2024/07/29

EE1202 — Digital Circuits
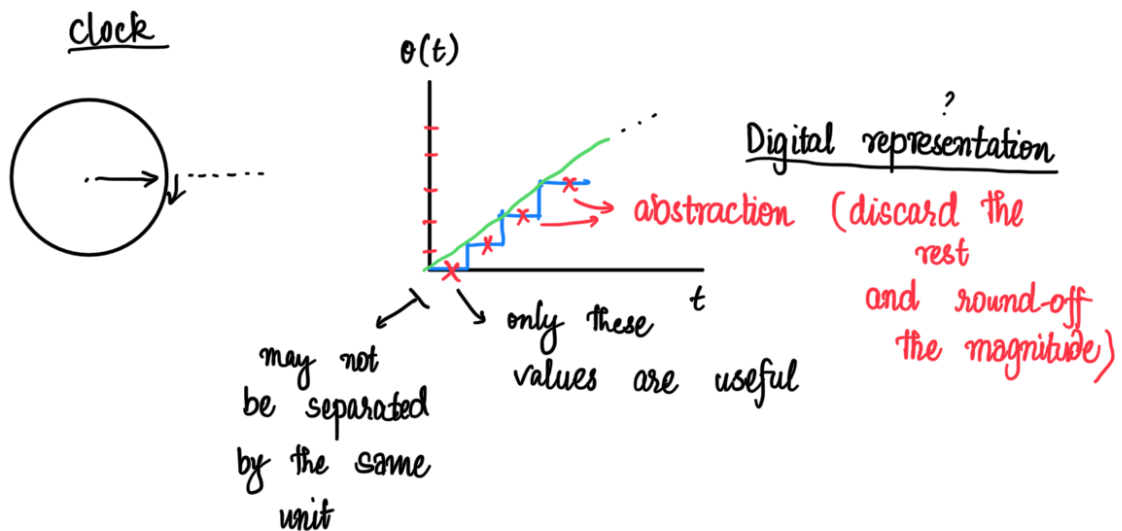
HDL → Hardware Descriptive Language

Teams code : yd 14a8o

Circuit → closed loop

Digital

Clock

$\theta(t)$

Digital representation

→ abstraction (discard the rest and round-off the magnitude)

may not be separated by the same unit

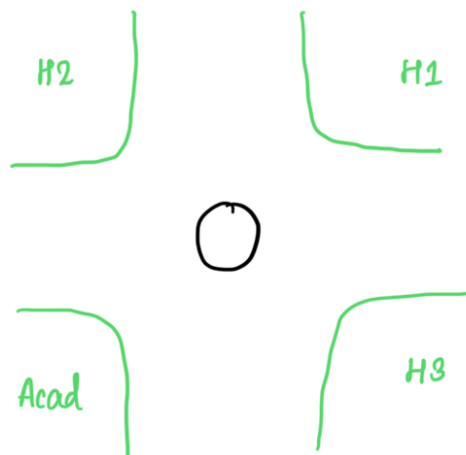only these values are useful

t

Example

Delivery System
Different levels of location accuracy

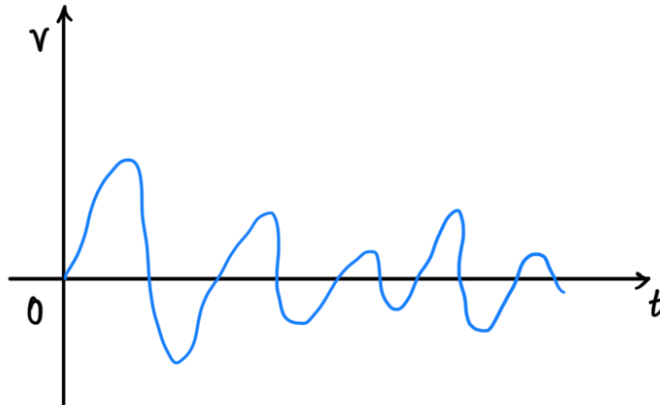Digitization {
— Building name / landmark
— Room no.

