Q.1. What are the major functions of an I/O module?

Ans I/O module stands for Input/Output module, which is a device that acts as the connective bridge between a computer system at one end and an I/O or peripheral device of some kind at the other, such as a printer, webcam or scanner. This enables a computer system to carry out its intended function, which is to communicate with the external world in whichever way it needs to.

- The key tasks of I/O Module's

① Processor communication:
This involves a number of tasks, primarily the transference of data between the processor and an I/O module, accepting and decoding commands sent by the processor, reporting of current status, and an ability for the I/O module to recognise its own unique address

② Device communication:
It needs to be able to perform standard device communications, such as reporting of status.

③ Control and timing:
An I/O module needs to be capable of managing data flow between a computer's internal resources and any connected external devices.

④ Data buffering:
A crucial function that manages the speed discrepancy that exists between the speed of

transfer of data between the processor and memory and peripherial devices

(5) Error detection:

Detecting errors, whether mechanical (such as a printer experiencing a paper jam) or data based, and reporting them to the processor is another vital function of an I/O module.

- Thus, without an I/O module the ability for the exchange of data between a processor and a peripheral device is non-existent, also making the ability to interpret data into information ready for communication and consumption impossible.

Q2. Compare memory mapped I/O programmed I/O

Ans

Memory mapped I/O	Programmed I/O
(1) External asynchronous input is used to tell the processor that I/O device needs its services and hence processor does not have to check whether I/O devices needs it services or not	(1) Processor has to check each I/O device in sequence and in effect 'ask' each one if it needs communication with the processor.
(2) The processor is allowed to execute its instruction in sequence and only stop to service	(2) During polling processor is busy and therefore have serious and decremented effect on

Memory mapped I/O	Programmed I/O
I/O device when it is told to do so by the device itself, this increased system throughput	effect on system throughput
③ Implemented using interrupt hardware support	③ It is implemented without interrupt hardware support
④ Must be enabled to process interrupt driven I/O	④ Does not depend on interrupt states
⑤ System throughput does not depend on number of I/O devices connected in the system.	⑤ System throughout decreases as number of I/O devices increases.

Q3 Write note on interrupt driven I/O

Ans ① This technique is used to overcome the limitation of programmed I/O.

② In interrupt driven I/O, instead of making the processor to verify the status of I/O module. It is the responsibility of I/O module to intimate the processor by interrupt signal.

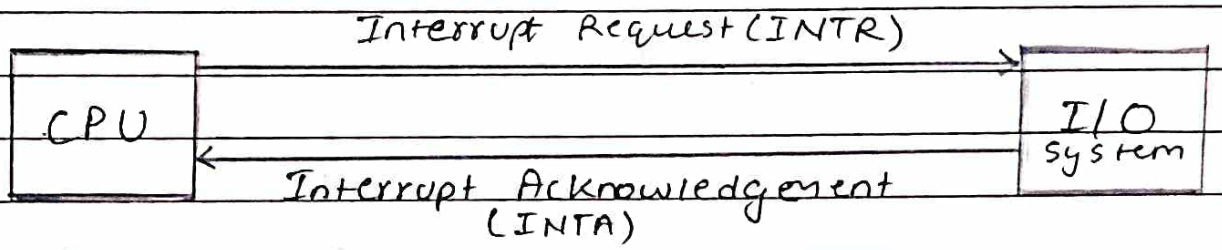
③ CPU responds to interrupt signals and stores the return address from the program counter (PC) into the memory stack and then the control branches to a interrupt service routine (ISR).

