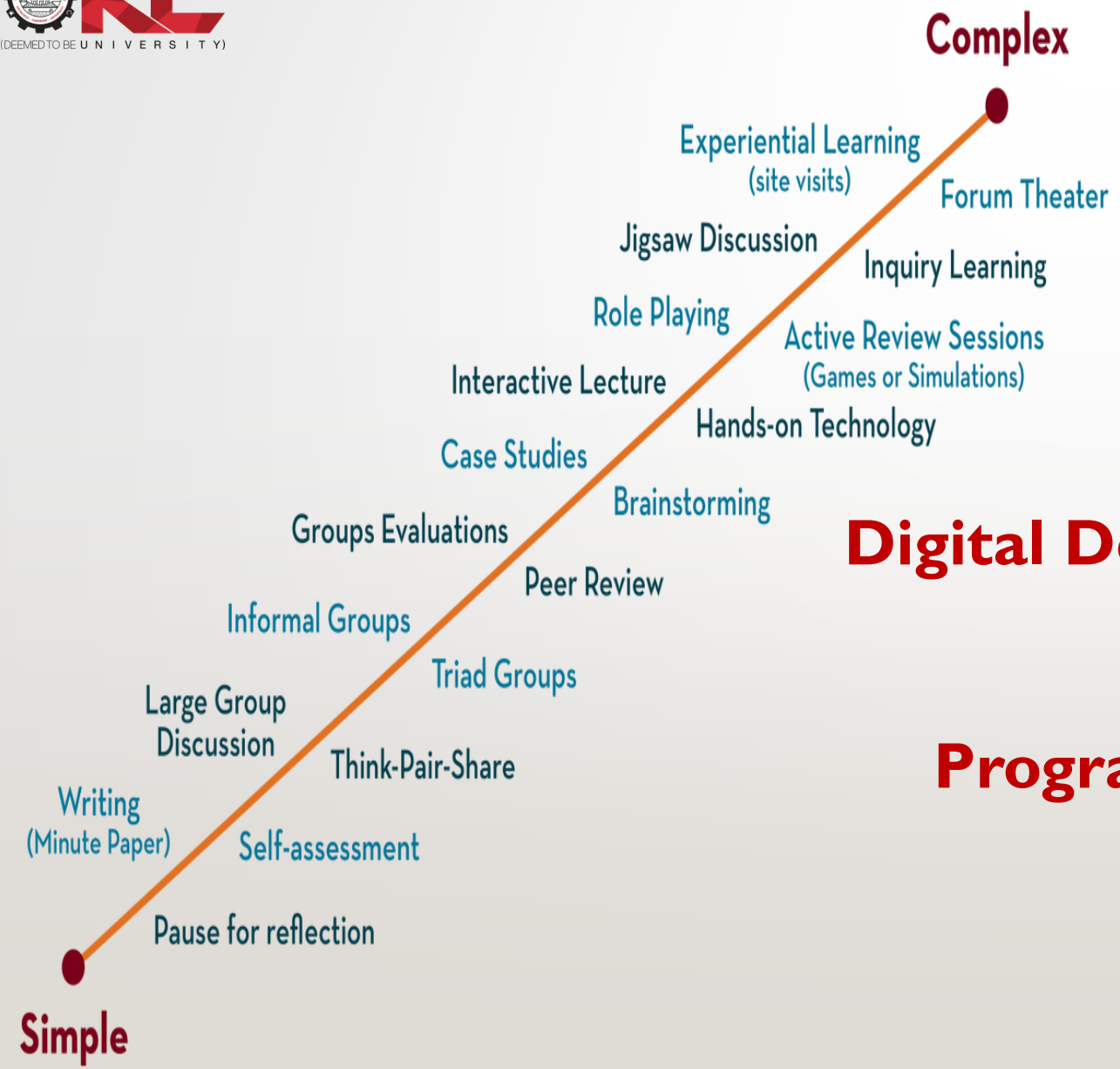


Department of BES-II

Digital Design and Computer Architecture

23EC1202

Topic:

Programmed IO, Interrupt driven IO

Session No: 39

AIM OF THE SESSION

To familiarize students with the basic concept of Programmed IO, Interrupt driven IO.

