Computer Fundaments
Unit-I

Mrs. Kiran Bala Dubey
Assistant Professor
Department of Computer Science
Govt. N. P. G. College of Science,
Raipur

Number System

- Decimal number system

10^5	10^4	10^3	10^2	10^1	10^0

- Binary number system

2^5	2^4	2^3	2^2	2^1	2^0

- octal number system

8^5	8^4	8^3	8^2	8^1	8^0

- Hexa decimal number system

16^5	16^4	16^3	16^2	16^1	16^0

- ASCII
- EBCDIC
- Gray code
- BCD

ASCII

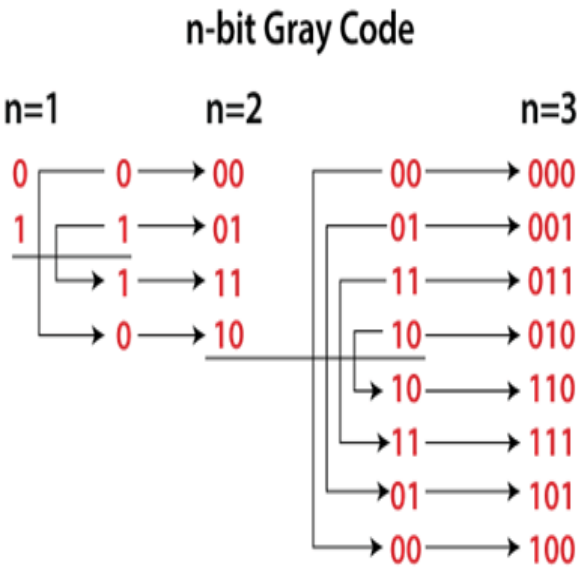
- ASCII abbreviated from American Standard Code for Information Interchange, is a character encoding standard for electronic communication. ASCII codes represent text in computers, telecommunications equipment, and other devices.
- ASCII is a standard that assigns letters, numbers, and other characters in the 256 slots available in the 8-bit code.

EBCDIC

- EBCDIC, in fullextended binary-coded decimal interchange code., Data-encoding system, developed by IBM, that uses a unique eight-bit binary code for each number and alphabetic character as well as punctuation marks and accented letters and non-alphabetic characters.
- EBCDIC differs in several respects from ASCII, the most widely used system of encoding text, dividing the eight bits for each character into two four-bit zones, with one zone indicating the type of character, digit, punctuation mark, lowercase letter, capital letter, and so on, and the other zone indicating the value (that is, the specific character within this type).

Gray code

- Gray code is an ordering of the binary numeral system such that two successive values differ in only one bit (binary digit).
- Gray codes are very useful in the normal sequence of binary numbers generated by the hardware that may cause an error or ambiguity during the transition from one number to the next. So, the Gray code can eliminate this problem easily since only one bit changes its value during any transition between two numbers.
- Gray code is not weighted that means it does not depends on positional value of digit. This cyclic variable code that means every transition from one value to the next value involves only one bit change.
- Gray code also known as reflected binary code, because the first (n/2) values compare with those of the last (n/2) values, but in reverse order.



Decimal Number	Binary Number	Gray Code
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111
6	0110	0101
7	0111	0100
8	1000	1100
9	1001	1101
10	1010	1111
11	1011	1110
12	1100	1010
13	1101	1011
14	1110	1001
15	1111	1000

BCD

- Binary Coded Decimal or BCD is simply the 4-bit binary code representation of a decimal digit with each decimal digit replaced in the integer and fractional parts with its binary equivalent. BCD Code uses four bits to represent the 10 decimal digits of 0 to 9.

Decimal	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001

Binary Addition

0	1	0	1
+0	+0	+ 1	+1
---	---	---	---
0	1	1	10

1's & 2's Compliment

- **1’s Complement of a Binary Number**

There is a simple algorithm to convert a binary number into 1’s complement. To get 1’s complement of a binary number, simply invert the given number.

Eg. 1’s complement of binary number 110010 is 001101

- **2’s Complement of a Binary Number**

There is a simple algorithm to convert a binary number into 2’s complement. To get 2’s complement of a binary number, simply invert the given number and add 1 to the least significant bit (LSB) of given result.

