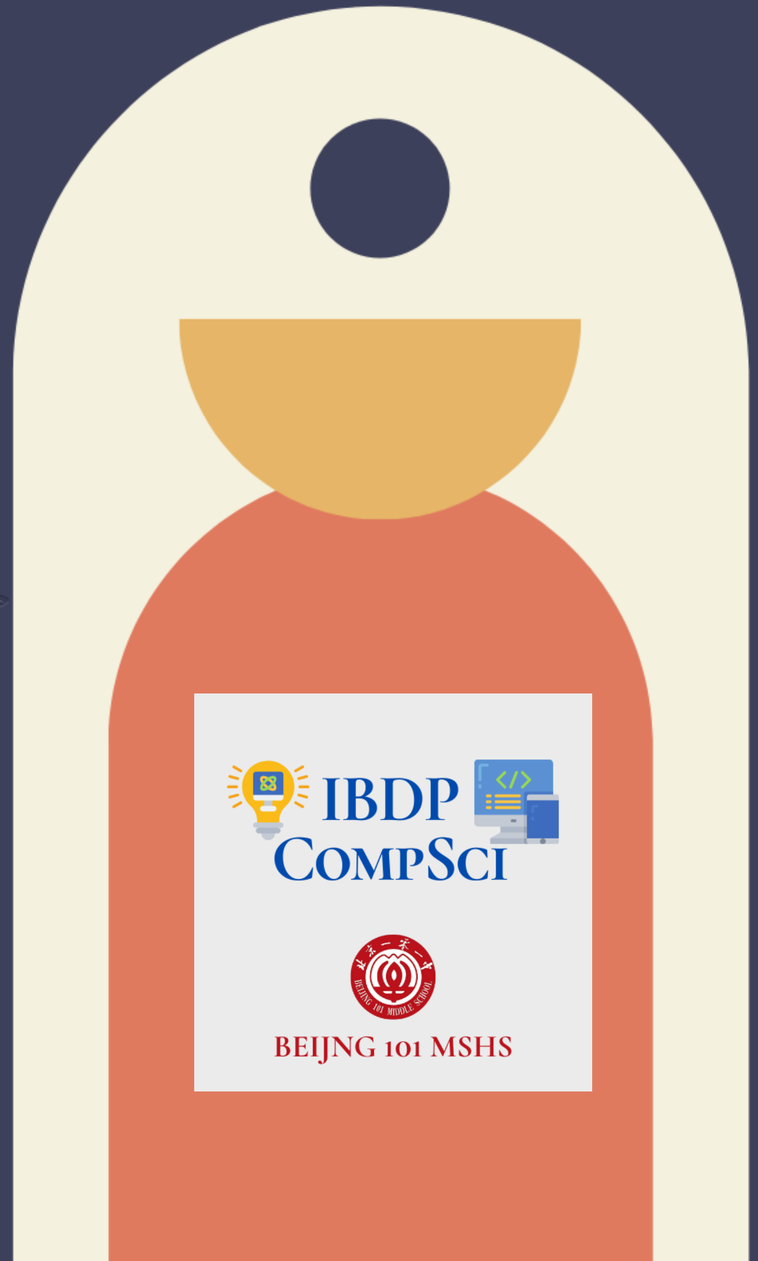
# Welcome to Computer Science ***IBDP***

