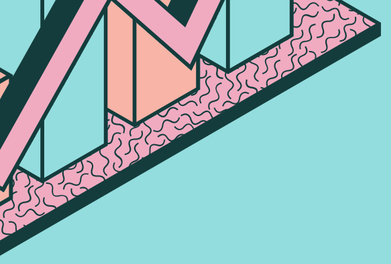
PORTOFOLIO #3

# Number Systems

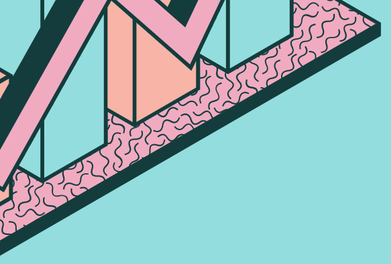
number systems and its uses and types



# Number system

Number systems or numerical systems are a way to represent or name numbers using a set of rules and symbols. There are many types of number systems but everyone is familiar with the system using 0 to 9 digits, however when we deal with computers, it is crucial to understand how a number is used.

**Understanding the number systems and its uses, conversions, representations, operations and its concepts is crucial to understand computers.**



# Number system

As programmers we are required to have knowledge about the different types of number systems, four of which are the most common, binary, octal, deciml and hexadecimal. Computers communicates in binary digits 0s and 1s; on the other hand humans use the decimal sysstems with ten digits 0-9.

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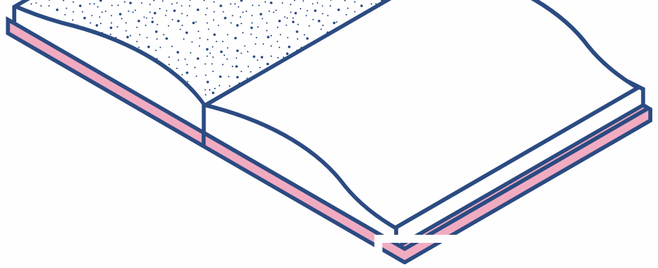
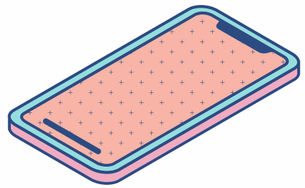
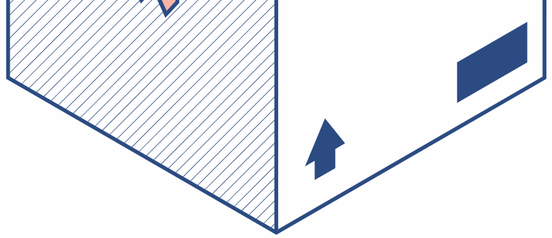




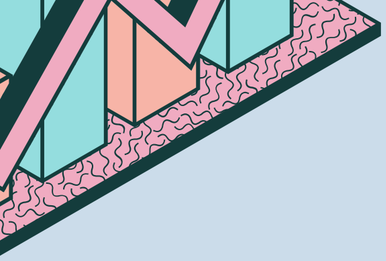


# Types of number systems

Technically there infinite types of number systems, each one is based on a different base. From 2, 10, all the way to infinite. Below is the names of base 1 to 16, highlighting the important types that we will be discussing.

| Base | Name of number system | Digits |
|---|---|---|
| 1 | Unary | 1 |
| 2 | **Binary** | 0-1 |
| 3 | Ternary | 0-2 |
| 4 | Quternary | 0-3 |
| 5 | Quinary | 0-4 |
| 6 | Senary | 0-5 |
| 7 | Septenary | 0-6 |
| 8 | **Octal** | 0-7 |
| 9 | Nonary | 0-8 |
| 10 | **Decimal** | 0-9 |
| 11 | Undecimal | 0-A |
| 12 | Duodecimal | 0-B |
| 13 | Tridecimal | 0-C |
| 14 | Tetradecimal | 0-D |
| 15 | Pentadecimal | 0-E |
| 16 | **Hexadecimal** | 0-F |

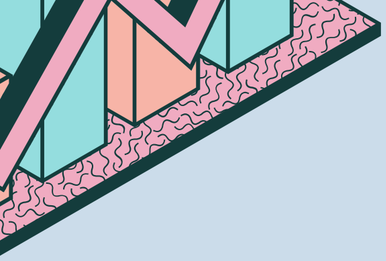
Out of all infinite possibillites in the number systems, four types stand out. Binary, Octal, Decimal and hexadecimal. Using these number systems, we are able to connect the human world to the computer world. These systems helps us and also help computers process, display and simplify information efficiently and correct.



