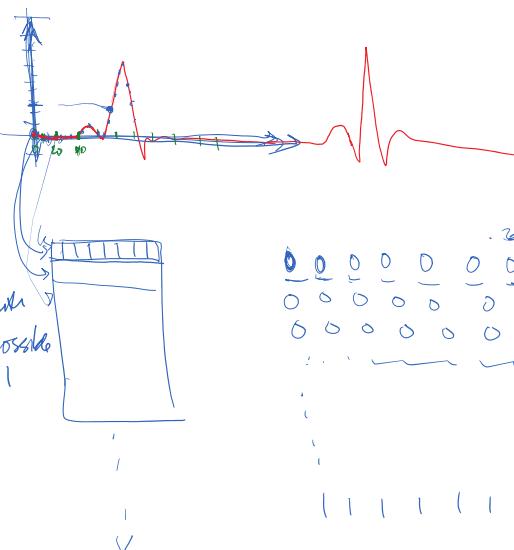


Analog vs digital

Monday, January 25, 2021 9:50 AM

	Analog	Digital	ADC parameter
① Time domain	continuous	discrete	sampling rate
② Amplitude scale.	infinite precision ⇒ continuous	finite precision ⇒ discrete	# of bits.

e.g. 8-bit A/D converts
⇒ ? How many possible
values can I represent



2⁸ possible values.

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1
0	0	0	0	0	0	1	0
...	1	1	0
					1	1	1

$$\# \text{ bits need} = \lceil \log_2(N_{\text{Value}}) \rceil$$

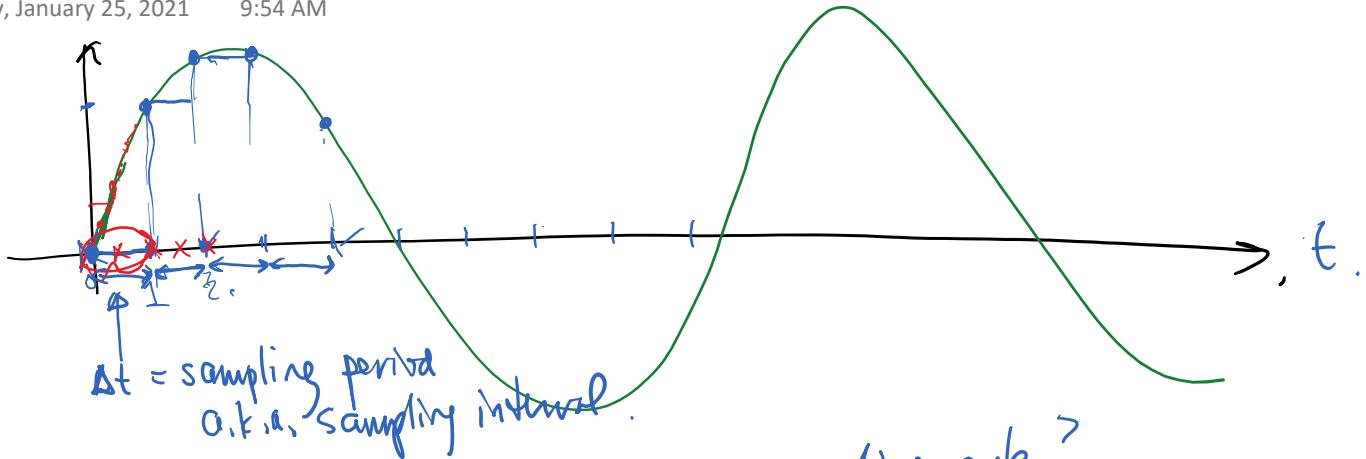
$$\text{or total } \# \text{ possible values} = 2^{N_{\text{bits}}}$$

①

Sampling

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9:54 AM



e.g. $\Delta t = 200\text{ms}$, what is the sampling rate?

f_s = sampling frequency
a.k.a sampling rate.
[samples/sec.] = Hz.

