UNIT I - BOOLEAN ALGEBRA AND LOGIC GATES

PART A – 2 MARKS

1. Define binary logic

Binary logic consists of binary variables and logical operations. The variables are designated by the alphabets such as A, B, C, x, y, z, etc., with each variable having only two distinct values: 1 and 0.

2. What is meant by Digital Systems?

A digital system is a system that manipulates discrete elements of information that is represented by binary form i.e. 0's and 1's.

3. List the number systems

  i) Decimal Number system
  ii) Binary Number system
  iii) Octal Number system
  iv) Hexadecimal Number system

4. Convert 736_8 into an equivalent binary number.

The binary equivalents of 7, 3 and 6 are 111,011 & 110 respectively.
Therefore $736_8 = 111011110_2$

5. Which gates are called as the universal gates? What are its advantages?

The NAND and NOR gates are called as the universal gates. These gates are used to perform any type of logic application.

6. State the sequence of operator precedence in Boolean expression?

  x Parenthesis
  x AND
  x OR

7. What are the different types of number complements? x Radix Complement
  x   Diminished Radix Complement

8. Why complementing a number representation is needed.

Complementing a number becomes as in digital computer for simplifying the subtraction operation and for logical manipulation complements are used.

9. How to represent a positive and negative sign in computers
  x Positive (+) sign by 0
  x Negative (-) sign by 1.

10. What is meant by Map method?

The map method provides a simple straightforward procedure for minimizing Boolean function.

11. What is meant by two variable map?

Two variable map have four minterms for two variables, hence the map consists of four squares, one for each minterm.

12. State Duality principle.

The dual of any Boolean function can be obtained by changing each OR sign to an AND sign and vice versa and complementing any 0 or 1 appearing in the expression.

13. Why parity checker is needed?

Parity checker is required at the receiver side to check whether the expected parity is equal to the calculated parity or not. If they are not equal then it is found that the received data has error.

14. What is meant by parity bit?

Parity bit is an extra bit included with a binary message to make the number of 1's either odd or even. The message, including the parity bit is transmitted and then checked at the receiving and for errors.

15. What are the needs for binary codes?
- x   Code is used to represent letters, numbers and punctuation marks.
- x   Coding is required for maximum efficiency in single transmission.
- x   Binary codes are the major components in the synthesis (artificial generation) of speech and video signals.
- x   By using error detecting codes, errors generated in signal transmission can be detected.
- x   Codes are used for data compression by which large amounts of data are transmitted in very short duration of time.

16. Mention the different type of binary codes?
- x   Binary weighted code
- x   Binary non - weighted code
- x   Sequential code
- x   Alphanumeric code
- x   Error-detecting and error-correcting code

17. List the advantages and disadvantages of BCD code?

Advantages of BCD code:

   a. Any large decimal number can be easily converted into corresponding binary number

   b. A person needs to remember only the binary equivalents of decimal number from 0 to 9.

   c. Conversion from BCD into decimal is also very easy.

Disadvantages of BCD code:

   a. The code is least efficient. It requires several symbols to represent even small numbers.

   b. Binary addition and subtraction can lead to wrong answer.

   c. c. Special codes are required for arithmetic operations.

   d. This is not a self-complementing code.

   e. Conversion into other coding schemes requires special methods.

18. What is meant by self-complementing code?

A self-complementing code is the one in which the members of the number system complement on themselves. This requires the following two conditions to be satisfied.

   x The complement of the number should be obtained from that number by replacing 1s with0s and 0s with 1s.

   x The sum of the number and its complement should be equal to decimal 9.

Example of a self-complementing code is

   i)   2-4-2-1 code. ii). Excess-3 code

19. Mention the advantages of ASCII code

   x There are 27 =128 possible combinations. Hence, a large number of symbols, alphabets etc.., can be easily represented.

   x There is a definite order in which the alphabets, etc.., are assigned to each code word.

   x The parity bits can be added for error-detection and correction.

20. What are the disadvantages of ASCII code?

   x The length of the code is larger and hence more bandwidth is required for transmission.

   x With more characters and symbols to represent, this is not sufficient.

21. Application of octal number system:

It is highly in convenient to handle long strings of binary numbers while entering into the digital systems. It may cause errors also. Therefore, octal numbers are used for entering binary data and displaying certain information.

22. What is a Logic gate?

Logic gates are the basic elements that make up a digital system. The electronic gate is a circuit that is able to operate on a number of binary inputs in order to perform a particular logical function.

23. List out the advantages and disadvantages of K-map method

The advantages of the K-map method are

- x It is a fast method for simplifying expression up to four variables.
- x It gives a visual method of logic simplification.
- x Prime implicants and essential prime implicants are identified fast.
- x Suitable for both SOP and POS forms of reduction.
- x It is more suitable for class room teachings on logic

simplification. The disadvantages of the K-map method are

- x It is not suitable for computer reduction.
- x K-maps are not suitable when the number of variables involved exceed four.
- x Care must be taken to fill in every cell with the relevant entry, such as a 0, 1 (or) don't care terms.

24. Obtain truth table and name operation performed for A'B+AB'

A	B	A'	B'	A'B	AB'	A'B+ AB'
0	0	1	1	0	0	0
0	1	1	0	1	0	1
1	0	0	1	0	1	1
1	1	0	0	0	0	0

PartB

1. **Reduce the expression using uine McCluskey method $f(x_1,x_2,x_3,x_4,x_5)= \sum m$ (0,2,3,6,7,8,10,12,13) (AU N/D 2009)**
   a) Represents the minerms
   b) Group of minterms for different number of 1's
   c) 2 cell combination and 4 cell combination
   d) Find prime Implicant table binary representation
   e) Finally find the SOP terms

2. **Simplify the following Boolean expression in i) SOP ii) POS using karnaugh map AC'+B'D+A'CD+ABCD**