# Binary system

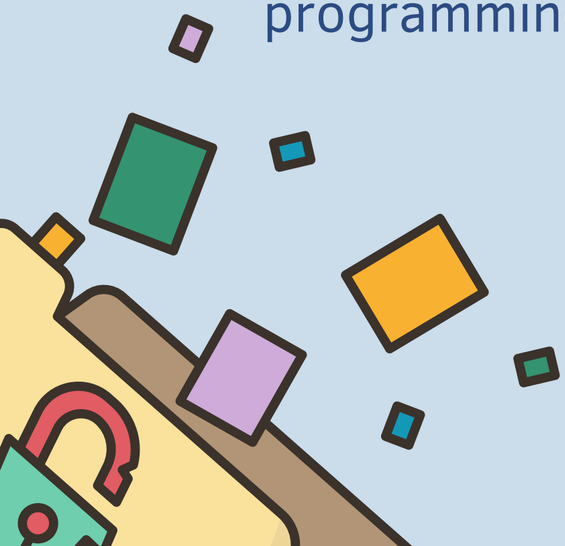
Binary number systems using only two digits, 0s and 1s. Each digit is called a bit, this bit represents the two states of digital systems, ON and OFF respectively. This is a fundamental language of computers as it is a posotional system based on powers of 2.

**Everything you see in this presentation are stored in binary form, which means all of these are made of 0s and 1s.**



# Octal system

Octal number system is based on eight digits, from 0-7. Its a positional system that uses the power of 8. Octal serves as a shorter way to represent binary numbers, this is due to three binary digits equates one octal digit. As its not as common today, it used to used in early programming and digital systems.



**One octal digit = three binary digits**

# Decimal System

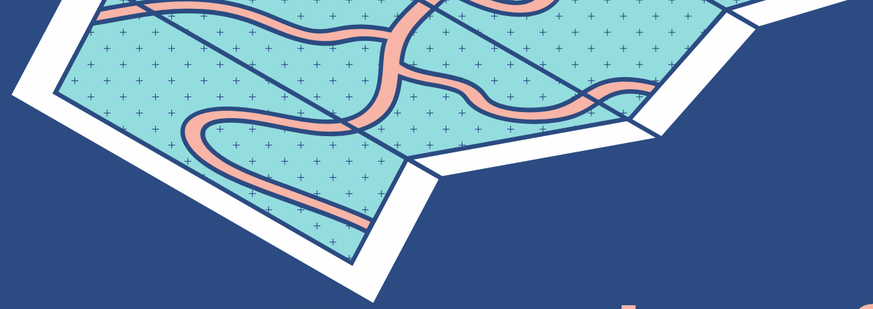
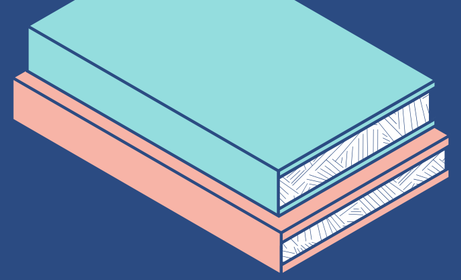
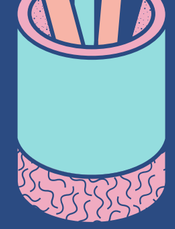
The decimal system is the most familiar and widely used. This is the number system that everyone uses in a daily basis, from humans to computers. It consists of ten digits, from 0-9, base on powers of 10. The base 10 is a practical choice for early counting.

**We used base 10 numbers because we have 10 fingers!**

# Hexadecimal System

The Hexadecimal number system uses sixteen digits and symbols. 0-9 and A-F, where A is 10 and F is 15. It uses a power of 16 and its often used as a compact form of binary, since 4 binary digits equates 1 hex digit. Hexadecimal is used in computer progrmming, color codes in web esign and memory addressing. It allows complex binary data to be presented in a shorter and concised form.