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

1. Demonstrate the Programmed IO, Interrupt driven IO
2. Describe the Programmed IO, Interrupt driven IO
3. List out the importance of Programmed IO, Interrupt driven IO

LEARNING OUTCOMES

At the end of this session, you should be able to:

1. Define the Programmed IO, Interrupt driven IO
2. Describe the Programmed IO, Interrupt driven IO
3. Summarize the Programmed IO, Interrupt driven IO

SESSION INTRODUCTION

Programmed I/O

- The programmed I/O was the simplest I/O technique for exchanging data or any communication between the processor and the external devices.

- Data transfer is initiated through instructions stored in the computer program.

Interrupt Driven I/O

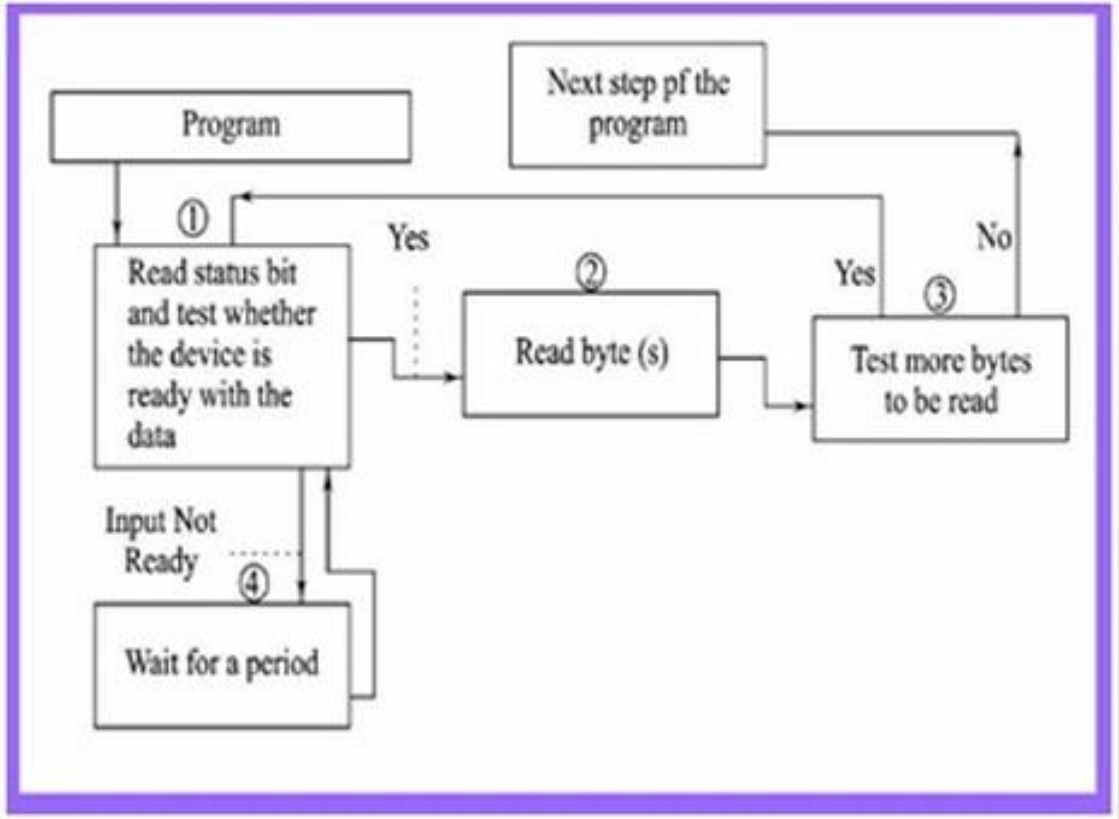
- The I/O transfer is initiated by the interrupt command issued to the CPU.

- There is no need for the CPU to stay in the loop as the interrupt command interrupts the CPU when the device is ready for data transfer.