*Beijing 101 Middle/High School*



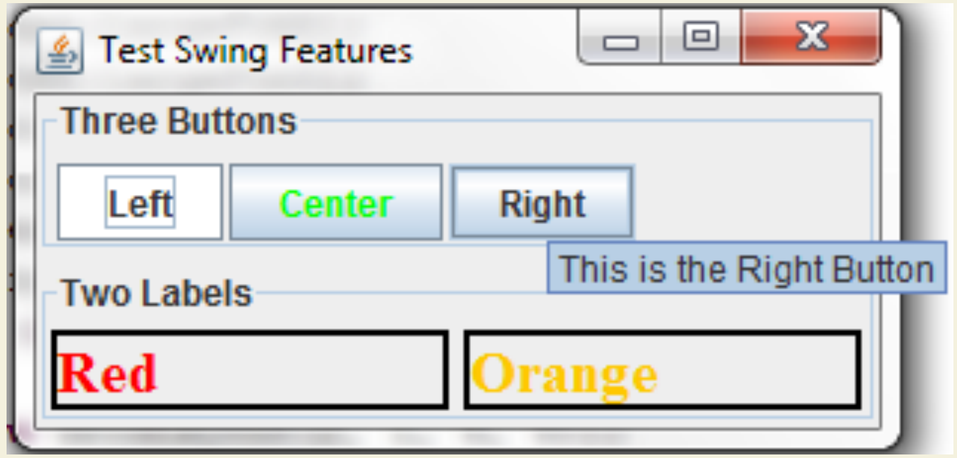
# Highlights from Last time

♥ Operating system and its functions

# Today

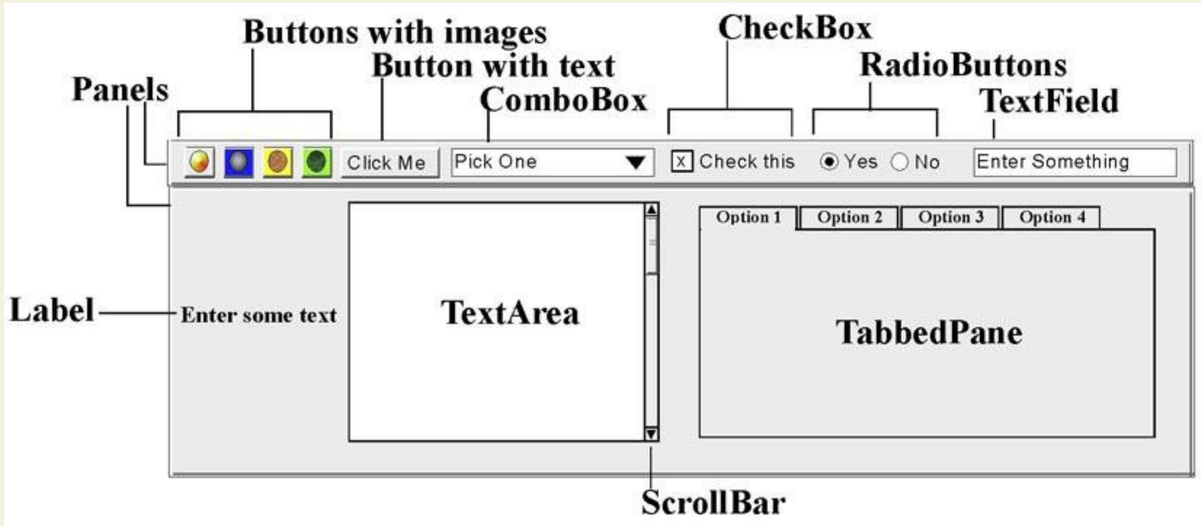
- Identify common features of applications
- Define the terms: bit, byte, binary, denary/ decimal and hexadecimal
- Common Number Systems

# Topic 2.1.8
# Identify common features of applications



# Common features of most programs are:

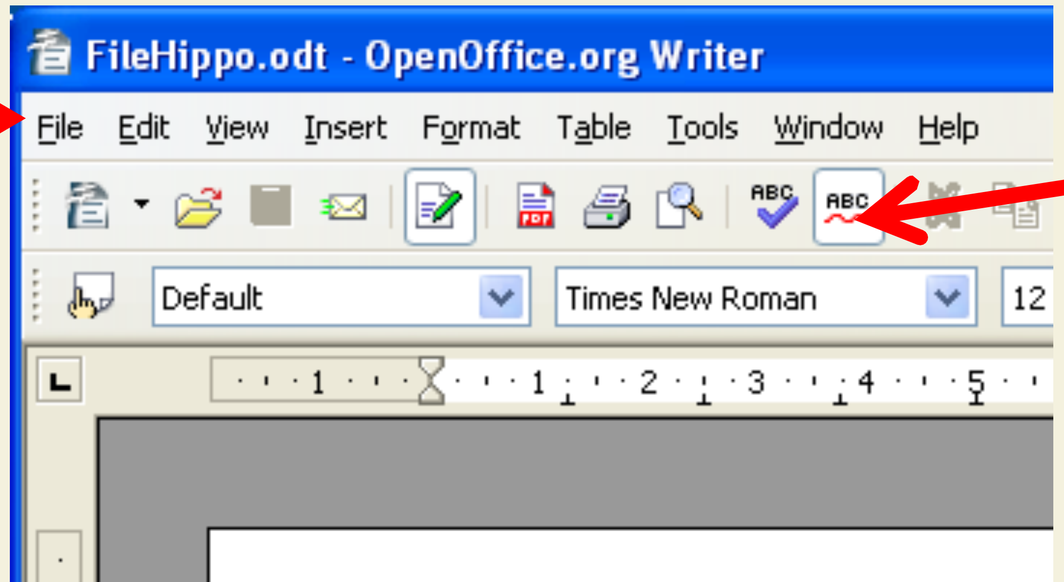
- Toolbars
- Menus
- Dialogue Boxes
- GUI components



# OS vs Application features

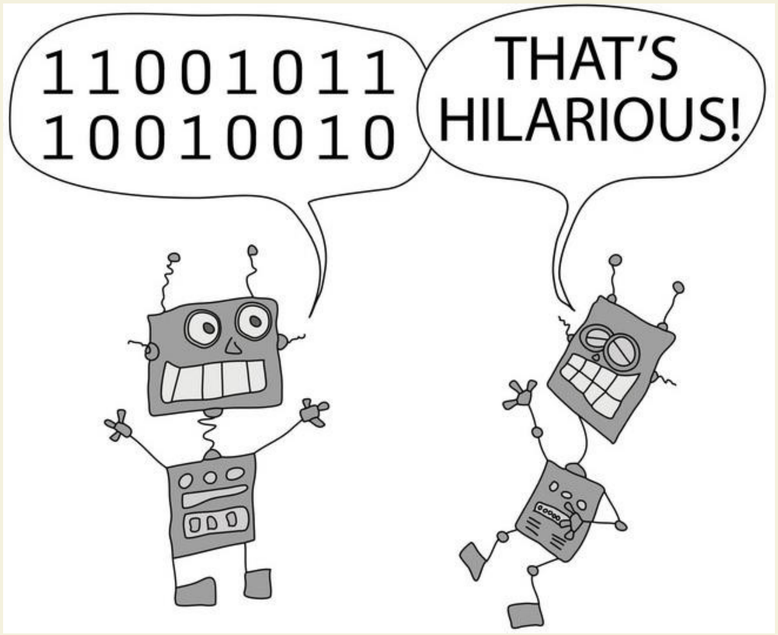
- Certain parts of the interface are provided by libraries in the
- OS and certain parts are specific to each application
- For example: the menu bar and buttons are standard, but the specifics/pictures are up to the individual application