H2   H1

Acad

H3

Different layers of abstraction can be added to simplify

a system.

information ⟶ change in some quantity

communicating V(t)

① *fourier, series*
     taylor expansion

$V(t) = A_o + A_1 t + \dots$
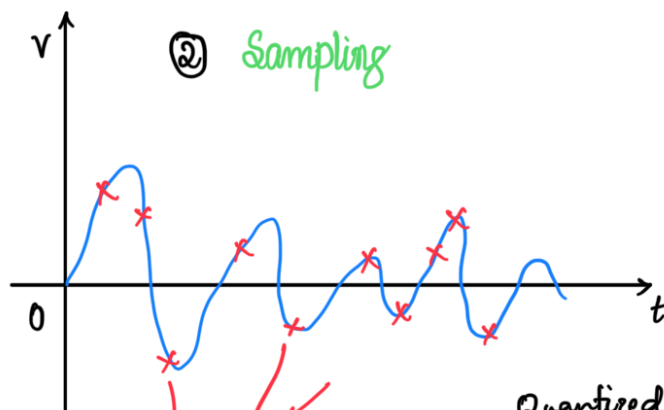
$A_0, A_1, \dots \in \mathbb{R}$

trade-offs:
① no. of terms
② decimal accuracy
     of coefficients

Quantization error

* We need to limit the number of significant digits to represent a physical quantity in a practical manner.

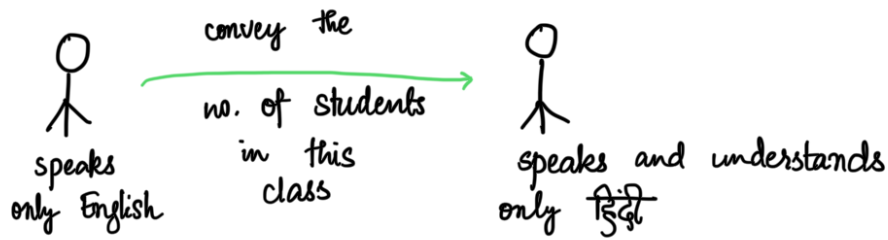This can be achieved using quantization.

② *Sampling*

compressive sampling

Store these values with their timestamps ⟶ synchronized clocks } (Network ...)

Quantized

with infinite precision

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speaks
only English

convey the
no. of students
in this
class

speaks and understands
only हिंदी

How to communicate the count of students to another person?

→ one signal per person (inefficient)

→ for every possible count, define a symbol ≡ people know the same language
   (most efficient)

communi rules becomes inefficient.
-cating
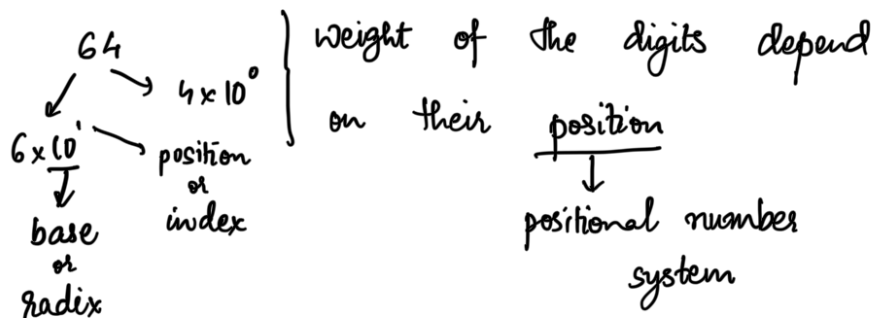
→ 10 / 16 / 8 / 2 symbols

Next : Number Systems

2024/08/01

Number System

→ Decimal → 10 symbols / digits

64
4×10^0
6×10^1 → position or index
↓
base or radix

weight of the digits depend on their position
↓
positional number system

— Number systems that are

→ <u>Hexadecimal (Base – 16)</u>

$(9A2)_{16}$

$= 9 \times 16^2 + 10 \times 16 + 2$

$= 16(9 \times 16 + 10) + 2 \qquad = (2466)_{10}$

$$
\begin{array}{r}
154 \\
16 \\
\hline
924 \\
154 \uparrow \\
\hline
2464
\end{array}
$$

→ <u>Binary (Base 2)</u>

radix point

$(101\overset{\vee}{\,}001)_2$

$= 1 \times 2^0 + 0 \times 2^1 + 1 \times 2^2$

$\quad + 0 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3}$

$= 1 + 4 + \dfrac{1}{8} = (5.125)_{10}$

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tally count

positional ~~number~~
~~system~~

alien

$\begin{bmatrix} \text{Binary number system} \\ \text{with two symbols is} \\ \text{most appropriate} \end{bmatrix}$

digital
- - - - - -
analog

inaccurate $\leftarrow \begin{cases} V = IR \\ I = \dfrac{V}{R} \quad \text{divis} \\ \qquad \text{-ion} \end{cases}$

o Digital circuits using 3 or more symbols

<u>Binary Number System</u>

bits

7 bit binary number

In a n-bit number → total count is 2^n

○ Decimal to binary

```
  0 1 1              1 0 1
  0 1 0              0 1 1
─────────          ─────────
  1 0 1            1 0 0 0
                      ↑
                   overflow
```

overflow → C-program

Next: Negative numbers