Programmed I/O

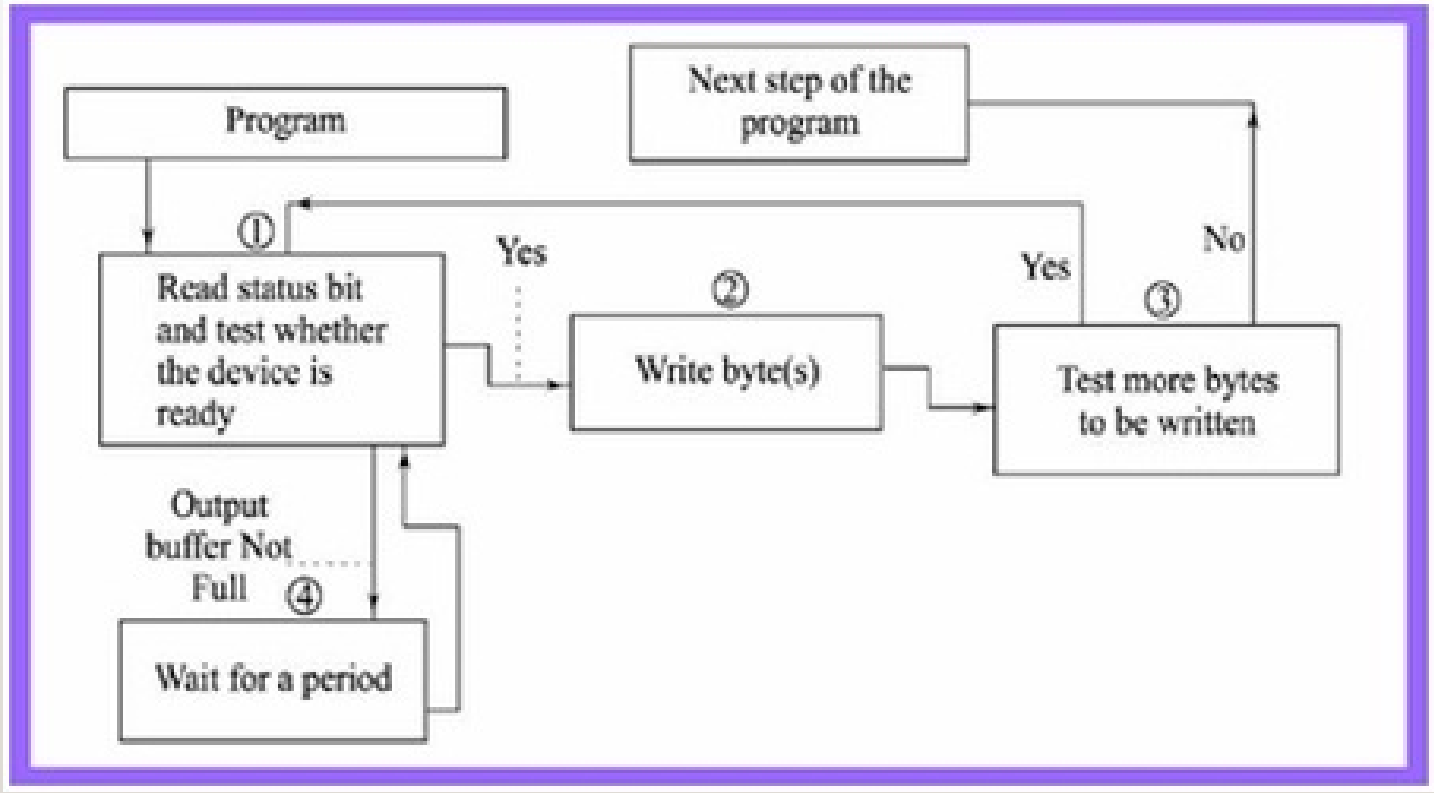
- With programmed I/O, data are exchanged between the processor and the I/O module. When the processor issues a command to the I/O module, it must wait until the I/O operation is complete.
- The overall operation of the programmed I/O can be summaries as follow:
  - The processor executes a program and encounters an instruction relating to I/O operation.
  - The processor executes that instruction by issuing a command to the appropriate I/O module.
  - The I/O module will perform the requested action based on the I/O command issued by the processor (READ/WRITE) and set the appropriate bits in the I/O status register.
  - The processor will periodically check the status of the I/O module until it finds that the operation is complete

Programmed I/O (Cont..)



Execution of Programmed I/O input data transfer

Programmed I/O (Cont..)



Execution of Programmed I/O Output data transfer

Programmed I/O (Cont..)

