTIONS WITH ANSWERS
UNIT-I NUMBERING SYSTEMS AND DIGITAL LOGIC FAMILIES

1) What are basic properties of Boolean algebra?

The basic properties of Boolean algebra are commutative property, associative Property and distributive property.

2) State the associative property of boolean algebra.

The associative property of Boolean algebra states that the OR ing of several variables results in the same regardless of the grouping of the variables. The associative property is stated as follows: A+ (B+C) = (A+B) +C

3) State the commutative property of Boolean algebra.

The commutative property states that the order in which the variables are OR ed makes no difference. The commutative property is: A+B=B+A

4) State the distributive property of Boolean algebra.

The distributive property states that AND ing several variables and OR ing the result With a single variable is equivalent to OR ing the single variable with each of the the several Variables and then AND ing the sums. The distributive property is: A+BC= (A+B) (A+C)

5) State the absorption law of Boolean algebra.

The absorption law of Boolean algebra is given by X+XY=X, X(X+Y) =X.

6) State De Morgan's theorem.

De Morgan suggested two theorems that form important part of Boolean algebra. They are,

1) The complement of a product is equal to the sum of the complements. (AB)' = A' + B'

2) The complement of a sum term is equal to the product of the complements. (A + B)' = A'B'

7) Reduce A (A + B)

A (A + B) = AA + AB= A (1 + B) [1 + B = 1]= A.

8) Reduce A'B'C' + A'BC' + A'BC

A'B'C' + A'BC' + A'BC = A'C'(B' + B) + A'B'C
= A'C' + A'BC [A + A' = 1]
= A'(C' + BC)
= A'(C' + B) [A + A'B = A + B]

9) Reduce AB + (AC)' + AB'C (AB + C)

AB + (AC)' + AB'C (AB + C) = AB + (AC)' + AAB'BC + AB'CC
= AB + (AC)' + AB'CC [A.A' = 0]
= AB + (AC)' + AB'C [A.A = 1]
= AB + A' + C' =AB'C [(AB)' = A' + B']
= A' + B + C' + AB'C [A + AB' = A + B]
= A' + B'C + B + C' [A + A'B = A + B]
= A' + B + C' + B'C
=A' + B + C' + B'
=A' + C' + 1
= 1 [A + 1 =1]

10) Simplify the following expression Y = (A + B) (A + C') (B' + C')

Y = (A + B) (A + C') (B' + C')
= (AA' + AC +A'B +BC) (B' + C') [A.A' = 0]
= (AC + A'B + BC) (B' + C')

= AB'C + ACC' + A'BB' + A'BC' + BB'C + BCC'
= AB'C + A'BC'

11) Show that (X + Y' + XY) (X + Y') (X'Y) = 0

(X + Y’ + XY)(X + Y’)(X’Y) = (X + Y’ + X) (X + Y’) (X’ + Y) [A + A’B = A + B]
= (X + Y’) (X + Y’) (X’Y) [A + A = 1]
= (X + Y’) (X’Y) [A.A = 1]
= X.X' + Y'.X'.Y
= 0 [A.A' = 0]

12) Prove that ABC + ABC' + AB'C + A'BC = AB + AC + BC

ABC + ABC' + AB'C + A'BC=AB(C + C') + AB'C + A'BC
=AB + AB'C + A'BC
=A(B + B'C) + A'BC
=A(B + C) + A'BC
=AB + AC + A'BC
=B(A + C) + AC
=AB + BC + AC
=AB + AC +BC ...Proved

13) Convert the given expression in canonical SOP form Y = AC + AB + BC

Y = AC + AB + BC
=AC (B + B’) + AB (C + C’) + (A + A’) BC
=ABC + ABC' + AB'C + AB'C' + ABC + ABC' + ABC
=ABC + ABC' +AB'C + AB'C' [A + A =1]

14) Define duality property.

Duality property states that every algebraic expression deducible from the postulates Of Boolean algebra remains valid if the operators and identity elements are interchanged. If the dual of an algebraic expression is desired, we simply interchange OR and AND operators and replace 1's by 0's and 0's by 1's.

15) Find the complement of the functions F1 = x'yz' + x'y'z and F2 = x (y'z' + yz).
By applying De-Morgan's theorem.

F1' = (x'yz' + x'y'z)' = (x'yz')'(x'y'z)' = (x + y' + z)(x + y +z')
F2' = [x (y'z' + yz)]' = x' + (y'z' + yz)'
= x' + (y'z')'(yz)'
= x' + (y + z) (y' + z')

16) Simplify the following expression

Y = (A + B) (A = C) (B + C)

= (A A + A C + A B + B C) (B + C)
= (A C + A B + B C) (B + C)
= A B C + A C C + A B B + A B C + B B C + B C C = A B C

17) What are the methods adopted to reduce Boolean function?

i) Karnaug map ii) Tabular method or Quine Mc-Cluskey method
iii) Variable entered map technique.

18) State the limitations of karnaugh map.

i) Generally it is limited to six variable map (i.e) more then six variable involving expression are not reduced.
ii) The map method is restricted in its capability since they are useful for simplifying only Boolean expression represented in standard form.

19) What is a karnaugh map?

A karnaugh map or k map is a pictorial form of truth table, in which the map diagram is made up of squares, with each squares representing one minterm of the function.44) Find the minterms of the logical expression

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

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

=m0 + m1 +m3 +m6

=_m (0, 1, 3, 6)

20) Write the maxterms corresponding to the logical expression

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

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

=M1.M3.M6

= M (1, 3, 6)

PART-B

1. Design a 4-bit binary adder/ subtractor circuit.
a) Basic equations. (4)
b) Comparison of equations. (4)
c) Design using twos complement Circuit diagram. (8)
2. Design a half adder using NAND – NAND logic. (16)
3. Explain how a full adder can be built using two half adders. (16)
4. Design a half adder using at most three NOR gates. (16)
5. Using 8 to 1 multiplexer, realize the Boolean function
T = f(w, x, y, z) = Σ(0,1,2,4,5,7,8,9,12,13) (16)
6. Design a 8421 to gray code converter. (16)
7. Draw the logic diagram of full subtractor and explain its operation. (16)
8. Draw the circuit diagram of NMOS NAND gate and explain its operation. (16)
9. a) Design a full adder circuit using only NOR gates. (4)
b) Draw the circuit of a CMOS two inputs NAND gate (12)