$$\Delta t = 1\text{sec} \Rightarrow f_s = 1\text{Hz.}$$

$$\approx 2\text{sec.} \Rightarrow f_s = \frac{1}{2}\text{Hz.}$$

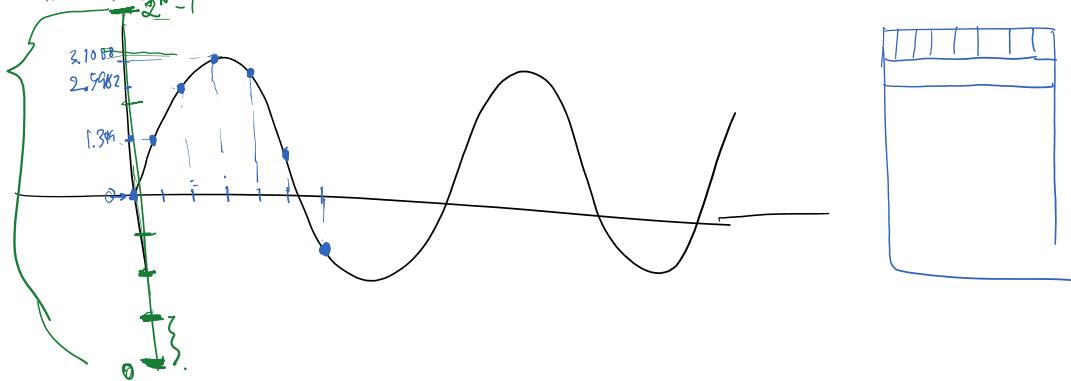
$$\approx 0.5\text{sec.} \Rightarrow f_s = \frac{1}{0.5}\text{Hz} \equiv 2\text{Hz.}$$

500ms.

$$= \frac{200\text{ms.}}{0.2\text{s.}} \Rightarrow f_s = \frac{1}{0.2\text{s.}} = 5\text{sample/sec.} \approx 5\text{Hz}$$

Quantizing

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decimal binary

$$15, \leftarrow 1111$$

5V

4V

3V

2V

1V

0V

4-bit ADC, $\rightarrow 2^4$ possible values
@ 16 "

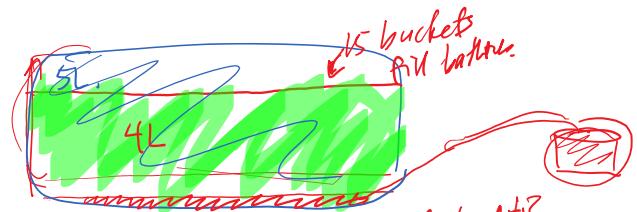
$$\Delta q = \frac{5V - 0V}{2^4 - 1} = \frac{5V}{15} = \frac{1}{3}V \text{ per digital step.}$$

2^N-1 "bucket-fills" or intervals

0 0 0 0	2
0 0 0 1	2
0 0 1 0	2
0 0 1 1	2

Digital value = $\frac{\text{Analog value}}{\Delta q}$.

$$\textcircled{2} \quad \frac{4V}{\frac{1}{3}V} = \textcircled{2} = 0b1\underset{2^3}{\underline{1}}\underset{2^2}{\underline{0}}\underset{2^1}{\underline{0}}\underset{2^0}{\underline{0}}$$



how much water is in each bucket?

$$\frac{4L}{15 \text{ buckets}} = \frac{1}{3}L \text{ per bucket.}$$

Now, if I want to fill tub to 4L
how many buckets do I need?

$$\frac{4L}{\frac{1}{3}L \text{ per bucket}} = 12 \text{ buckets.}$$

Data

Wednesday, January 26, 2022

4:06 PM

A hand-drawn diagram of a 2D array. It consists of a grid of boxes. The first column contains labels: 't=0', 't=3ms', 'G', 'q', and 'I2.'. The second column contains binary strings: '0011 <', '1011 <', '1000', and '1'. A green arrow points from the top of the first column to the top of the second column. A curly brace on the right side groups the entire grid.

t=0	0011 <
t=3ms	1011 <
G	1000
q	
I2.	

array = collection of elements.

matrix = multidimensional array.

Quantization error

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