

# Testing, Simulation and Debugging Techniques and Tools :

## Lesson-3

### Laboratory Tools

# 1. Hardware Diagnostic Laboratory Tools

# Hardware Diagnostic Laboratory Tools

- Volt-Ohm meter— useful for checking the power supply voltage at source and voltage levels at chips power input pins, and port pins initial at start and final voltage levels after the software run, checking broken connections, improper ground connections, and burnout resistances and diodes.

# Hardware Diagnostic Laboratory Tools

- LED test — useful for testing port outputs and when using port conditions 1 or 0 for debugging a particular set of conditions

# Hardware Diagnostic Laboratory Tools...

- Logic Probe
- Oscilloscope
- Logic Analyser
- Bit Rate meter
- ICE
- System Monitor Codes

## 2. Use of Logic Probe

# Use of Logic Probe

- Simplest hardware test device.
- Handheld pen like device with LEDs – Glows green for '1' and red for '0'
- Important tool when studying the long port-delay effects ( $>1s$ ).
- Delay program tests the presence of system clock ticks

### 3. Use of Oscilloscope



# Uses of Oscilloscope

- Screen to display two signal voltages as a function of time
- Displays analog as well as digital signals as a function of time
- Noise detection tool
- Mal-function detection of a sudden transitions between '0' and '1' states during a period.

## 4. Use of Logic Analyzer

## Uses of Logic Analyser

- A powerful hardware tool for checking multiple lines carrying address, data and control bits, IO buses, ports, peripherals and clock.
- Recognizes only discrete voltage conditions, '1' and '0'.

## Logic Analyser ...

- Collects, stores and tracks multiple signals and bus transactions simultaneously and successively.
- Reads multiple input lines (24 or 48) and later displays, using this tool, each transaction on each of these on computer monitor (screen) observed

## Logic Analyser ...

- Also shows states on the horizontal axis instead of time in its state mode of display.
- Displays the logic states of a particular line as a function of '0' and '1' on another line.
- Catches intermittent bugs

## Logic Analyser ...

- Does not help on a program halt due to a bug.
- Does not show processor register and memory contents, if the processor uses caches then a bus examination alone may not help.

# Logic Analyser ...

- Cannot modify the memory contents and input parameters and study their effects [simulator needed as that helps in studying these effects]

## Logic Analyzer two modes of functioning

- One mode— to show time on x-axis, and logic states of the clock signal, bus signals and other signals on y –axis.
- Second mode — to give address, data bus and other signal states from a trigger point to examine illegal op-codes, access in protected address space and other states as a function of a reference state.



## 5. Use of Bit rate meter

## Use of Bit rate meter

- A measuring device that finds numbers of '1's and '0' in the pre-selected time spans.
- Measures throughput.
- can estimate bits '1's and '0's in a test message and then use bit rate meter to find whether that matches with the message.

# Summary

## We learnt

- Volt Ohm meter
- LED
- Logic probe
- Oscilloscope used to test the fast changing signals, their wave forms, overshoots and undershoots at transitions.

## We learnt

- Logic analyser used to measure logic states on many connections simultaneously.
- Bit rate meter to test by measuring number of bit changes in given time span and expected ones

# End of Lesson-3 of chapter 14 on Laboratory Tools