Fundamentals of Electrical Engineering Signals and Systems

- Definition of a signal
- Kinds of signals
- Signals and information
- Systems
- Fundamental model of communication



# What's a Signal?

**Definition:** A signal is a function.



# Electrical Signals

Electrical signals-voltages, currents, electromagnetic waves-"carry" two different quantities

- Power
- Information



# Kinds of Signals

Analog signal: function of a continuous variable





### Kinds of Signals

Digital signal: function of the integers

84104105115321161011201163210511532973210010510310511697108321151051031109710846





#### Kinds of Signals

#### Images: s(x, y)





Video: 
$$s(x, y, t) = \begin{bmatrix} r(x, y, t) \\ g(x, y, t) \\ b(x, y, t) \end{bmatrix}$$



#### Where's the Information?

- Information does not exist without a signal representing it
- Information *encoded* in a signal by modifying the signal's structure

$$s(t) = A \sin(2\pi f_0 t + \phi)$$

• *Systems* operate on signals to produce a modified signal and to extract information





# Fundamental Model of Communication