**We also used hexadecimal in color coding!**

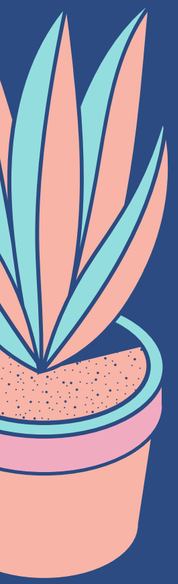
# Examples of the number systems

**A number in any base system can be reprsented in a generalized format as follows:**

**N = An Bn + An-1 Bn-1 + - - - + A1 B1 + A0B0, where**
**N = Number, B=Base, A= any digit in that base**

**Lets use 150 as an example:**

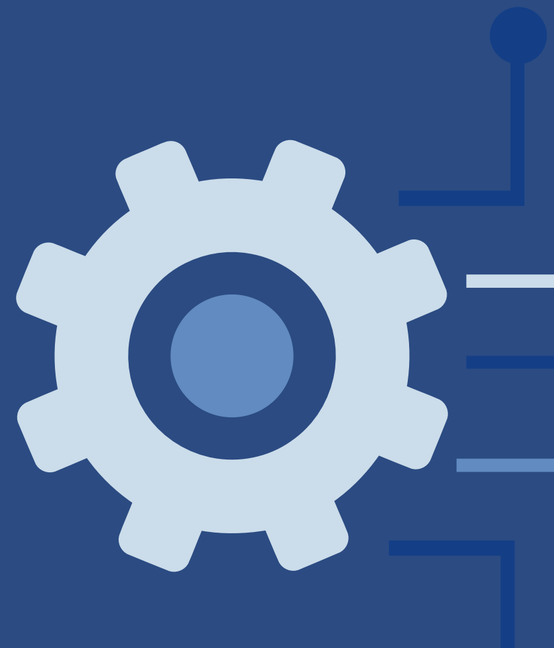
| | | | |
|---|---|---|---|
| Decimal | 150 | 1 * 10^2 + 5*10^1 +0 * 10^0 = 100+50+0 | 150 |
| Binary | 10010110 | 1 * 2^7 + 1 * 2^4 + 1 * 2^2 + 1 * 2^1= 127+16 + 4 + 2 | 150 |
| Octal | 226 | 2 * 8^2 + 2 8^1 + 6 * 8^0 = 128 + 16 + 6 | 150 |
| Hexidecimal | 96 | 9 * 16^1 + 6 * 16^0 = 144 +6 | 150 |



# What is the use of number systems?

Number systems are used to process and represent data in both everyday living and technology. In computers they allow information to be stored, transmitted, and calculated effieciently. In real life, the decimal system is used for countig, measuring, and performing mathematical operations. Additionally, number systems also help programmers, engineers and scientist interpret and organize complex data correctly.

Number systems form the foundation of all mathematical and digital operations. They provide a structured way to express quantities, perform calculations, and communicate values between computers and humans. Without it, computers would not be able to process daata, and everyday tasks like counting, measuring, calculating would be impossible. In shor, number systems connect the world of logic, computation, and real-life application.



# Reflection

Going through this portfolio on number systems was honestly a bit of an eye-opener. Before this, I, like most people, never really thought much beyond the decimal system we use every day. It's just how we count, right? We have ten fingers, so we use ten digits (0-9). It’s intuitive. This portfolio, however, really clarified why, as a computer science student, I can't just stop there. The document makes it clear that to truly understand computers, we have to understand their language, and that language is fundamentally different from ours.

The core idea that a number system is simply a way to represent numbers using a specific set of symbols and rules, or a "base," was a major takeaway. The portfolio effectively contrasts the human world, which runs on the decimal (base-10) system, with the computer world, which operates in binary (base-2). It’s fascinating to think that everything on a computer, from this text to complex applications, boils down to a massive sequence of 0s and 1s, representing the simple states of ON and OFF.

# Reflection

What I found most useful was the explanation of why other systems like Octal and Hexadecimal are so important. At first, they seemed redundant, but the portfolio explains them as practical tools that bridge the gap between complex binary code and human readability. Learning that one octal digit represents three binary digits and one hexadecimal digit represents four made their purpose click. Hexadecimal, in particular, is a compact way to manage long binary strings, which explains its use in things I see all the time, like web color codes and memory addressing.

Ultimately, this portfolio solidified my understanding that number systems are the bedrock of all digital operations. They are not just an abstract mathematical concept but the essential framework that allows us to communicate and process information in the digital age.

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# Thank you so much for listening!! :}