

Philip Pesic

Week 2

January 29 2023

Week 2 Lecture 2 Notes

Unit

A unit is a representation of a physical thing or entity. This unit is usually represented as 1.

Eg: A Rock

Digit

A symbol used to represent multiple/many single units. Helpful when overcoming your CROW limit.

Eg: 8

Number system

A system that makes use of several digits and positional notations in order to represent a number of units higher than that representable by a single digit. Modern number systems have 3 defining characteristics: a base, positions, position/place values.

Eg: Decimal system. Base 10, digits 0-9, 1 digit per place value

4 Modern number systems

Binary: Base 2 | digits 01

Octal: Base 8 | digits 01234567

Decimal: Base 10 | digits 0123456789

Hexadecimal: Base 16 | 0123456789ABCDEF

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Decimal Number System

The number system we use in everyday life. It has a base of 10 digits and each place value increases by 10x.

Eg: Digits 0123456789 | Base 10 | Place values multiply by 10 | Example number: 19

Binary Number System

Number system/code used in digital devices, representative of the off/on state of transistors. Has a base of 2 digits and each place value increases by 2x.

Eg: Digits 01 | Base 2 | Place values multiply by 2 | Example number: 10011 (19 in decimal)

How a number system works

Place values are used to represent values higher than that represented by a single digit. By putting one digit in the 10s place, that digit can now represent 10 times its value.

Eg: 82 (in decimal) means $8 \times 10 + 2 \times 1$ | 8 is in the 10s place value

The octal system for example has a base of 8. Upon going past its final digit, 7, it will go back to 0, and then add 1 in the 8s place, representing 10 (8 in decimal)

Early digital devices

The telegraph was the first digital device used for long distance communication. A key would be used to open and close an electrical circuit. When closed, the telegraph circuit would send an

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electrical signal across telegraph lines to another station that would receive it. By alternating long and short circuit closes, the operator could send a message in morse code, a code with dots and dashes used to represent letters.

Eg: By closing the circuit in this pattern: short short short long long long short short short, or . . . - - - . . ., an operator would send the message “SOS”

The code - the soul of the modern machine

All digital devices rely on binary code to move, store, and present information, however there are no physical 0s and 1s floating around in a computer. Instead these 0s and 1s represent the off/on state of transistors, which makes them an efficient way of representing information.

Eg: If a transistor flickers the sequence: on, off, off, on, it represents 1001 in binary.

Two coding systems commonly used today

ASCII code - a collection of numbers in each modern number system that can represent an english letter/character.

Eg: According to ASCII, binary 110 0001 represents the english letter a.

Unicode - a universal coding system similar to ASCII, but not limited to just english.

Eg: Θ in UTF-8 is U+03B8

Code tables for computer devices

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Because the same binary code may be interpreted differently by different computers, device drivers are used to translate binary code into another format.

Eg: One device may read 1100001 as ASCII letter a, while another reads it as decimal number

97. Drivers can translate this binary code into another format so that both can read it as ASCII letter a