Advantages of Programmed I/O

- Easy implementation
- Requires less hardware support

Disadvantages of Programmed I/O

- Busy waiting
- ties up CPU for long period with no useful work

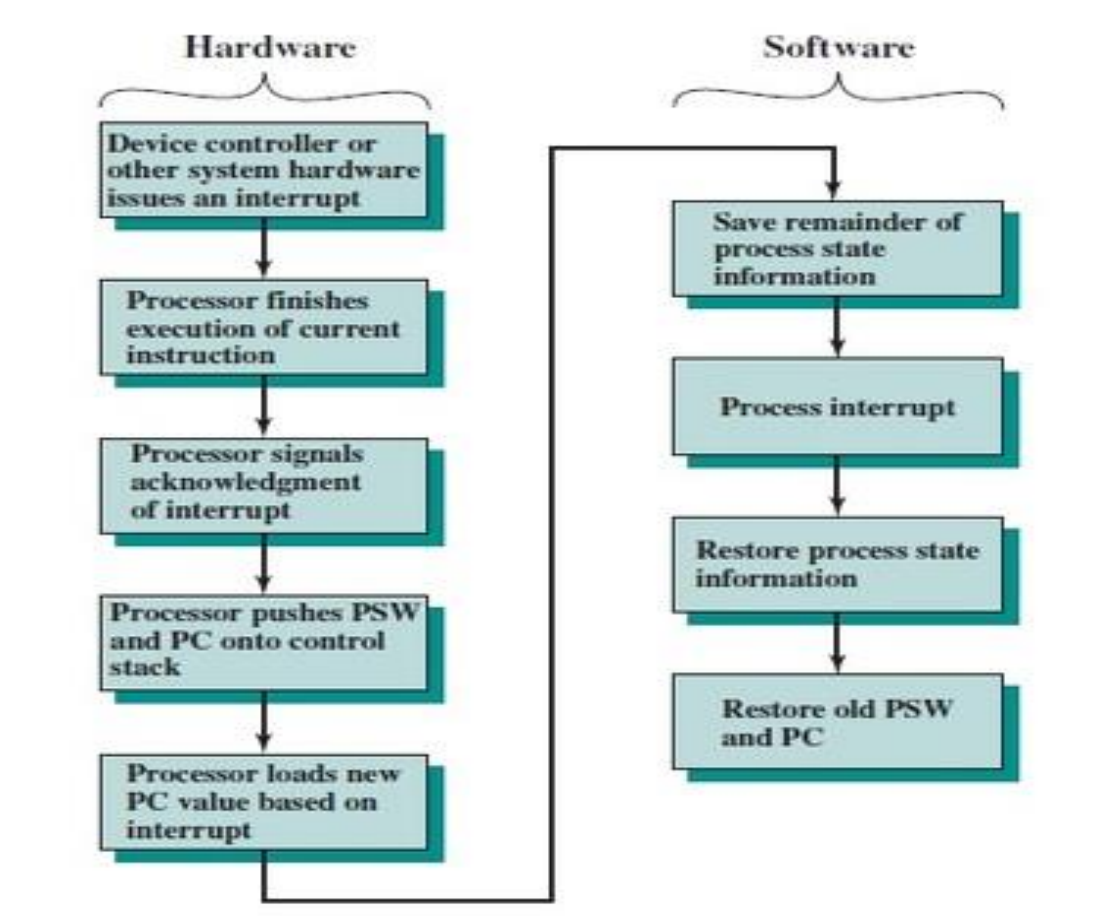
Interrupt driven I/O

- Interrupt I/O is a way of controlling input/output activity whereby a peripheral or terminal that needs to make or receive a data transfer sends a signal.
- This will cause a program interrupt to be set. At a time appropriate to the priority level of the I/O interrupt.

