Master of Computer Applications

# CAPOL403R01: Computer Organization & Architecture

## Unit V: Lecture 2
## Programmed IO

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# Techniques for IO

- Programmed IO
- Interrupt driven IO
- Direct Memory Access

| | No Interrupts | Use of Interrupts |
|---|---|---|
| **I/O-to-memory transfer through processor** | Programmed I/O | Interrupt-driven I/O |
| **Direct I/O-to-memory transfer** | | Direct memory access (DMA) |

# Programmed I/O

- IO instructions are a part of the program
- Processor executes the IO instruction to the appropriate IO module
- The IO module will perform the requested action
- The IO module will set the appropriate bits in the IO status register
- The IO module won’t alert the processor
- Processor has to check the status of IO module periodically to know the completion of the operation

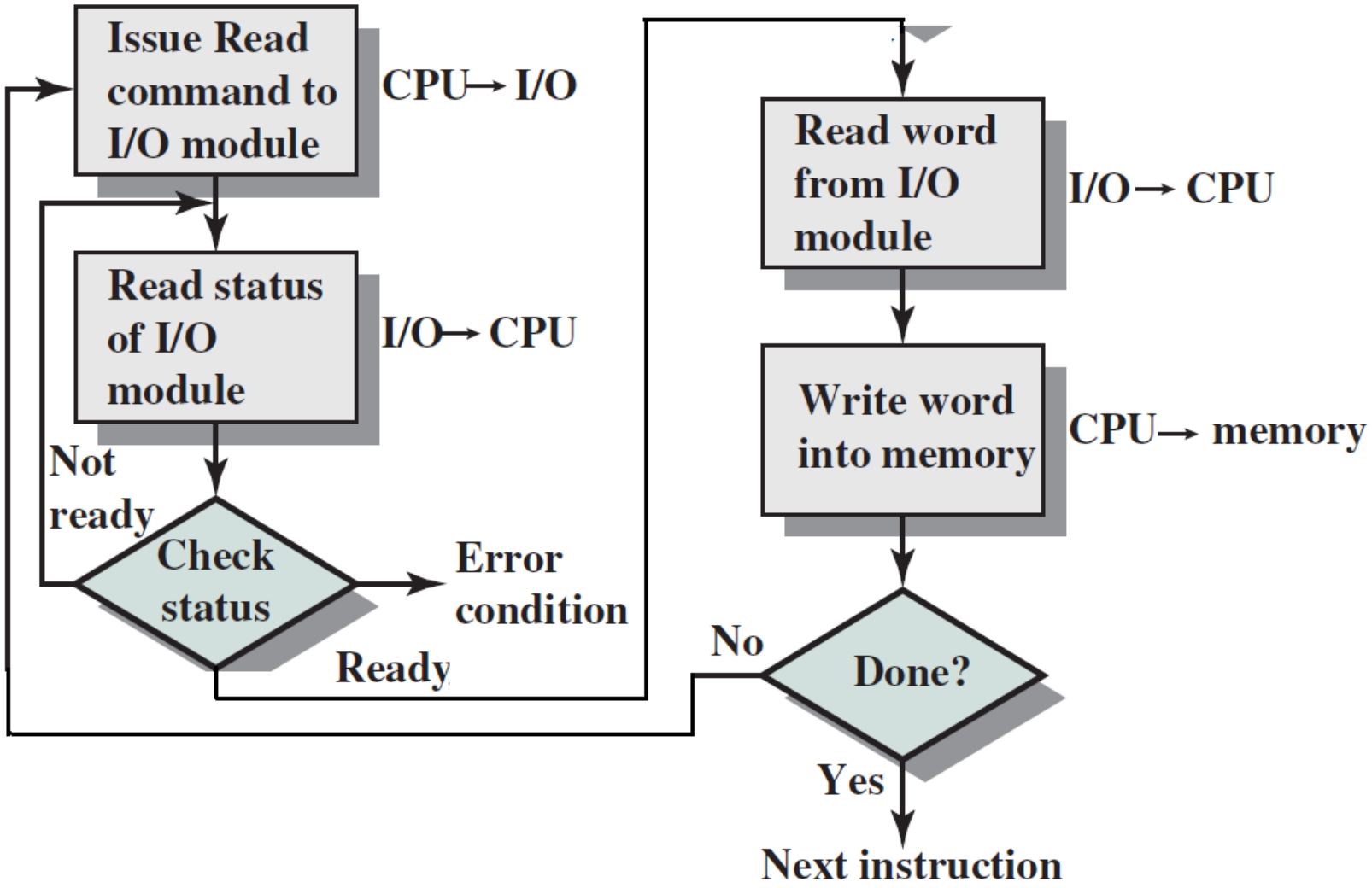
# I/O Commands

- Control
  - This command is used to activate a peripheral
  - It instructs the IO module what to do
  - These commands are tailored to the particular type of peripheral device
  - For example, a printer may receive commands like paper size, layout, printing details etc.,
- Test
  - This command is used to test various status conditions associated with an IO module and its peripherals
  - The processor will want to know that the peripheral of interest is powered on and available for use
  - It will also want to know if the most recent I/O operation is completed and if any errors occurred