Eg. 2’s complement of binary number 110010 is

```
          1
 001101---------->(1’s complement of 110010)
+         1
-----------
          001110---------->(2’s complement of 110010)
```

Logic Gates

Logic gates are the basic building blocks of any digital system.

It is an electronic circuit having one or more than one input and only one output.

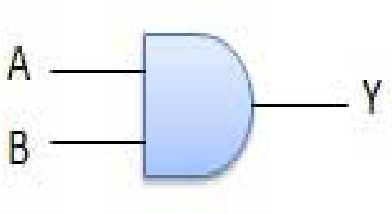
The relationship between the input and the output is based on a certain logic. Based on this, logic gates are named as -

- AND gate
- OR gate
- NOT gate
- NOR gate
- NAND gate
- XOR gate

The AND gate is an electronic circuit that gives a high output (1) only if all its inputs are high. A dot (.) is used to show the AND operation i.e. A.B

A circuit which performs an AND operation is shown in figure -

Logic diagram

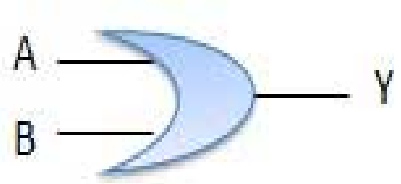


Truth Table

Inputs		Output
A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

The OR gate is an electronic circuit that gives a high output (1) if one or more of its inputs are high. A plus (+) is used to show the OR operation.
A circuit which performs an OR operation is shown in figure -

Logic diagram

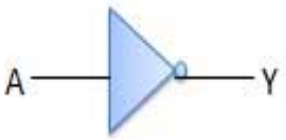


Truth Table

Inputs		Output
A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	1

The NOT gate is an electronic circuit that produces an inverted version of the input at its output.NOT gate is also known as Inverter. It has one input A and one output Y.

Logic diagram

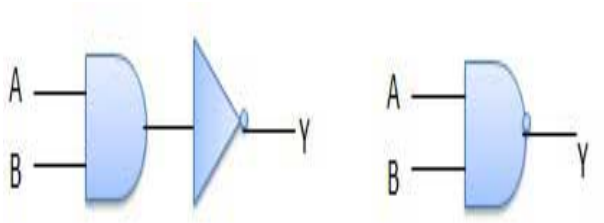


Truth Table

Inputs	Output
A	B
0	1
1	0

This is a NOT-AND gate which is equal to an AND gate followed by a NOT gate. The outputs of all NAND gates are high if any of the inputs are low. The symbol is an AND gate with a small circle on the output. The small circle represents inversion.

Logic diagram

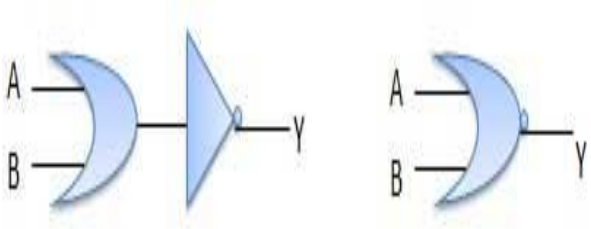


Truth Table

Inputs		Output
A	B	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

This is a NOT-OR gate which is equal to an OR gate followed by a NOT gate. The outputs of all NOR gates are low if any of the inputs are high.
The symbol is an OR gate with a small circle on the output. The small circle represents inversion.

Logic diagram

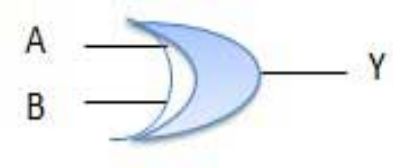


Truth Table

Inputs		Output
A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

The exclusive-OR gate is abbreviated as EX-OR gate or sometime as X-OR gate.The 'Exclusive-OR' gate is a circuit which will give a high output if either, but not both, of its two inputs are high. XOR or Ex-OR gate is a special type of gate. It can be used in the half adder, full adder and subtractor.

Logic diagram



Truth Table

Inputs		Output
A	B	A ⊕ B
0	0	0
0	1	1
1	0	1
1	1	0