Computers Architecture: Computers architecture refers to those attributes of a system that have a direct impact on the logical execution of a program.

Computers Organization: Computers organization refers to the operational units and their interconnections that realize the architectural specifications.

Difference between Architecture and Organization:-

Computers Architecture	Computers Organization
1] Architecture describe what computers does.	1] The organization describes how it does it.
2] It deals with the functional behavior of computers systems.	2] It deals with a structural relationship.
3] Architecture indicates it's hardware.	3] Organization indicates its performance.
4] Computers architecture comprises logical function such as instruction sets, registers, data types and addressing modes.	4] computers organization consist of physical unit like circuit designs peripherals and adders.

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Why do we need to study computers Architecture?

↳ Because, A professional in any field of computing should not regard the computers as just a black box that executes programs by magic.

* Students should have understanding and appreciation of a computers systems functional components, their characteristic, their performance and their interactions.
* Complex trade offs between CPU clock speed, cache size, bus organization, number of core processor and so on.
* Acknowledging the complexity of existing commercial system.

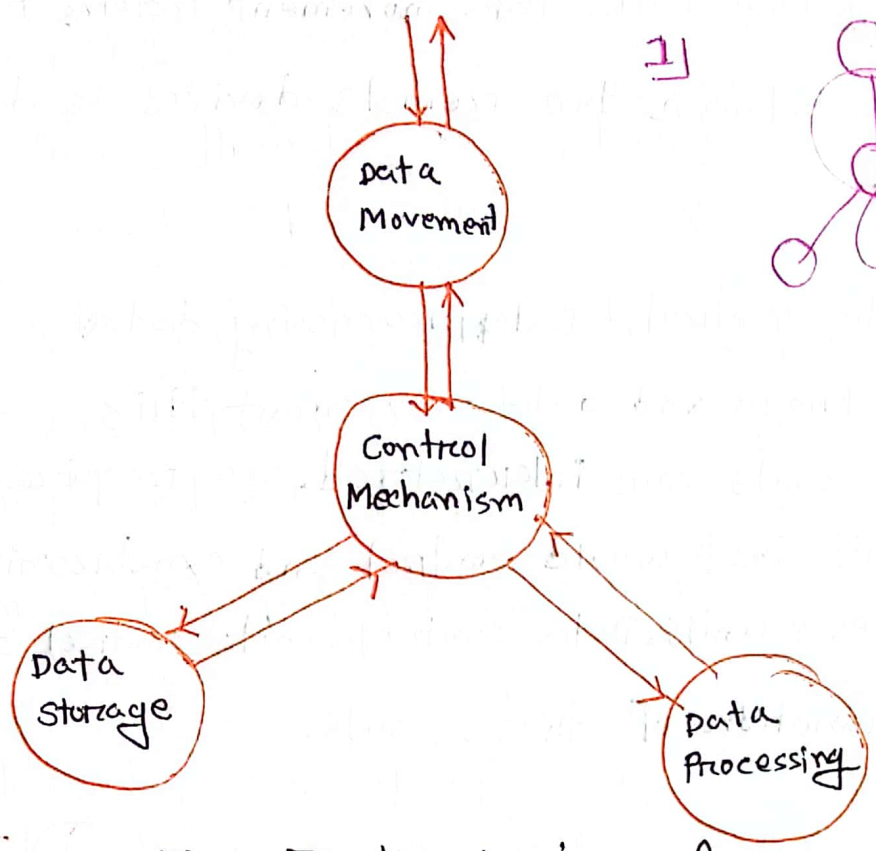
Structure and Function:→

↳ Structure is the way in which components relate to each other.

↳ Function is the operation of individual components as part of the structure.

The four basic functions are:

1) Data Processing.
2) Data Storage.
3) Data Movement.
4) Data control.

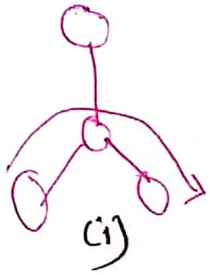


1]

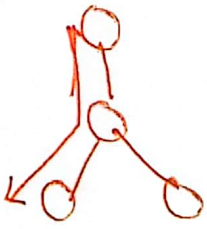
Fig:- Functional view of computer

1] Data processing:- Data processing unit process the data. It must also be able to process data in a wide variety of forms. The range of processing requirements is broader.

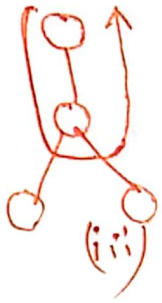
2] Data Storage:- Once the processing is done there must be some means to store the final and intermediate result. It generally used to store the intermediate and final result or data.



