Protocol Violations Considered Harmful

What happens if the processor reads KBDR before a key is ready?

The bits read have no meaning.

(In some implementations, they may not even be bits!)

13

LC-3 Output Also Uses Two Registers

LC-3 has only one input device: the keyboard.

And **one output device: the display**.

In LC-3, output is also based on ASCII.*

And LC-3 uses two more 16-bit registers…
- **DDR: Display Data Register** (the character)
- **DSR: Display Status Register** (the status signal: ready or not ready?)
  *Not generally true of actual devices; take ECE391.

14

LC-3 Changes Status Signal Implicitly with Display

Display is initially "ready" to display a character.

1. LC-3 processor writes character into **DDR**, **implicitly changing status bit to 0** (not ready) by flipping processor's SYNC signal.
2. Display reads and displays the character.
3. Display changes status bit to 1 (ready) by flipping display's SYNC signal.
4. LC-3 processor waits to observe 'ready' before writing another character (step 1).

15

Processors May Spend Many Cycles Waiting

In practice, LC-3 code
- must begin by waiting for 'ready,' (Step 4)
- as the code cannot know whether other code has already used the display.

Generally,
- the display is slower than the LC-3, so
- the LC-3 may spend many cycles waiting.

Humans are even slower, so waiting for keystrokes takes even longer.

16