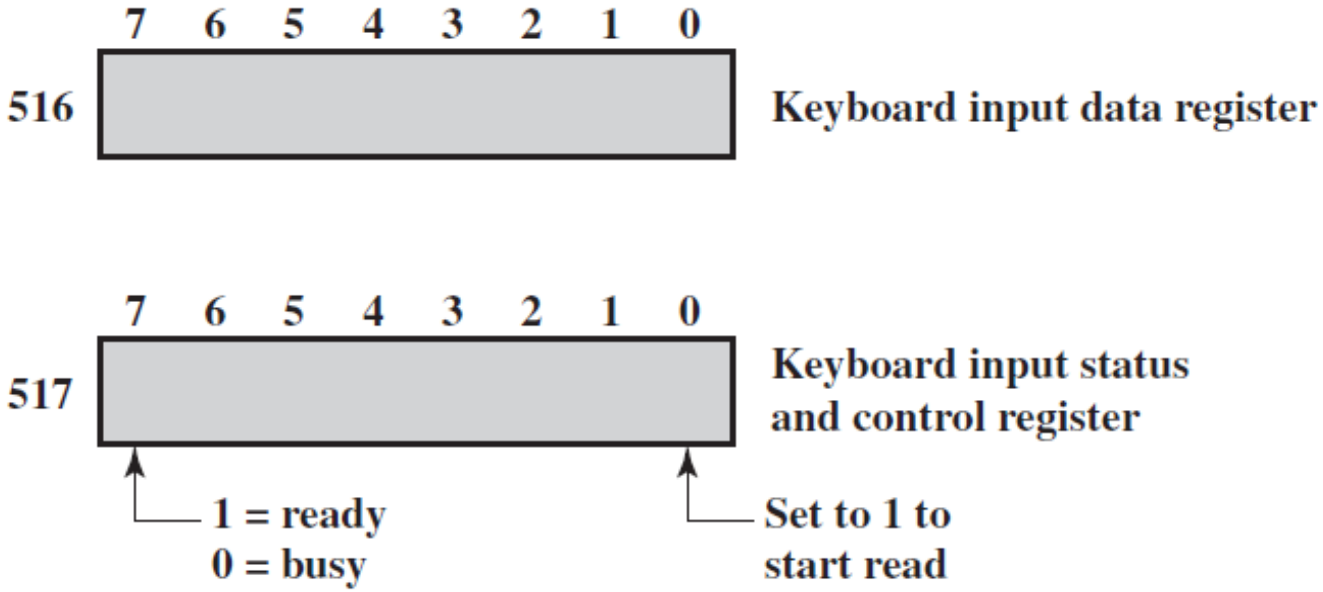
# I/O Commands

- Read
  - This command causes the I/O module to obtain an item of data from the peripheral and places it in an internal buffer
  - The processor can then obtain the data item by requesting that the I/O module place it on the data bus
- Write
  - This command asks the I/O module to take an item of data (byte or word) from the data bus
  - The IO module transmits that data item to the peripheral

# Memory write operation



# Memory mapped IO




| ADDRESS | INSTRUCTION | OPERAND | COMMENT |
|---|---|---|---|
| 200 | Load AC | "1" | Load accumulator |
| | Store AC | 517 | Initiate keyboard read |
| 202 | Load AC | 517 | Get status byte |
| | Branch if Sign = 0 | 202 | Loop until ready |
| | Load AC | 516 | Load data byte |

# Isolated IO

- Special instructions are used for IO communication
- Two sets of read/write instructions are available
- Let’s assume the keyboard is connected to the address ‘5’
- An example for memory write (or IO read) is given below

| ADDRESS | INSTRUCTION | OPERAND | COMMENT |
|---|---|---|---|
| 200 | Load I/O | 5 | Initiate keyboard read |
| 201 | Test I/O | 5 | Check for completion |
| | Branch Not Ready | 201 | Loop until complete |
| | In | 5 | Load data byte |

*Thank you*