OS Generic



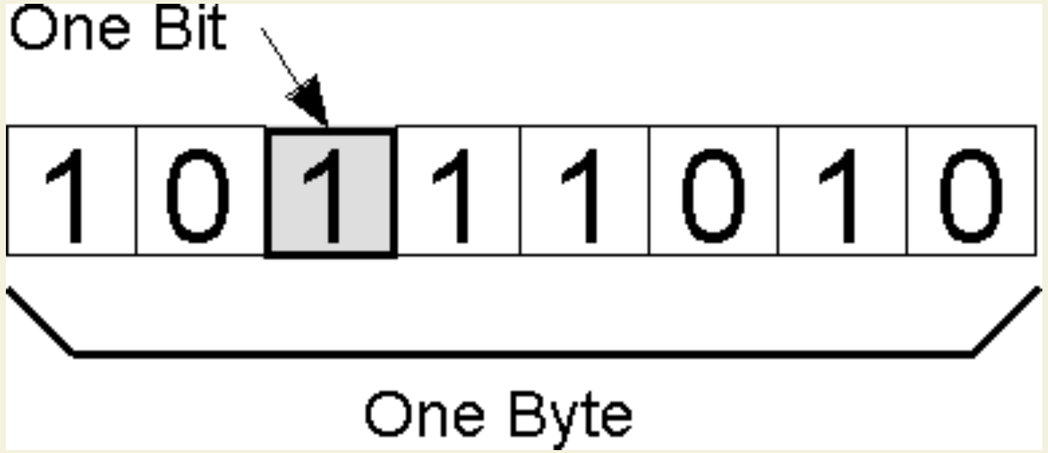

Program Specific

# Topic 2.1.9
# Define the terms: bit, byte, binary, denary/decimal and hexadecimal



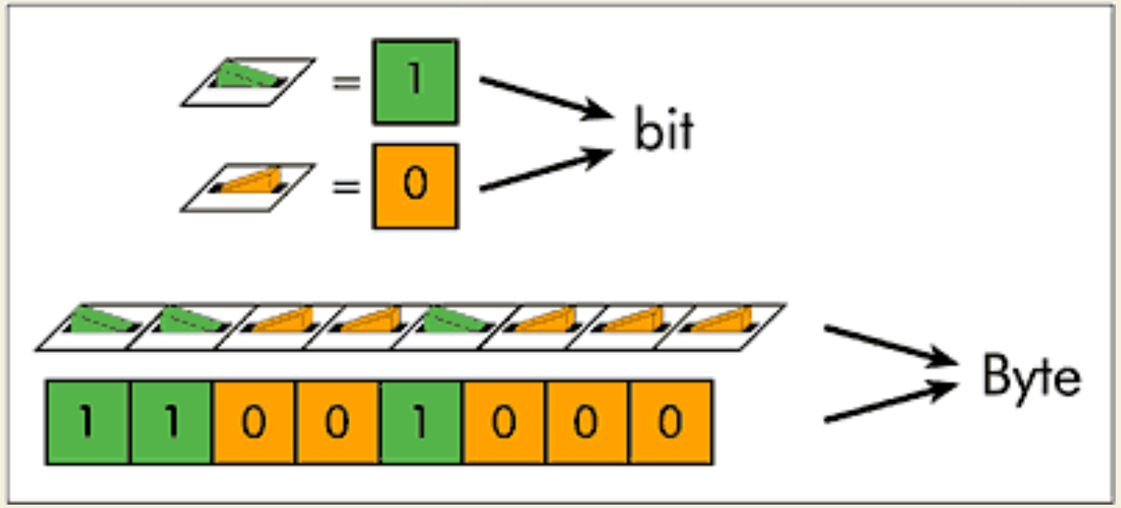
# Definition: bit

♥ Computers use binary - the digits 0 and 1 - to store data. A binary digit, or bit, is the **smallest unit of data** in computing. It is represented by a 0 or a 1.



# Definition: byte

♥ Bits can be grouped together to make them easier to work with. A group of 8 bits is called a byte.