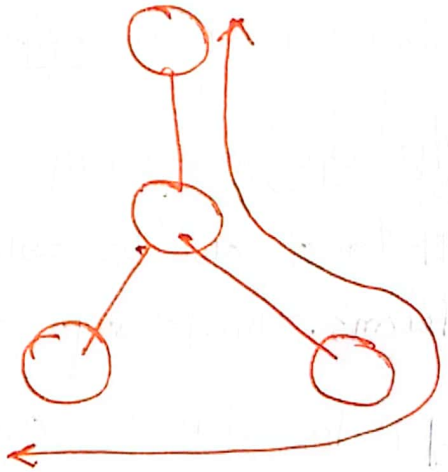
(i)



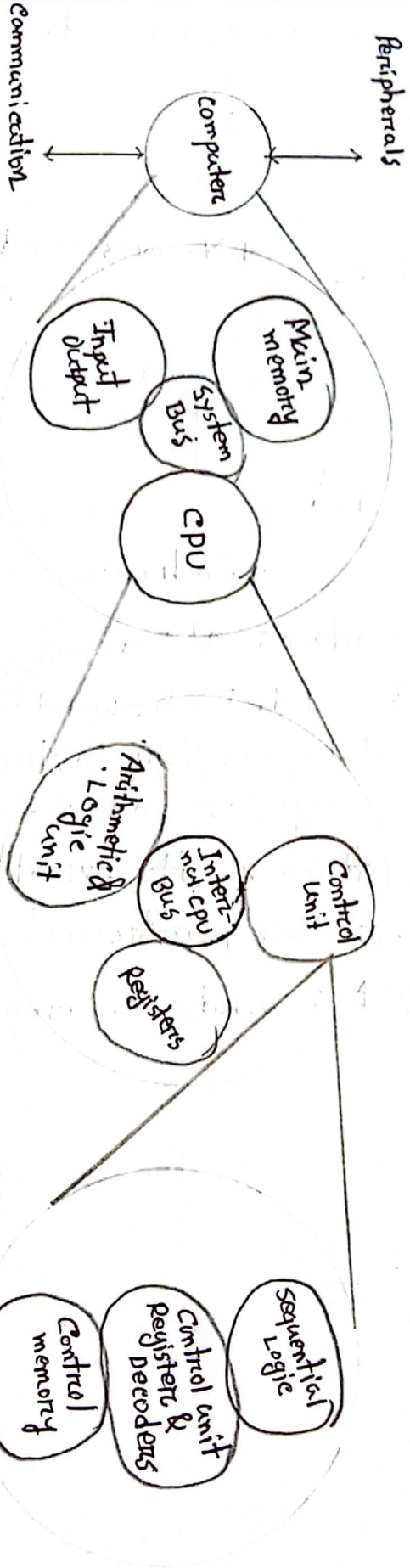
3] Data Movement:- Data movement refers to moving of data between the remote devices as data communication.



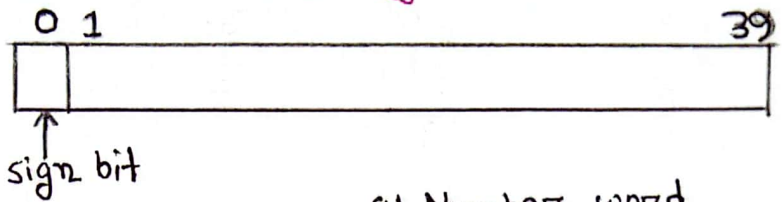
4] Data control:- Data processing, data storage and data movement this three units are interrelated. we require a unit that would control and synchronize the function of these units. Data control unit control and synchronize the function of these units.



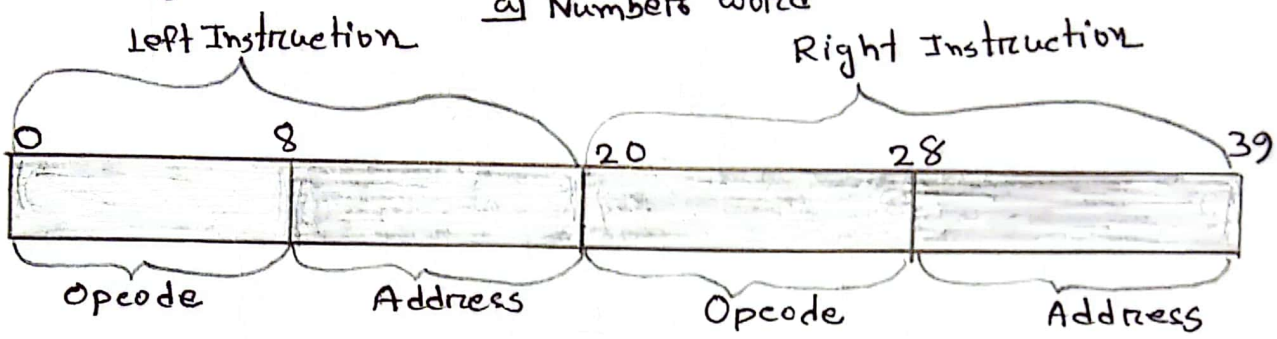
Draw the Top Level View Digram of computer, cpu and control unit in one figure:



