Other Useful Number Systems

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Binary

- Base 2 can be difficult to “parse”
- Hard to read quickly

- What are some other common bases?

Binary

- Base 2 can be difficult to “parse”
- Hard to read quickly

- What are some other common bases?
    - Base 16
    - Base 8

Hexadecimal

- Base 16 = Hexadecimal
- Same basic premise
- Each digits
  - New power of 16
- Problem:
- We only have 10 digits (0-10)
  - What do?

Hexadecimal

- Just use letters!
- 0-9, A-F

Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E
Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

- What comes next?

Hexadecimal

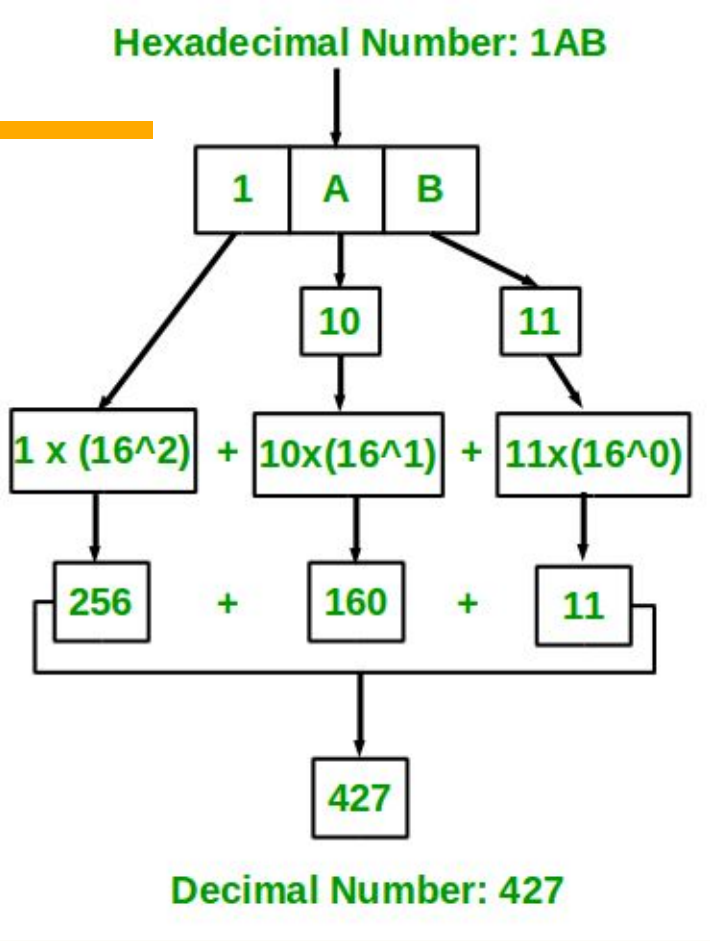
- Just use letters!
- 0-9, A-F

Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E
Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

- What comes next?
- 10, 11, ... , 19, 1A, ...