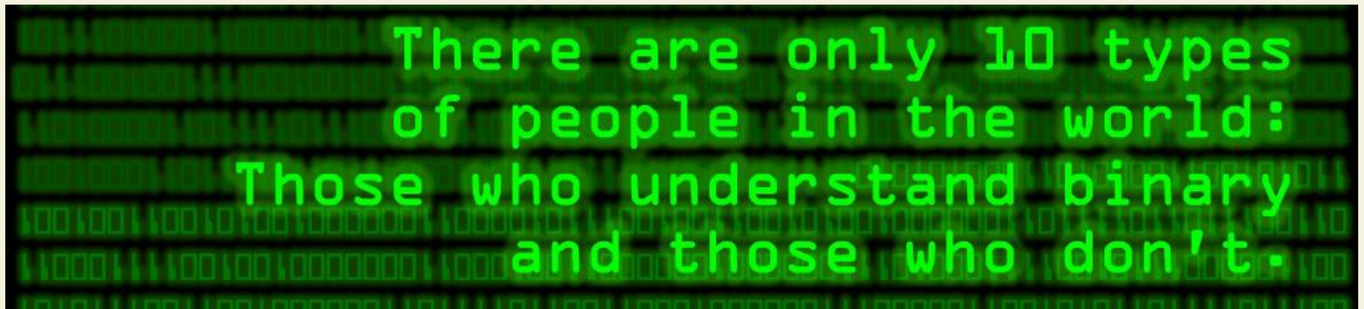

| Multiples of byte | | |
|---|---|---|
| SI decimal prefixes | | Binary usage |
| Name (Symbol) | Value | |
| kilobyte (kB) | $10^3$ | $2^{10}$ |
| megabyte (MB) | $10^6$ | $2^{20}$ |
| gigabyte (GB) | $10^9$ | $2^{30}$ |
| **terabyte** (TB) | $10^{12}$ | $2^{40}$ |
| petabyte (PB) | $10^{15}$ | $2^{50}$ |
| exabyte (EB) | $10^{18}$ | $2^{60}$ |
| zettabyte (ZB) | $10^{21}$ | $2^{70}$ |
| yottabyte (YB) | $10^{24}$ | $2^{80}$ |

# Common byte storage capacities

| Data | Storage |
| --- | --- |
| One extended-ASCII character in a text file (eg 'A') | 1 byte |
| The word 'Monday' in a document | 6 bytes |
| A plain-text email | 2 KB |
| 64 pixel x 64 pixel GIF | 12 KB |
| Hi-res 2000 x 2000 pixel RAW photo | 11.4 MB |
| Three minute MP3 audio file | 3 MB |
| One minute uncompressed WAV audio file | 15 MB |
| One hour film compressed as MPEG4 | 4 GB |

# Definition: binary

- Computers use binary - the digits 0 and 1 - to store data.
- Because it only has 2 symbols (0 & 1) it is also called BASE-2
- numbering
- Binary also refers to the format in which numbers are
- transmitted and calculated in a computer system.



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# Common Number Systems

| System | Base | Symbols | Used by humans? | Used in computers? |
|---|---|---|---|---|
| Decimal | 10 | 0, 1, … 9 | Yes | No |
| Binary | 2 | 0, 1 | No | Yes |
| Octal | 8 | 0, 1, … 7 | No | No |
| Hexa-decimal | 16 | 0, 1, … 9,<br>A, B, … F | No | No |

# Quantities/Counting (1 of 3)

| Decimal | Binary | Octal | Hexa-decimal |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 10 | 2 | 2 |
| 3 | 11 | 3 | 3 |
| 4 | 100 | 4 | 4 |
| 5 | 101 | 5 | 5 |
| 6 | 110 | 6 | 6 |
| 7 | 111 | 7 | 7 |

# Quantities/Counting (2 of 3)

| Decimal | Binary | Octal | Hexa-decimal |
|---|---|---|---|
| 8 | 1000 | 10 | 8 |
| 9 | 1001 | 11 | 9 |
| 10 | 1010 | 12 | A |
| 11 | 1011 | 13 | B |
| 12 | 1100 | 14 | C |
| 13 | 1101 | 15 | D |
| 14 | 1110 | 16 | E |
| 15 | 1111 | 17 | F |