Explain IAS memory format:-



a) Numbers word



b) Instruction word

↳ IAS computers contains 2^{12} memory locations. The memory locations are called word. Each word is 40-bit long and could hold one piece of data or two instruction. Each numbers is represented by a sign bit and a 39-bit value. Each instruction consisting of an 8-bit operation code (opcode) specifying the operation to be performed and a 12-bit address designating one of the words in memory.

Describe different registers uses in IAS structure? →

1] Instruction Register (IR): The instruction register holds the instruction currently being executed or decoded by the cpu.

2] Instruction Buffer Register (IBR): The IBR hold temporarily the right-hand instruction from a word in memory.

3] Memory Address Register (MAR): MAR specifies the address in memory of the word to be written form or read into the MBR.

4] Memory Buffer Register (MBR): The MBR serves as a temporary storage for data being transferred between the CPU and main memory.

5] Program Counter (PC): The program counter keeps track of the memory address of the next instruction be fetched and executed.

6] Accumulator (AC): The AC serves as a temporary storage for intermediate results during arithmetic and logic operations.

7] Multiplier Quotient Register (MQ): The MQ register is used for multiplication and divison operations.

* It stores the multiplicand during multiplication and the Quotient during division.

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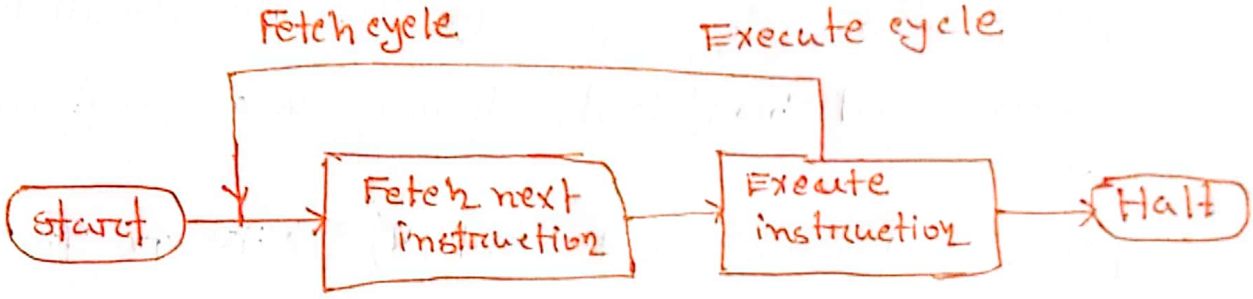
Instruction cycle:-



i) Fetch cycle:

* Program counter holds address of next instruction to fetch.
* Processor fetches instruction from memory location pointed to by pc.
* Increment pc.
* Instruction loaded into Instruction Register.

* It stores the multiplicand during multiplication and the Quotient during division.

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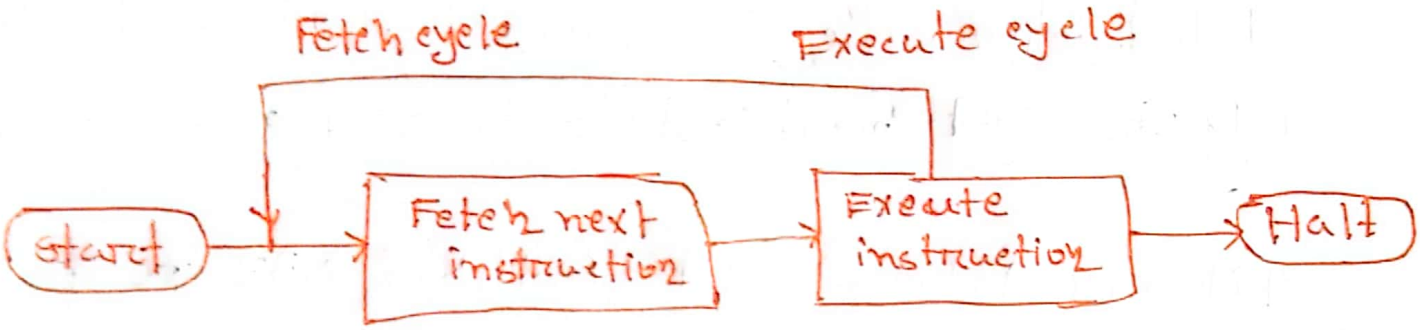
Instruction cycle:-