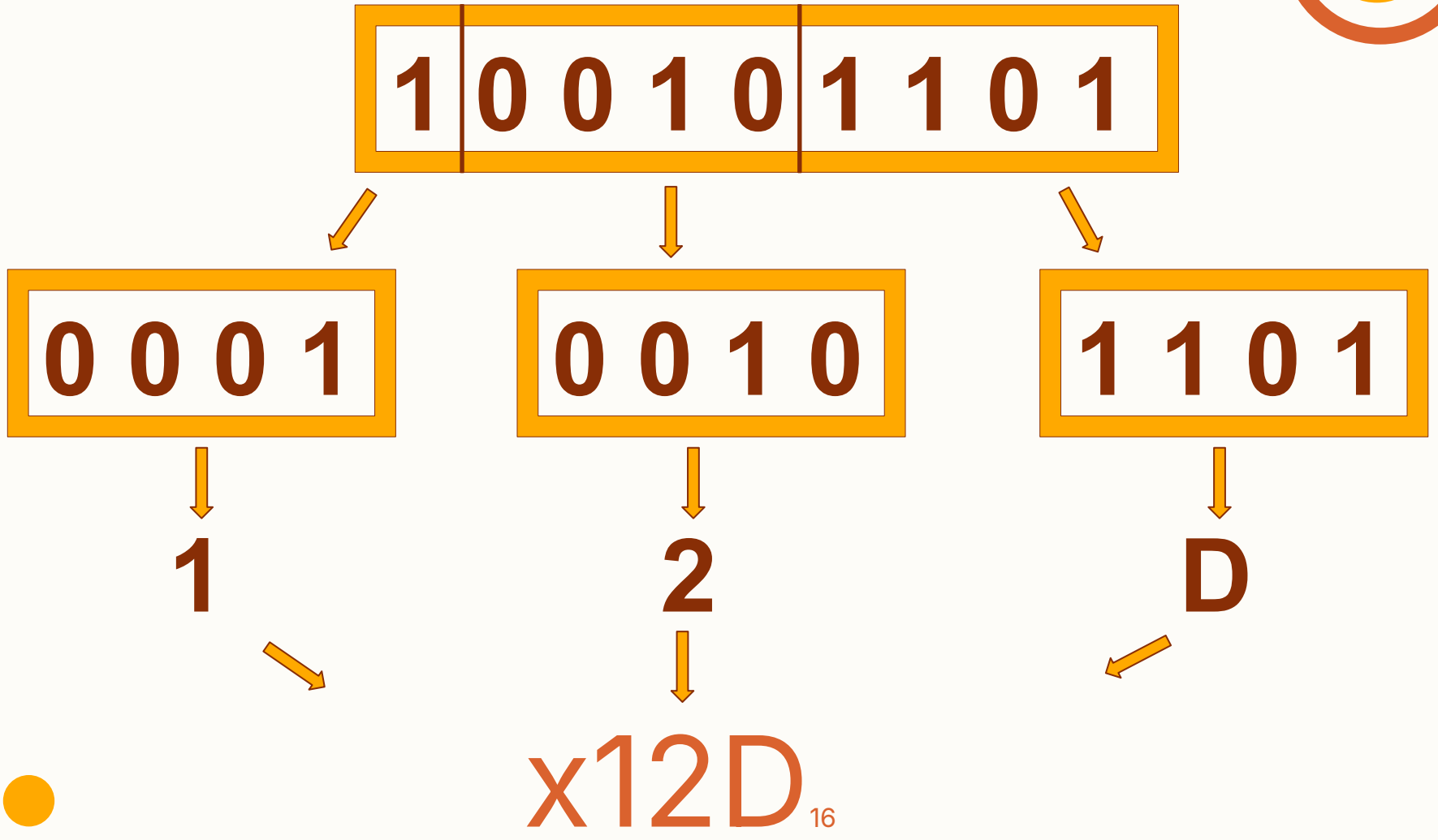
Hexadecimal

- Power of 16 principle
- Same technique
  - Except.....



Hexadecimal

- Binary and hex have a special relationship
  - Super easy to convert
- Group by 4s
- Convert piece to hex
- Concatenate


1 0 0 1 0 1 1 0 1
0 0 0 1
0 0 1 0
1 1 0 1
1
2
D
x12D16

Hexadecimal

- Decimal to hex
  - Decimal to binary first
  - Binary to Hex
- This is, generally easier than Dec ⇒ Hex Directly

- Prefixed with x

Hexadecimal

- Example together
  - 127_{10}

- Whiteboard example
  - $1010\ 0001\ 0111\ 1111_{2}$

Special Relations

- Why does this group by 4 trick exist?
- Base 2 =?⇒ Base 16
- 16 is a power of 2
- What about other bases?
    - Base 8 (octal)

Octal

- Same concept
- Digits 0-7
  - Start with binary
  - Group by 3 instead of 4
  - Convert
  - Concatenate
- Lets try it

Hexadecimal

- Example together
  - 96_{10}

- Whiteboard example
  - $1011\ 1001\ 0011\ 1001_{2}$

Overview

- Decimal
- Binary
- Hex
- Octal
- Conversion between them
  - Several ways
- Why this is important to computers