④ ISR processes the required I/O Transfer

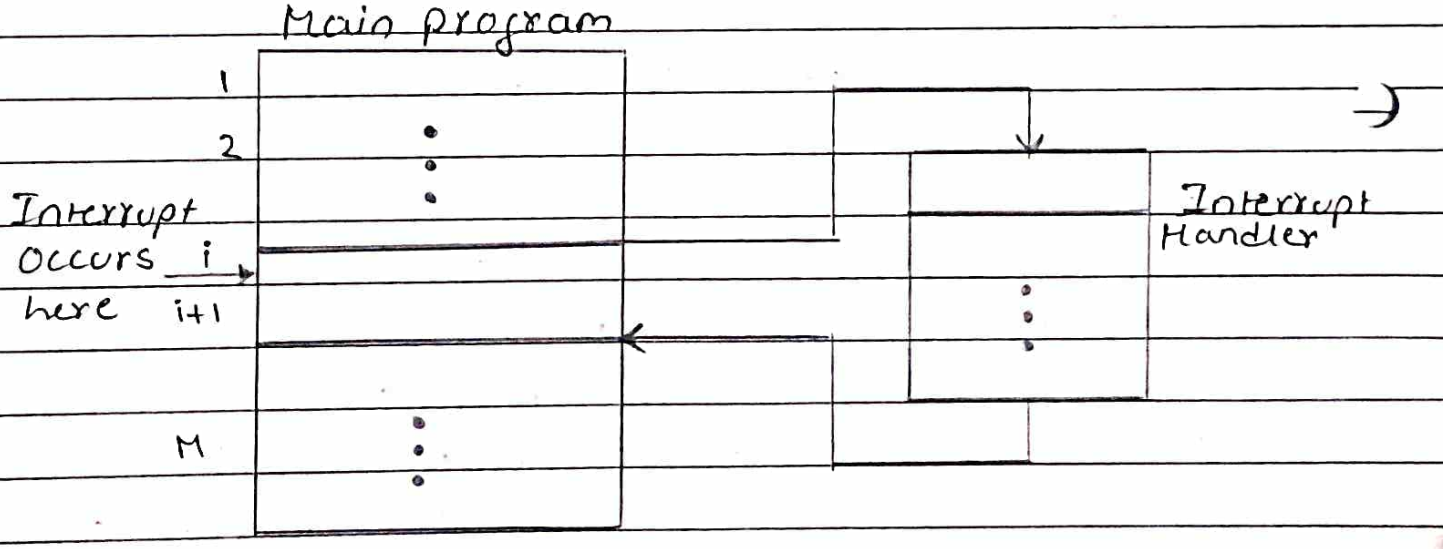
(5) After completion of executing interrupt routine CPU returns to previous program and continue what it was doing before.

