

# EEE 4107 Signals and Communication I.

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3rd June, 2020

# Operations on signals

- ▶ Amplitude scaling: Form the signal  $y(t) = \alpha x(t)$
- ▶ Addition, Subtraction  $x_3(t) = x_1(t) \pm x_2(t)$
- ▶ Multiplication  $x_3(t) = x_1(t)x_2(t)$

# Examples

- ▶ Sketch the following signals
  - ▶  $2u(t)$
  - ▶  $2r(t)$
  - ▶  $u(t) - r(t)$
  - ▶  $e^{-t}u(t)$

# Operations on Signals

- ▶ Time scaling  $y(t) = x(at)$  where  $a > 0$ 
  - ▶ If  $a > 1$  the signal is compressed
  - ▶ If  $0 < a < 1$  the signal is expanded

# Operations on signals

- ▶ Delay (time shifting): a delayed version of a signal  $x(t)$  is given by  $x'(t) = x(t - D)$  where  $D$  is a real number. If  $D > 0$  then we have a delay. If  $D < 0$  we advance.
- ▶ Sketch  $u(t - 1)$
- ▶ Sketch  $u(t) - u(t - 1)$
- ▶ Sketch  $r(t) - r(t - 2)$

# Operations on signals

- ▶ Time reversal (reflection): the time reversed version of a signal  $x(t)$  is given by  $x'(t) = x(-t)$
- ▶ Sketch  $r(-t)$
- ▶ Sketch  $u(-t + 2)$

- ▶ Examples in Jupyter notebook