



Number System

Number System

- **Binary Numbers** – are base 2 numbers represented by **0** and **1**.
- **Octal** – are base 8 numbers represented by **0** to **7**.
- **Decimal** – are base 10 numbers represented by **0** to **9**.



Number System

- **Hexadecimal** – are base 16 numbers represented by **0** to **9** and the letters **A** to **F**. They are equivalent to 4 bits per hexadecimal digit.

Number System

- **Radix** – refers to the base of a number system.
- **Weight** – refers to the place value of a digit in a set of numbers of a particular number system.

Number System

How do we determine what base a number is?

- Usually, it is decimal
- Other bases will be labeled
- We can rule out bases if the digits are large enough.

Number System

ILLEGAL BASES EXAMPLE

7010 cannot be binary because the 7 is not a valid binary digit. This number could be octal.
4291 cannot be octal because the 9 is not a valid octal digit. This number could be decimal.
4A711D cannot be decimal because A is not a valid decimal digit. This number is most likely hex.



Radix Conversion

Radix Conversion

- **Binary** to Decimal
- **Binary** to Octal
- **Binary** to Hexadecimal
- **Decimal** to Binary
- **Decimal** to Octal

Radix Conversion

- **Decimal** to Hexadecimal
- **Octal** to Decimal
- **Octal** to Binary
- **Hexadecimal** to Decimal
- **Hexadecimal** to Binary

Radix Conversion

Binary to Decimal

- Note all the place values of the binary value.
- Sum up all the place values that has 1 on the binary value.

Radix Conversion

Binary to Octal

- Starting from the rightmost column, separate the binary value into 3 bits.
- Find the octal value of every separated 3 bits using the 4, 2, 1 place value.

Radix Conversion

Binary to Hexadecimal

- Starting from the rightmost column, separate the binary value into 4-bits.
- Find the hexadecimal value of every separated 4 bits using the 8, 4, 2, 1 place value.

Radix Conversion

Decimal to Binary

- Divide the decimal value by 2.
- Separate the remainder by the whole number.
- Divide the whole number again by 2.
- Stop if the decimal value is less than by 2.
- Write the listed remainders orderly and create the binary result.

Radix Conversion

Decimal to Octal

- Divide the decimal value by 8.
- Separate the remainder by the whole number.
- Divide the whole number again by 8.
- Stop if the decimal value is less than 8.
- Write the listed remainders orderly and create the octal result.

Radix Conversion

Decimal to Hexadecimal

- Divide the decimal value by 16.
- Separate the remainder by the whole number.
- Divide the whole number again by 16.
- Stop if the decimal value is less than 16.
- Write the listed remainders orderly and create the hexadecimal result.