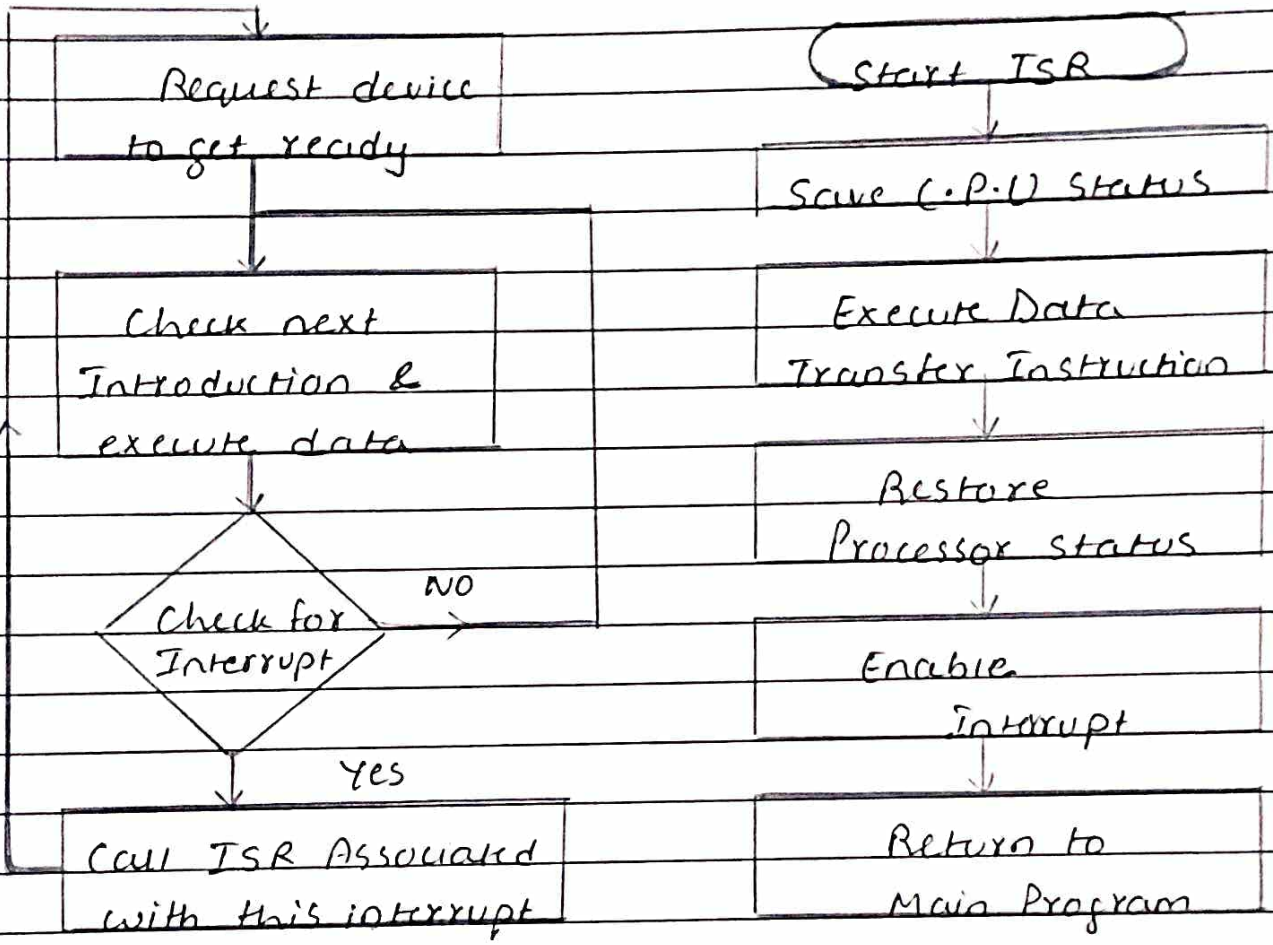
Interrupt

- An interrupt or exception causes CPU to transfer the control temporarily from its current program to anther program i.e. interrupt handler.
- Block Diagram for Interrupt Driven I/O.



Transfer control from main program to Interrupt Handler





Q4 What is the need of DMA? Explain its various techniques of data transfer.

Ans

DMA Function

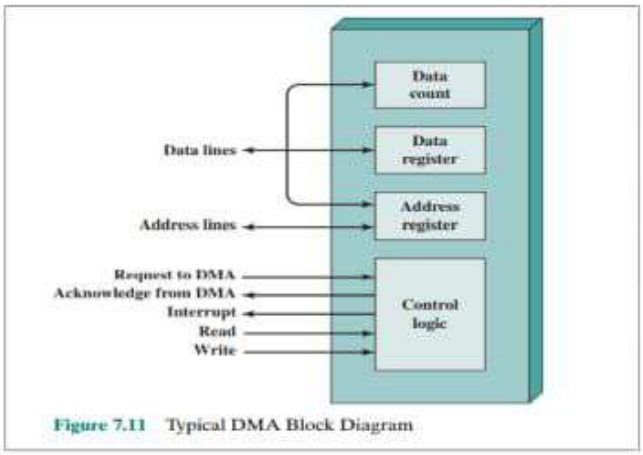


Figure 7.11 Typical DMA Block Diagram

DMA Function

- DMA involves an additional module on the system bus. The DMA module (Figure 7.11) is capable of mimicking the processor and, indeed, of taking over control of the system from the processor.
- It needs to do this to transfer data to and from memory over the system bus.
- For this purpose, the DMA module must use the bus only when the processor does not need it, or it must force the processor to suspend operation temporarily.
- The latter technique is more common and is referred to as cycle stealing, because the DMA module in effect steals a bus cycle.

DMA Function

When the processor wishes to read or write a block of data, it issues a command to the DMA module, by sending to the DMA module the following information:

- Whether a read or write is requested, using the read or write control line between the processor and the DMA module
- The address of the I/O device involved, communicated on the data lines
- The starting location in memory to read from or write to, communicated on the data lines and stored by the DMA module in its address register
- The number of words to be read or written, again communicated via the data lines and stored in the data count register

DMA Function

- The processor then continues with other work.
- It has delegated this I/O operation to the DMA module.
- The DMA module transfers the entire block of data, one word at a time, directly to or from memory, without going through the processor.
- When the transfer is complete, the DMA module sends an interrupt signal to the processor.
- Thus, the processor is involved only at the beginning and end of the transfer.