AMA
LEARNING

Digital Information: Notes

In this lesson:

- Boolean Logic & Logic Gates
- Number Systems
- Algorithms
- File Size
- Text Compression
- Abstraction

Boolean Logic & Logic Gates:

- **A boolean value is either true or false**
- A comparison using a **relational operator** evaluates to a boolean
- **= = , >, <, > =, < =, ! =**
    - The 6 signs symbols used to test the relationship between 2 variables, expressions, or values
- **Logic Gates**
    - **AND (&&)**
        - 0 && 0 = 0
        - 0 && 1 = 0
        - 1 && 0 = 0
        - 1 && 1 = 1
    - **OR (!!)**
        - 0 !! 0 = 0
        - 0 !! 1 = 1
        - 1 !! 0 = 1
        - 1 !! 1 = 1
    - **NOT (!)**
        - ! 0 = 1
        - ! 1 = 0

Number Systems:

- **Number bases** including binary/decimal are **used to represent data**
- **Binary (base 2)** uses combinations of digits 0 and 1 (in bits)
- **Decimal (base 10)** uses combinations of digits 0-9
    - With decimal, digit's position in binary sequence determines # value (equal to bit's value multiplied by place value of its position)
    - With binary, the place value of position is determined by the base raised to the power of position (positions are numbers starting right, increasing to the left)

- **Bit (binary digit 0 or 1; 1 byte = 8 bits)**
    - Computer represent data digitally (lowest level is bits)
    - They are grouped to **represent abstractions** (numbers, characters, colors)
    - Some sequences of bits can represent different types of data in different contexts
        - Ex: ASCII table (when a number represents a character)
        - Ex: 1010 = 8421 = 8+2 = 10

Algorithms:

- **A set of instructions**
- Can be written in different ways to do the same thing
- Ones that look the same can have different side effects/results
    - Ex: Robot pseudocode

File Size:

- **Byte (8 bits): standard "chunk" for binary information**
- Kilobyte (KB): 1,000 bytes
- Megabyte (MB): 1,000,000 bytes or 1,000 KB
- Gigabyte (GB): 1,000,000,000 bytes or 1,000 MB
- Terabyte (TB): 1,000,000,000,000 bytes or 1,000 GB
- Petabyte (PB): 1,000,000,000,000,000 bytes or 1,000 TB
- Exabyte (EB): 1,000,000,000,000,000,000 bytes or 1,000 PB
- Typical file sizes:
    - .txt : 2.5 KB
    - .jpg image: 100 - 1,000 KB
    - Animated gif: 250 KB or 2 MB
    - .pdf file: under 10 MB
    - Audio file as .mp3: 1 MB
    - .mov or .mp4 movie: 15 MB

Text Compression:

- **To save time/storage,** information is compressed (reduce size/ number of bits of transmitted/stored data)
- However, **fewer bits DOES NOT mean less information**
- Amount of **size reduction depends** on amount of original data and the compression algorithm
- **Lossless Data**
    - Data remains in file after uncompressed
    - All information can be restored
    - Text, spreadsheets, gif
- **Lossy Data**

- Reduces file size permanently by getting rid of certain information
- Some information can be restored
- Video, sound, jpeg
- Can reduce file size more than lossless data

Abstraction:

- **Process of reducing complexity by focusing on main idea**
- Hiding irrelevant details related to question and bringing together useful details
- Uses complexity and allows one to focus on the idea
    - Ex. use of digital data to approximate real world analog data