

* NUMBER SYSTEM

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Introduction

Number systems are the technique to represent numbers in the computer system architecture, every value that you are saving or getting into/from computer memory has a defined number system. Computer architecture supports following number systems.

- Binary number system
- Octal number system
- Decimal number system
- Hexadecimal (hex) number system

Binary Number System

A Binary number system has only two digits that are 0 and 1. Every number (value) represents with 0 and 1 in this number system. The base of binary number system is 2, because it has only two digits.

Octal Number System

Octal number system has only eight (8) digits from 0 to 7. Every number (value) represents with 0,1,2,3,4,5,6 and 7 in this number system. The base of octal number system is 8, because it has only 8 digits.

Decimal Number System

Decimal number system has only ten (10) digits from 0 to 9. Every number (value) represents with 0,1,2,3,4,5,6, 7,8 and 9 in this number system. The base of decimal number system is 10, because it has only 10 digits.

Hexadecimal Number System

A Hexadecimal number system has sixteen (16) alphanumeric values from 0 to 9 and A to F. Every number (value) represents with 0,1,2,3,4,5,6, 7,8,9,A,B,C,D,E and F in this number system. The base of hexadecimal number system is 16, because it has 16 alphanumeric values. Here A is 10, B is 11, C is 12, D is 14, E is 15 and F is 16.

Number system	Base(Radix)	Used digits	Example
Binary	2	0,1	(11110000) ₂
Octal	8	0,1,2,3,4,5,6,7	(360) ₈
Decimal	10	0,1,2,3,4,5,6,7,8,9	(240) ₁₀
Hexadecimal	16	0,1,2,3,4,5,6,7,8,9, A,B,C,D,E,F	(F0) ₁₆

Conversion decimal to binary

- ❑ Check if your number is odd or even.
- ❑ If it's even, write 0 (proceeding backwards, adding binary digits to the left of the result).
- ❑ Otherwise, if it's odd, write 1 (in the same way).
- ❑ Divide your number by 2 (dropping any fraction) and go back to step 1. Repeat until your original number is 0.

Example-

- * Convert 68 to binary:
- * 68 is even, so we write 0.
- * Dividing 68 by 2, we get 34.
- * 34 is also even, so we write 0 (result so far - 00)
- * Dividing 34 by 2, we get 17.
- * 17 is odd, so we write 1 (result so far - 100 - remember to add it on the left)
- * Dividing 17 by 2, we get 8.5, or just 8.
- * 8 is even, so we write 0 (result so far - 0100)
- * Dividing 8 by 2, we get 4.
- * 4 is even, so we write 0 (result so far - 00100)
- * Dividing 4 by 2, we get 2.
- * 2 is even, so we write 0 (result so far - 000100)
- * Dividing 2 by 2, we get 1.
- * 1 is odd, so we write 1 (result so far - 1000100)
- * Dividing by 2, we get 0.5 or just 0, so we're done.
- * Final result: 1000100

Conversion binary to decimal

- Write the values in a table as shown before.
- Add the value in the column header to your number, if the digit is turned on (1).
- Skip it if the value in the column header is turned off (0).
- Move on to the next digit until you've done them all.

Example-

- * Convert 101100 to decimal:
 - * • Highest digit value: 32. Current number: 32
 - * • Skip the "16" digit, its value is 0. Current number: 32
 - * • Add 8. Current number: 40
 - * • Add 4. Current number: 44
 - * • Skip the "2" and "1" digits, because their value is 0.
 - * • Final answer: 44

Conversion octal to binary

Converting from octal to binary is as easy as converting from binary to octal. Simply look up each octal digit to obtain the equivalent group of three binary digits.

Octal	0	1	2	3	4	5	6	7
Binary	000	001	010	011	100	101	110	111

Octal	3	4	5	
Binary	011	100	101	011100101 binary