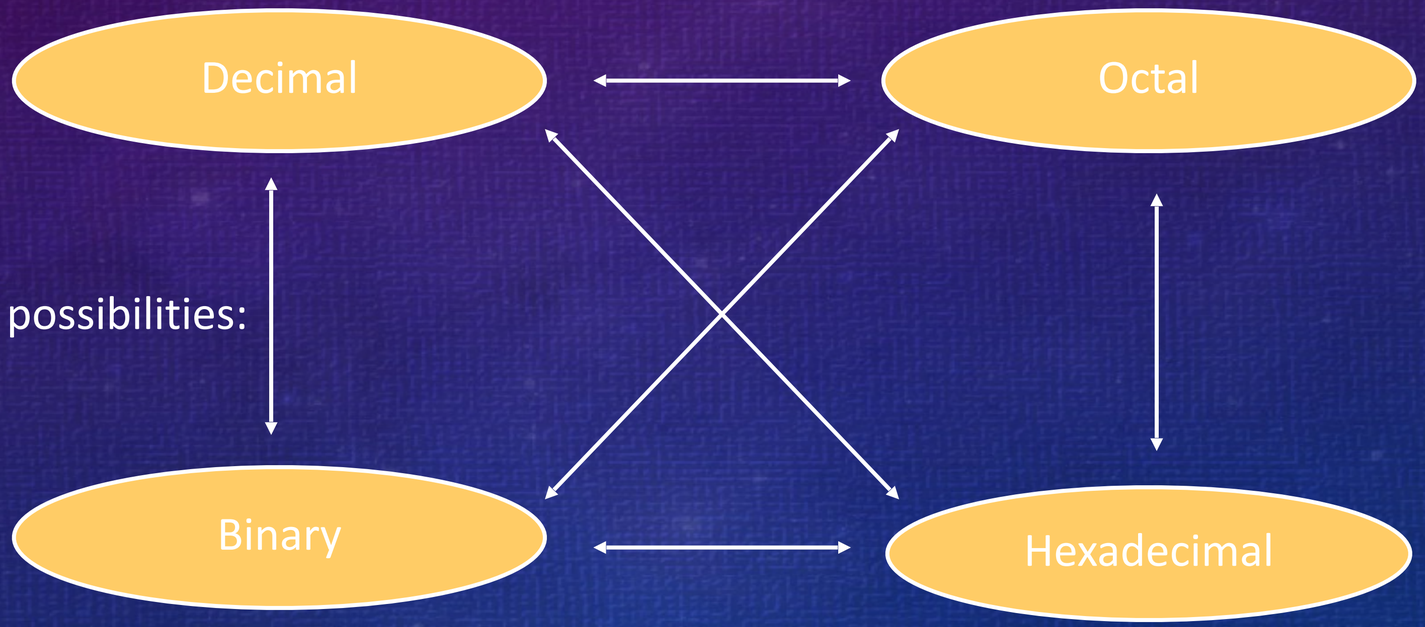
# Quantities/Counting (3 of 3)

| Decimal | Binary | Octal | Hexa-decimal |
|---|---|---|---|
| 16 | 10000 | 20 | 10 |
| 17 | 10001 | 21 | 11 |
| 18 | 10010 | 22 | 12 |
| 19 | 10011 | 23 | 13 |
| 20 | 10100 | 24 | 14 |
| 21 | 10101 | 25 | 15 |
| 22 | 10110 | 26 | 16 |
| 23 | 10111 | 27 | 17 |

Etc.

# Conversion Among Bases

- The possibilities:



