

# Signal Processing - 1 by One

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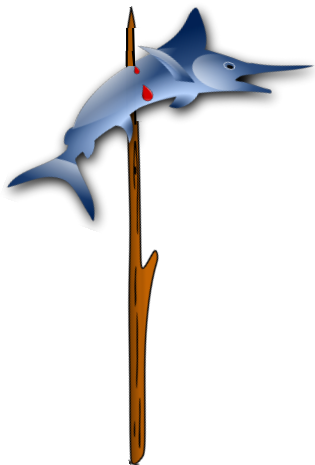


# Sampling: Evolutionary View

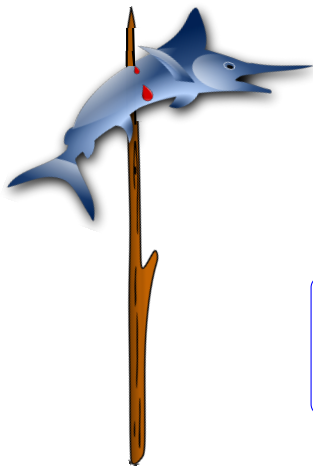
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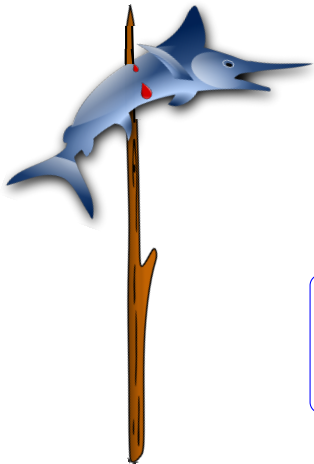
# Sampling: Evolutionary View



Using spears to pick  
the correct samples  
is a practice from  
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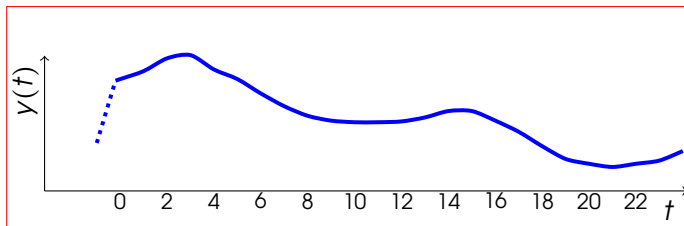
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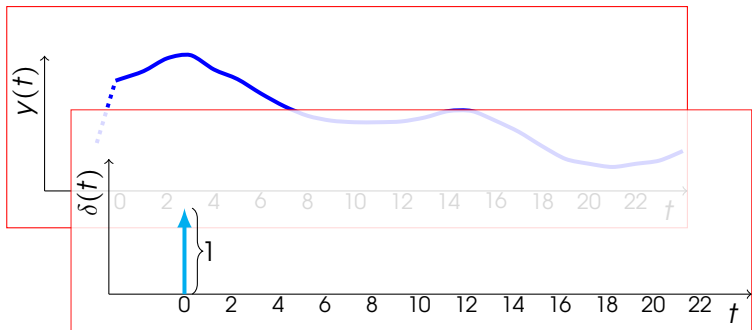
# Pricking an Analog Signal



Sampling Operator:  $y(t) \cdot \delta(t) = y(0)$  at  $t = 0$  when  $y(0)$  well-defined.



