Numeral systems. Transfer numeral from one numeral system to another. Arithmetic in the numeral systems.

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Numeral system

- (or system of numeration) is a writing system for expressing numbers; that is, a mathematical notation for representing numbers of a given set, using digits or other symbols in a consistent manner

The number the numeral represents is called its value.

- Ideally, a numeral system will:
- Represent a useful set of numbers (e.g. all integers, or rational numbers)
- Give every number represented a unique representation (or at least a standard representation)
- Reflect the algebraic and arithmetic structure of the numbers

Main numeral systems

- The most commonly used system of numerals is the Hindu–Arabic numeral system. Two Indian mathematicians are credited with developing it. Aryabhata of Kusumapura developed the place-value notation in the 5th century and a century later Brahmagupta introduced the symbol for zero.

Decimal Numbers

- Decimal numbers (base 10)
  - Represented using 10 numerals: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- Each position represents a power of 10:
  - 401= 4*102+ 0*101 + 1*100 = 400+ 1
  - 130= 1*102 + 3*101+0*100 = 100 + 30
  - 9786= 9*103 + 7*102 + 8*101 + 6*100=
    = 9*1000 +7*100 + 8*10 + 6*1

Binary Numeral System

- Binary numbers are represented by sequence of bits (smallest unit of information – 0 or 1)
  - Bits are easy to represent in electronics
- 1 0 0 1 0 0 1 0
- 1 0 0 1 0 0 1 1
- 1 1 1 1 1 1 1 1
- 1 0 1 1 0 0 1 0

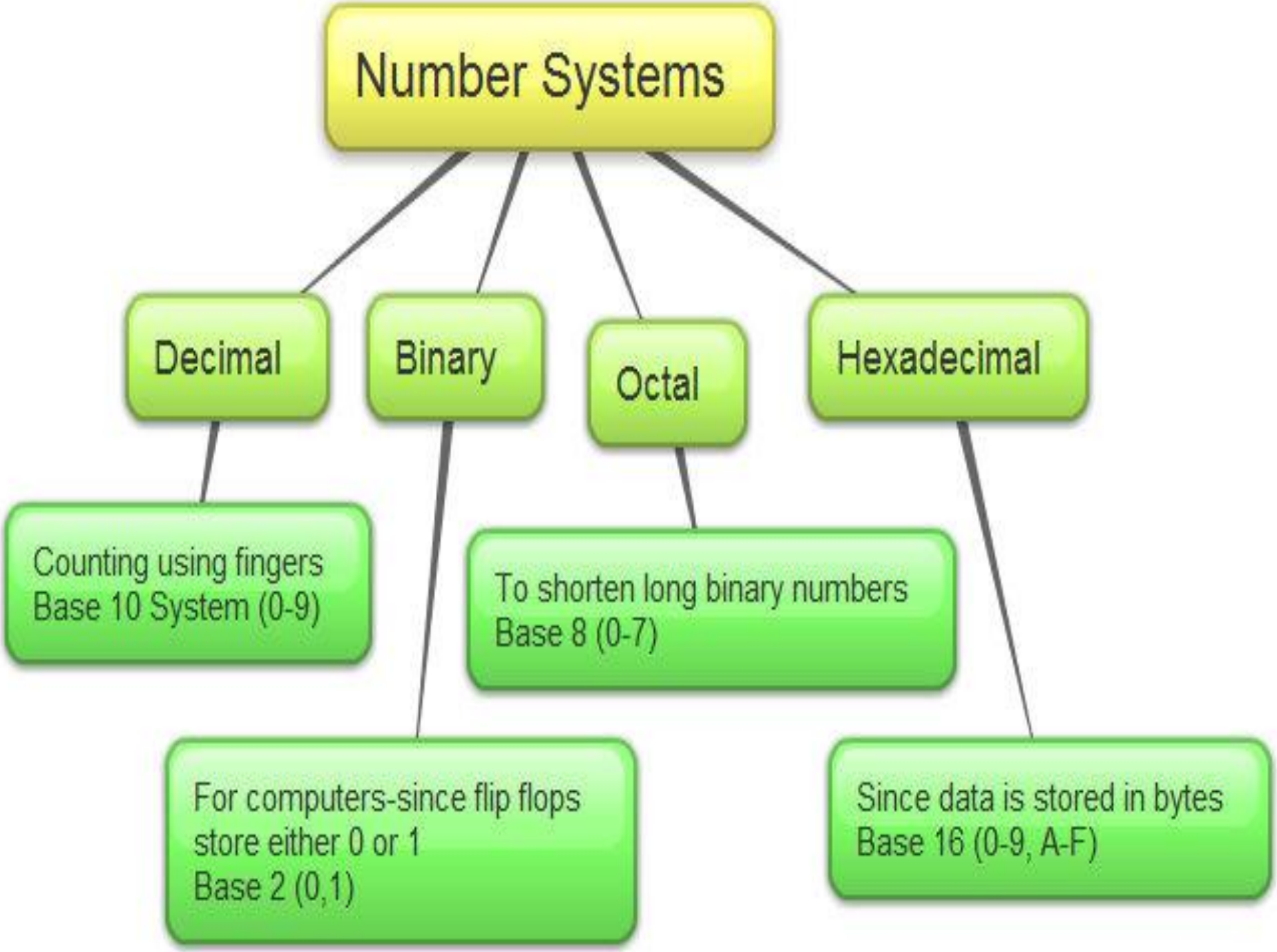
Binary Numbers

- Binary numbers (base 2)
  - Represented by 2numerals: 0and 1
- Each position represents a power of 2:
  - 101b= 1*22 + 0*21 + 1*20 = 100b + 1b = 4+1= 5
  - 110b = 1*22 + 1*21 + 0*20 = 100b + 10b = 4+2=6
  - 110101b= 1*25 + 1*24 + 0*23 + 1*22 + 0*21+ 1*20=

= 32 + 16 + 4 + 1= = 53

How ComputersRepresent Text Data?

- A text encoding is a system that uses binary numbers (1and 0) torepresent characters
  - Letters, numerals, etc.
- In the ASCII encoding each character consists of 8 bits (one byte) of data
  - ASCII is used in nearly all personal computers
- In the Unicode(UTF-16) encoding each character consists of 16 bits (two bytes)
  - Can represent many alphabets


Number Systems
Decimal
Binary
Octal
Hexadecimal
Counting using fingers
Base 10 System (0-9)
To shorten long binary numbers
Base 8 (0-7)
For computers-since flip flops
store either 0 or 1
Base 2 (0,1)
Since data is stored in bytes
Base 16 (0-9, A-F)