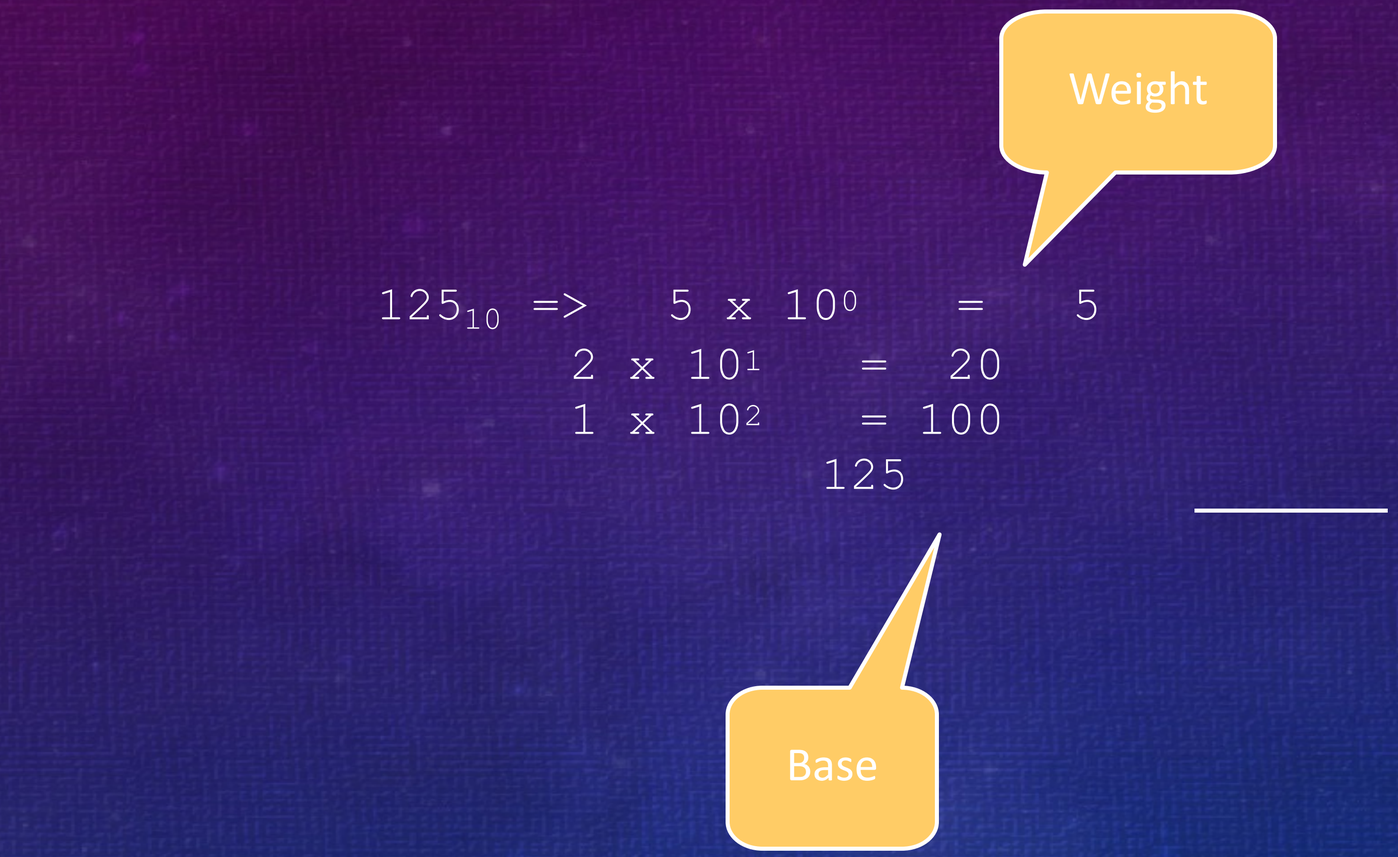
# Quick Example

$$25_{10} = 11001_{2} = 31_{8} = 19_{16}$$

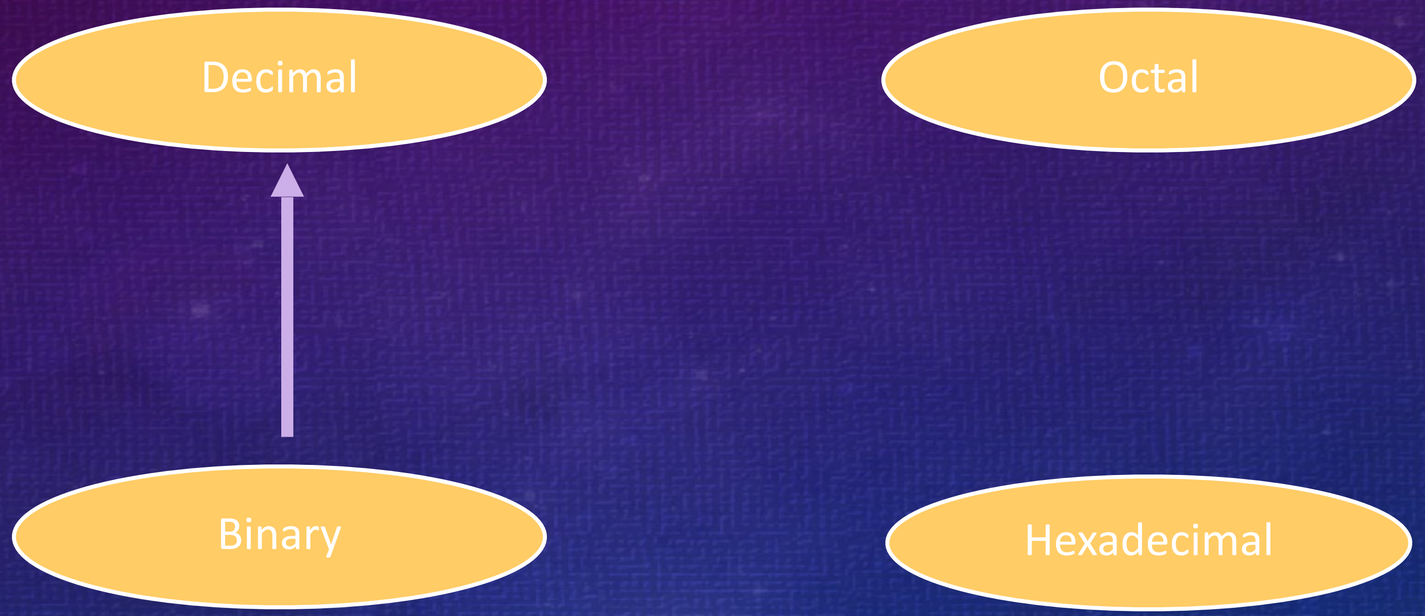
Base

# Decimal to Decimal (just for fun)


Next slide…


Weight
$125_{10}$ => 5 x $10^0$ = 5
2 x $10^1$ = 20
1 x $10^2$ = 100
125
Base

# Binary to Decimal



# Binary to Decimal

- Technique
  - Multiply each bit by $2^n$, where *n* is the “weight” of the bit
  - The weight is the position of the bit, starting from 0 on the right
  - Add the results