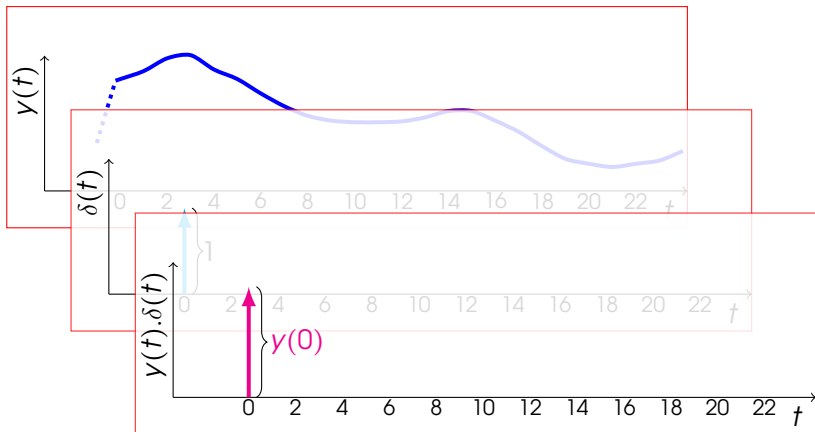
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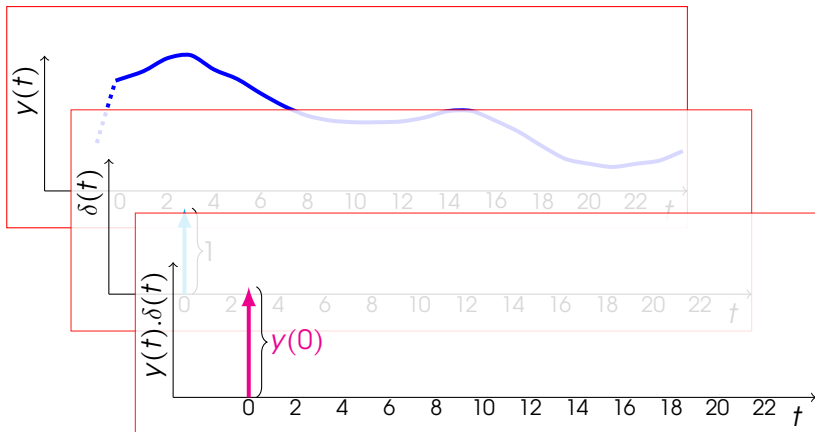


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# Dirac's Formalism

Definition: [**Dirac Delta**] An operator  $\delta(t)$  such that

$$\int_{\mathbb{R}} x(t) \delta(t) dt = x(0),$$

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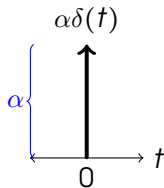
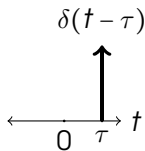
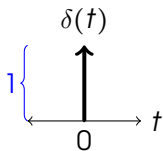
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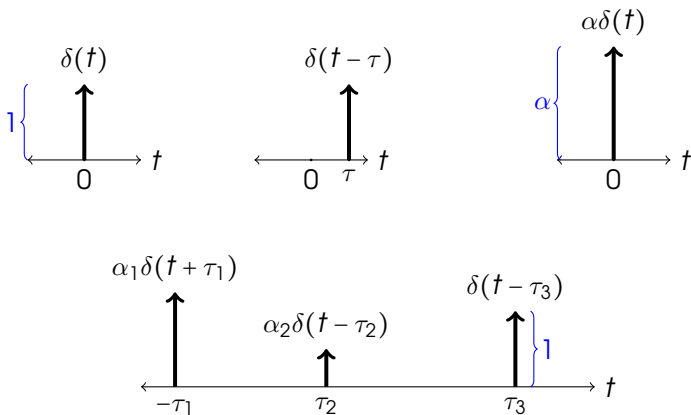
Sampling will be represented as **product** with an impulse,  $y(t) = x(t) \delta(t - \tau)$ , but the operation is **sample and hold**.



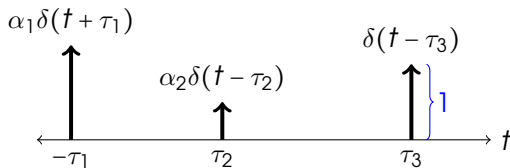
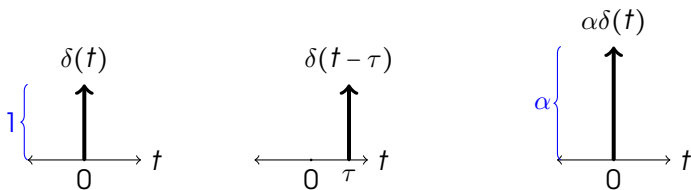
# Impulse Operations



