Overview

- Sampling and Digitizing a Signal
- Logic Analyzer vs. Oscilloscope
- Logic Analyzer Operation
Sampling and Digitizing a Signal

• Signal acquisition:
  – Sampling input signal
  – Digitizing it to convert to digital data
  – Assembling it into a waveform record

• Logic analyzer converts incoming data into ones and zeros
  – Uses comparator with user-selectable threshold
  – Samples data at regular time intervals
  – Reference: Figure 2-1, Tektronix extract
Logic Analyzer vs. Oscilloscope

• Oscilloscope samples incoming signal at regular time intervals.
  – Stores sample amplitude into 8-bit digital value.
  – Preserves amplitude information
  – Signal is analog in nature

• LA monitors multiple channels simultaneously
  – Signal is digital in nature
  – Provides timing relationship information

• Both are powerful analysis, troubleshooting tools
Logic Analyzer Operation

Data from target system → Probes → Comparator

Threshold Voltage

Comparator → Sampler

Clock
- Internal (asynchronous)
- External (synchronous)

Sampler → Memory

Trigger
Logic Analyzer Operation

• Clocks control when data is sampled

• Types of clocking
  – External (synchronous) - listing data
    • clock source external to LA
    • useful for obtaining state aspects of data
  – Internal (asynchronous) waveform data
    • data may be lost between clocks
    • asynchronous provides all data
    • useful for obtaining timing aspects of data
Logic Analyzer Operation

• Acquiring data
  – Logic analyzer samples data from probes
  – Sample taken when clock occurs

• Triggering
  – Trigger program looks at sampled data for specific events and then takes specified action
  – Also provides storage qualification conditions.
    • If met, allows data to be stored in memory
Waveform Data Concepts

- Use LA to observe timing relationship between signals
- All waveforms are time-aligned horizontally and displayed in same time per division
- Can display waveforms or magnitude mode.
  - Provides hexadecimal value of multi-channel bus
Waveform Data Concepts

• Sampling resolution
  – Waveform accuracy depends on sample clock rate used to record incoming signals (remember Nyquist Criteria !?)
  – If sampled too slow, aliasing will occur (Ref: 2-13)
• LA has fixed memory
  – Trade-off between resolution of recorded signal and its duration
  – A faster sample clock will record a smaller portion of the signal