# Example


$101011_2$ =>

$1 \times 2^0 = 1$

$1 \times 2^1 = 2$

$0 \times 2^2 = 0$

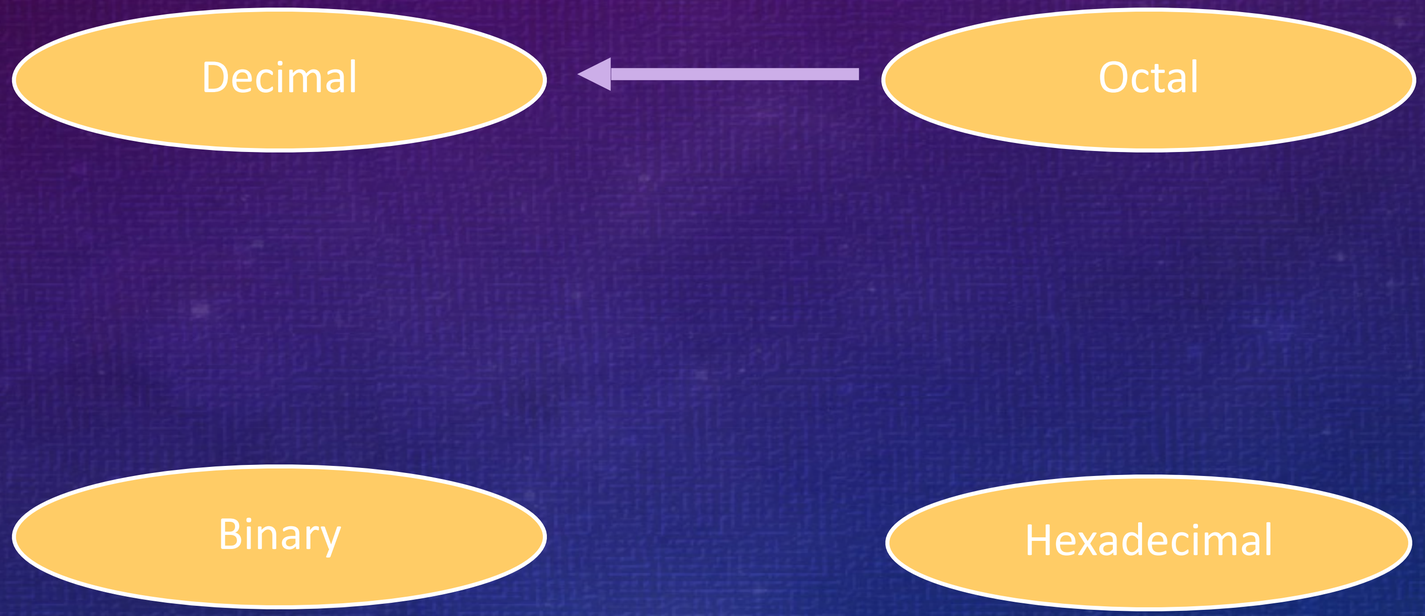
$1 \times 2^3 = 8$

$0 \times 2^4 = 0$

$1 \times 2^5 = 32$

$43_{10}$

# Octal to Decimal



# Octal to Decimal

- Technique
  - Multiply each bit by $8^n$, where *n* is the “weight” of the bit
  - The weight is the position of the bit, starting from 0 on the right
  - Add the results