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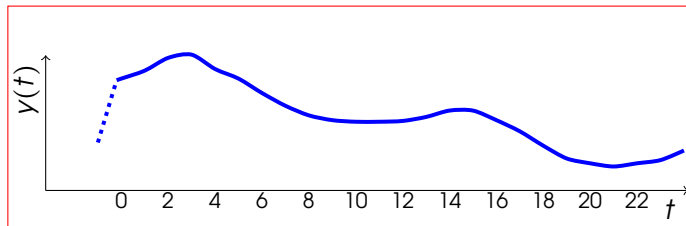
# Impulse Operations



$$f(t) = \alpha_1\delta(t + \tau_1) + \alpha_2\delta(t - \tau_2) + \delta(t - \tau_3) \text{ "Superposition"}$$

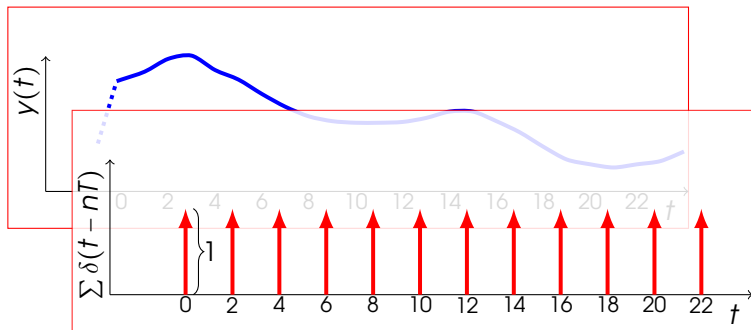


# Periodic Sampling

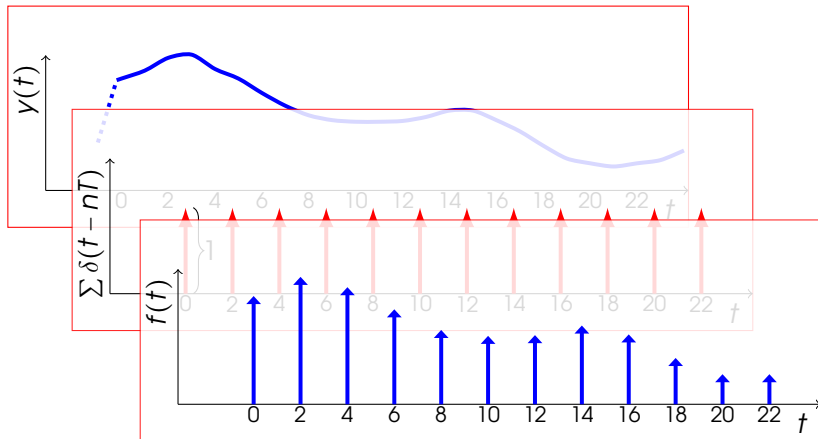




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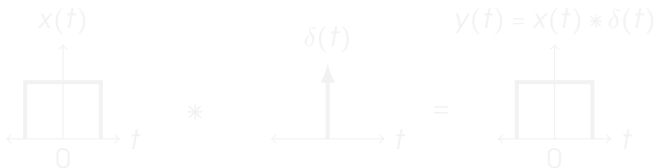


$$f(t) = y(t) \sum_{n \in \mathbb{Z}} \delta(t - nT)$$



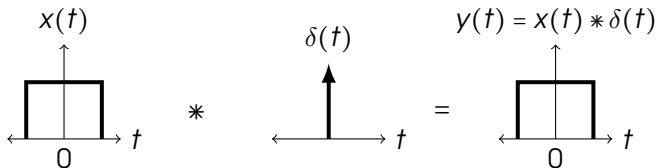
# Replacement Operation

- ▶ Product operation of a signal  $x(t)$  with  $\delta(t)$  is sampling.
- ▶ Star operation with  $\delta(t)$  is defined as:  
replacement of  $\delta(t)$  by the function  $x(t)$ .



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# GnuRadio Experiments

## Options

ID: top\_block

Generate Options: QT GUI

QSS Theme: ...s/projector.qss

## Variable

ID: samp\_rate

Value: 100k

## Variable

ID: leopard

Value: (2.95, 3.05, 3.2, 3...

## QT GUI Range

ID: width

Default Value: 8

Start: 2

Stop: 16

Step: 1

## QT GUI Range

ID: dcycle

Default Value: 1

Start: 1

Stop: 8

Step: 1

