A given input into a specific output
Transformation on operators in a system maps to unique and absolute mathematical as a unique system.

Digital System Design

LECTURE 1
The acceleration depends on the position of the system. The speed of a car can be any value which is 
\[ \frac{dx}{dt} \] 

\( x \) can take any value 
\[ x \neq \pm x(t), \quad t > 0 \]

\( x \) is a continuous stream of information (signal) that transfers

Continuous or Analog Systems

Continuous vs. Discrete Systems
\( x(n) = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \} \ldots \)

Hence, to "truncate" could be:

And its values form a tuple from \( x(n) \) can be like gate, 2m gear, ... 

The gear ratios on a manual.

\( \overline{\text{Ex}} \)

or variables.

\( x \) can take only a fixed number.

\( \overline{x} \)

By a finite number of digits.
Elements or information represented 
\( x \) is a sequence of discrete 

Discrete or \( \overline{\text{Discrete}} \) system.
A bit, for binary digits.

Eleven of the strange, is referred to as

we call it a binary system and each

If $x(\ell)$ is a string of only 0's and 1's,

\[ x(\ell) = \{ 000, 020, 120, 493, \ldots \} \]

\[ e.g. \ x(\ell) = \{ 000, 020, 120, 493, \ldots \} \]

This is called a decimal system.

And each digit can be two symbols, 0, 1, "2", "3", "4"...

If $x(\ell)$ is a string, say, of three digits

Symbols: "0", "1", "2", "3", "4".

One digit, one of five possible (fixed) values or

In the example above, $x(\ell)$ is a string of only
Advantages of Digital Over Analog Systems...

- Digital meters, digital watches, clocks, etc.
- Digital systems: Digital computers, CD's, DVD's, etc.
- Analog meters (voltmeters, ammeters, etc.) Analog voltages
- Analog systems: Analog computers, AM/FM radio, some amplifiers,
To be processed by a digital system, analog signals (information) must be converted into digital information. So, continuous (analog) signals (information) in nature. Digital systems and the real world.
The A/D converter samples the input signal at regular intervals (MP3 @ 48kHz, 22kHz, ...). Each sample is then converted (quantized) to binary digits (bits) (MP3 with 8 bits, 16 bits...). Loss of information leads to quantization error vs. accuracy of signal.

Audio (headphones/speakers)

Line in

A/D

D/A

MPC Recorder Player
To increase accuracy: use Bits/Sample Sampling Rate

\[ x(n) = \{ 011, 101, 110, 101, 110, 110, 100, 111 \} \]

The J/A Converter reconstructs a continuous signal from the sequence of integers (by interpolation).