# Example

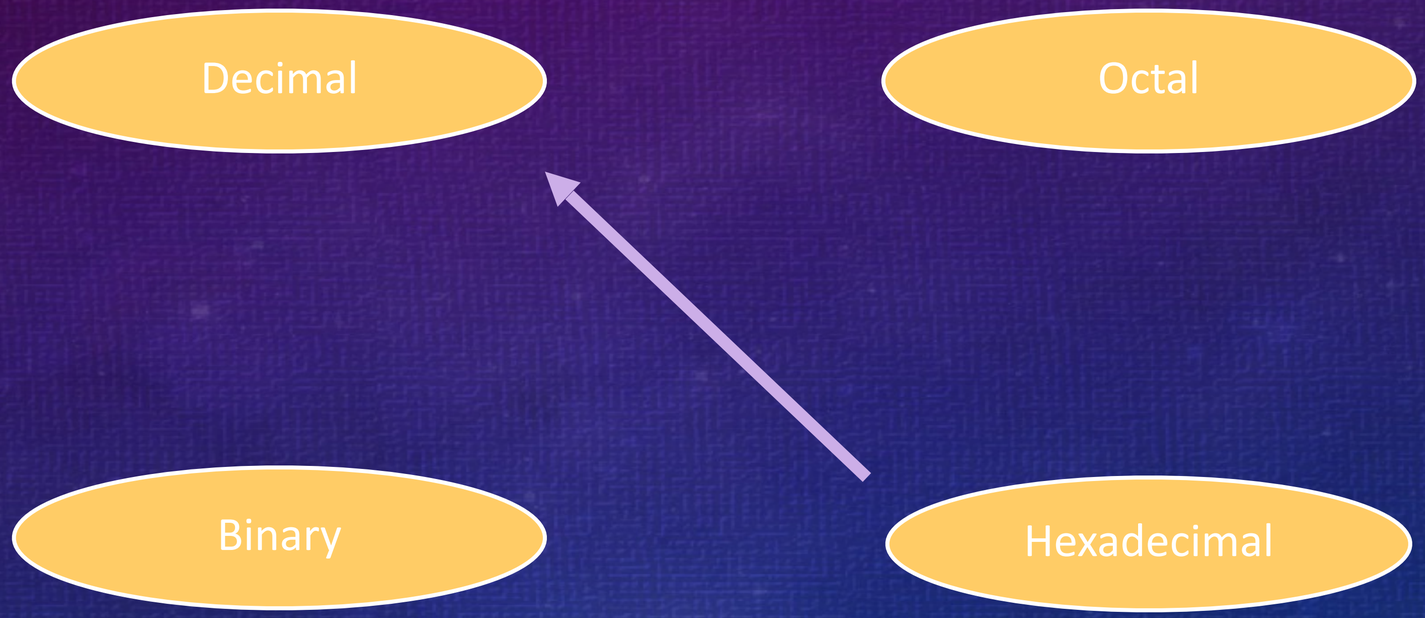
$724_8$ => 4 x $8^0$ = 4

2 x $8^1$ = 16

7 x $8^2$ = 448

$468_{10}$

# Hexadecimal to Decimal



# Hexadecimal to Decimal

- Technique
  - Multiply each bit by $16^n$, where *n* is the “weight” of the bit
  - The weight is the position of the bit, starting from 0 on the right
  - Add the results

# Example

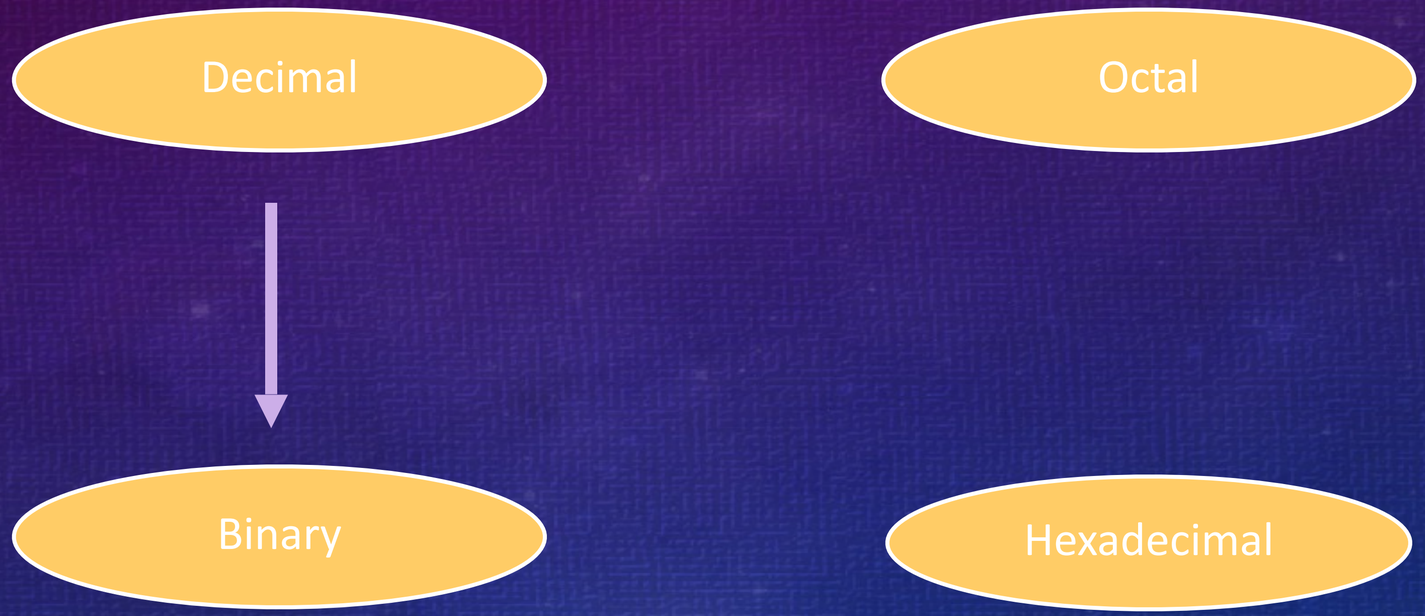
$ABC_{16}$ =>  C x $16^0$ = 12 x  1 =  12

B x $16^1$ = 11 x  16 =  176

A x $16^2$ = 10 x 256 = 2560

$2748_{10}$

# Decimal to Binary

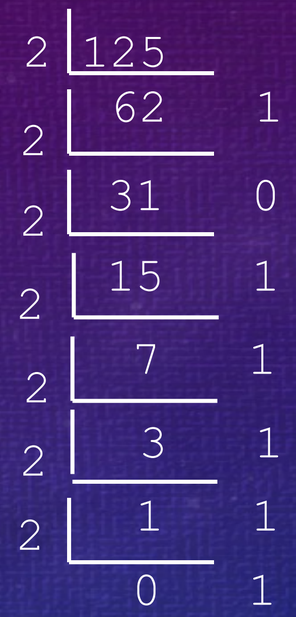


# Decimal to Binary

- Technique
  - Divide by two, keep track of the remainder
  - First remainder is bit 0 (LSB, least-significant bit)
  - Second remainder is bit 1
  - Etc.

# Example

$125_{10} = ?_2$




$125_{10} = 1111101_2$