







- Are analog signals necessarily as clean as the image suggests?
- No:
  - > "imperfections" in source
  - > Background noise, other interference
  - ➤ If recorded:
    - Limitations of recording technology
      Noise in the recording
    - Limitations of the playback technologyNoise in the playback









# Analog to Digital Conversion

- Take *samples* of original signal
  - > Sample: measurement at a particular point in time
- Can vary:
  - > Frequency of the samples
  - > Number of levels of quantization

# Quantization

- Original signal must be converted to a discrete value
- The range of values depends on the number of bits allocated
- 8 bits
  - Range from 00000000 to 11111111 (binary)0 to 255 (decimal)
- 16 bits

> 0 to 65535

> Range from 000000000000000 to 11111111111111

# Demo on 1D Signals

- Varying sample frequency
- Varying quantization
- Lines to illustrate error



### Rasterization

- Discretization of an image
- Continuous image must be mapped to a pixel grid
- Each pixel may store one and only one value
- Also have quantization
  - > # bits allocated for color
- Sampling frequency determined by grid resolution

### **Rasterization Demo**



# Vector vs. Raster Graphics

#### Vector Graphics

- Vector graphics use a continuous representation
  e.g. floating point coordinates,
  - > U.g. Hoating point coordinates, object parameters
     > Will be rasterized when they
  - are rendered, but this hasn't happened yet
  - Can be more compact to store
    Can be rendered at any resolution

#### **Raster Graphics**

- Raster graphics have already been converted to a pixel grid
   Can be larger
  - Resolution cannot be changed (easily)
  - > If a higher resolution is
    - needed, image will look jagged