Basic operations of interrupt-driven I/O

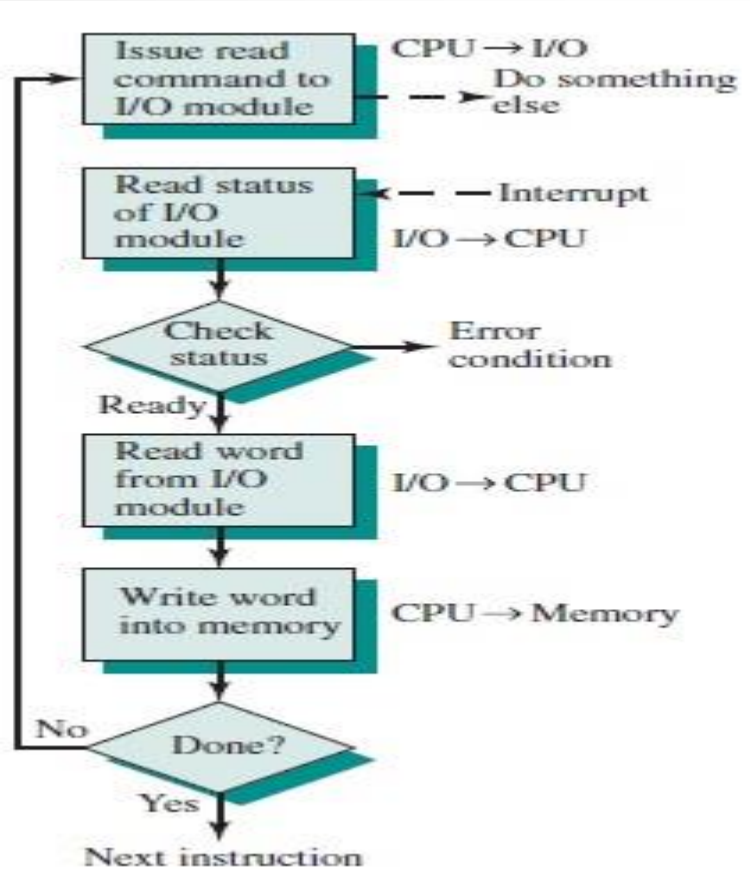
- CPU issues read command.
- I/O module gets data from peripheral whilst CPU does other work.
- I/O module interrupts CPU.
- CPU requests data.
- I/O module transfers data.

Interrupt driven I/O (Cont..)



Simple interrupt processing

Interrupt driven I/O (Cont..)



Interrupt processing

Interrupt driven I/O (Cont..)

Advantages of Interrupt driven I/O

- Fast
- Efficient

Disadvantages of Interrupt driven I/O

- Can be tricky to write if using a low level language
- Can be tough to get various pieces to work well together
- Usually done by the hardware manufacturer / OS maker, e.g. Microsoft

SUMMARY

- The programmed I/O was the simplest I/O technique for exchanging data or any communication between the processor and the external devices. Data transfer is initiated through instructions stored in the computer program.

- The I/O transfer is initiated by the interrupt command issued to the CPU. There is no need for the CPU to stay in the loop as the interrupt command interrupts the CPU when the device is ready for data transfer.

SELF-ASSESSMENT QUESTIONS

1. Disabling an interrupt is known as…

(a) Making

(b) run

(c) halt

(d) stop

2. Which hardware triggers some operations after certain program count?

(a) Programmable timer

(b) interrupt timer

(c) programmable interval timer

(d) None of these

SELF-ASSESSMENT QUESTIONS

3. In general two request lines are

(a) nonmaskable and maskable interrupt

(b) maskable interrupt

(c) nonmaskable interrupt

(d) blocked interrupt

4. The first instruction of bootstrap loader program of an operating system is stored in

(a) RAM

(b) Harddisk

(c) BIOS

(d) None of these

TERMINAL QUESTIONS

Long answer questions:

1. Construct a flowchart for the utilization of Programmed I/O in a traffic light control system.
2. In designing a real-time system for an autonomous drone, evaluate the pros and cons of Programmed IO versus Interrupt-driven IO, and recommend the most suitable approach for ensuring timely data processing and control.
3. Utilizing interrupt-driven I/O, build a flow diagram for the purpose of sensing data from external devices in a data acquisition system.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer Organization by Carl Hamacher, Zvonko Vranesic and Saftwat Zaky.
2. Computer System Architecture by M. Morris Mano
3. Computer Organization and Architecture by William Stallings

Sites and Web links:

1. https://www.geeksforgeeks.org/difference-between-programmed-and-interrupt-initiated-i-o

THANK YOU

(DEEMED TO BE UNIVERSITY)

Team – Digital Design & Computer Architecture