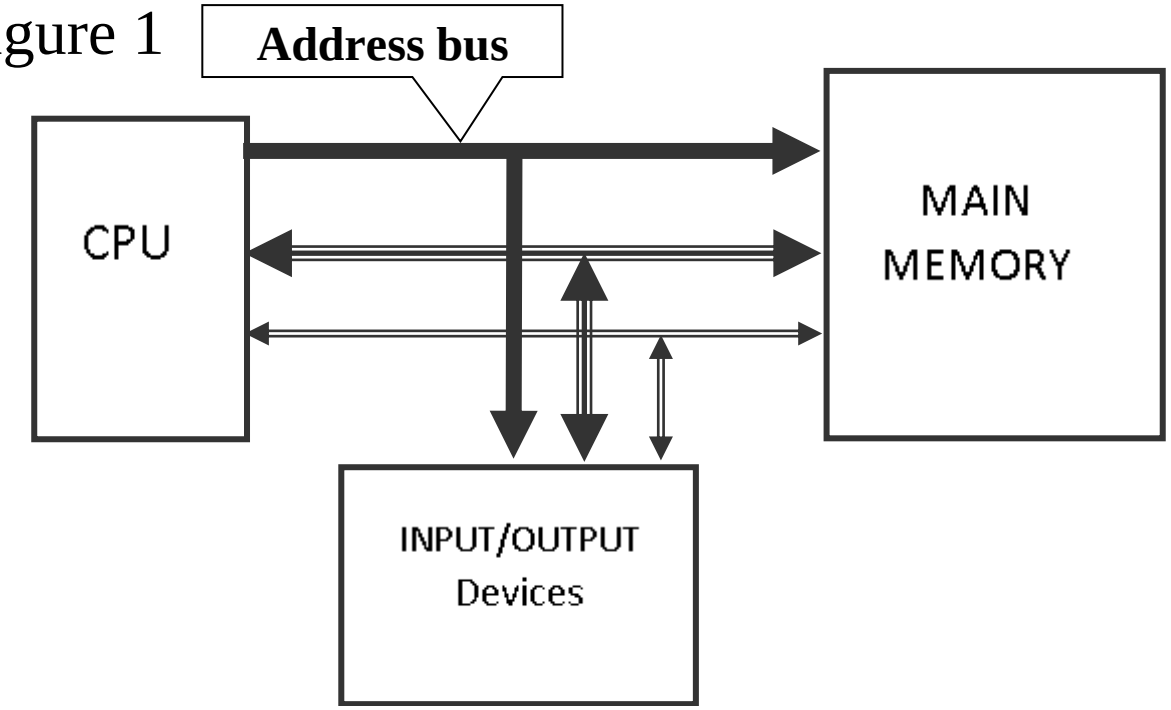
Buses System in Computer

BUS - Physically a set of wires. The components of the Computer are connected to these buses. All computers use three

types of basic buses. See figure 1

1. Address Bus
2. Data Bus
3. Control Bus



Address Bus

- The ***address bus :*** the address lines are used to designate the source or destination of the data on the data bus. For example, if the processor wishes to read a word (8, 16, or 32bits) of data from memory, it puts the address of the desired word on the address lines. Clearly; the width of the address bus determines the maximum possible memory capacity of the system. Furthermore, the address lines are generally also used to address I/O ports. Typically, the higher-order bits are used to select a particular module on the bus, and the lower-order bits select a memory location or I/O port within the module. For example, on an 8-bit address bus, address 01111111 and below might reference locations in a memory module (module 0) with 128 words of memory, and address 10000000 and above refer to devices attached to an I/O module (module 1).

Used to specify the address of the memory location to access.

- Each I/O devices has a unique address. (monitor, mouse, CD-ROM)
- CPU reads data or instructions from other locations by specifying the address of its location.
- CPU always outputs to the address bus and never reads from it.

Data Bus

- The ***data bus*** transfers instructions coming from or going to the processor. It is a *bidirectional bus*.

❖ Actual data is transferred via the data bus.

❖ When the CPU sends an address to memory, the memory will send data via the data bus in return to the CPU.

Control Bus

- The control lines are used to control the access to and the use of the data and address lines. Because the data and address lines are shared by all components, there must be a means of controlling their use.
- Control signals transmit both *command* and *timing* information among system modules. **Timing signals** indicate the validity of data and address information. **Command signals** specify operations to be performed. Typical control lines include.

- The operation of the bus is as follows. If one module wishes to send data to another, it must do two things: (1) obtain the use of the bus, and (2) transfer data via the bus.
- If one module wishes to request data from another module, it must (1) obtain the use of the bus, and (2) transfer a request to the other module over the appropriate control and address lines. It must then wait for that second module to send the data.

Characteristics of a bus

- A bus is a communication pathway connecting two or more devices. A key characteristic of a bus is that it is a shared transmission medium. Multiple devices connect to the busman a signal transmitted by any one device is available for reception by all other devices attached to the bus. If two devices transmit during the same time period, their signals will ***overlap*** and become garbled.
- Thus, only one device at a time can successfully transmit

INTERCONNECTION STRUCTURES

- A computer consists of a set of components or modules of three basic types (processor, memory, I/O) that communicate with each other. In effect, a computer is a network of basic modules. Thus, there must be paths for connecting the modules.
- The collection of paths connecting the various modules is called the interconnection structure. The design of this structure will depend on the exchanges that must be made among modules

- **Memory:** Typically, a memory module will consist of N words of equal length. Each word is assigned a unique numerical address (0,1,...,N – 1).A word of data can be read from or written into the memory. The nature of the operation is indicated by read and write control signals. The location for the operation is specified by an address.
- **I/O module**: From an internal (to the computer system) point of view, I/O is functionally similar to memory. There are two operations, read and write.Further,an I/O module may control more than one external device.We can refer to each of the interfaces to an external device as a port and give each a unique address (e.g.,0,1,...,M – 1).In addition,there are external data paths for the