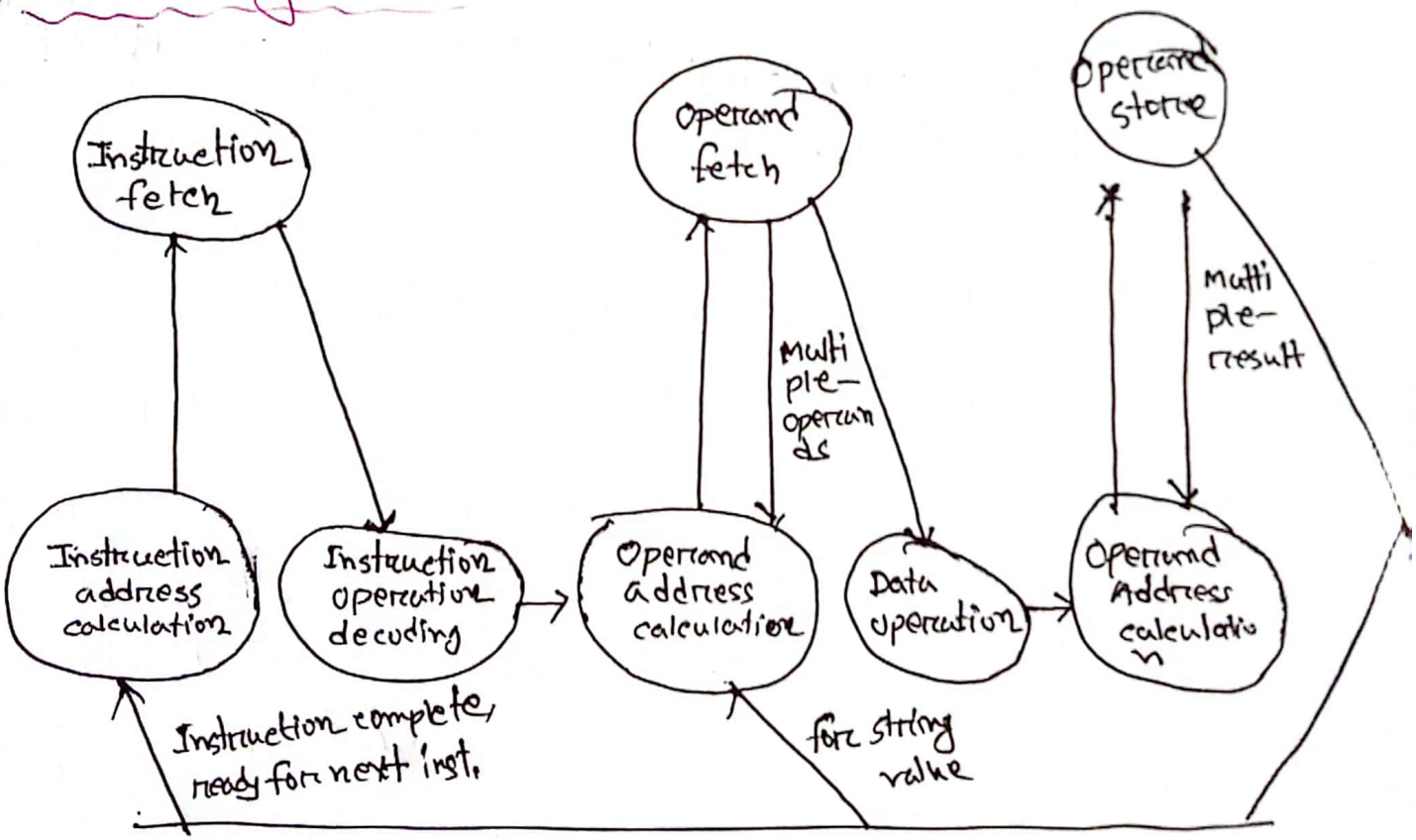
i) Fetch cycle:

* Program counter holds address of next instruction to fetch.
* Processor fetches instruction from memory location pointed to by pc.
* Increment pc.
* Instruction loaded into Instruction Register.

iii) Execute cycle:-

* Processor-memory:- Data transfers between CPU and main memory.
* Processor I/O: Data transfers between CPU and I/O module.
* Data processing:- Some arithmetic and logical operation on data.

State-diagram:



Interrupts: Mechanism by which other module may interrupt normal sequence of processing.

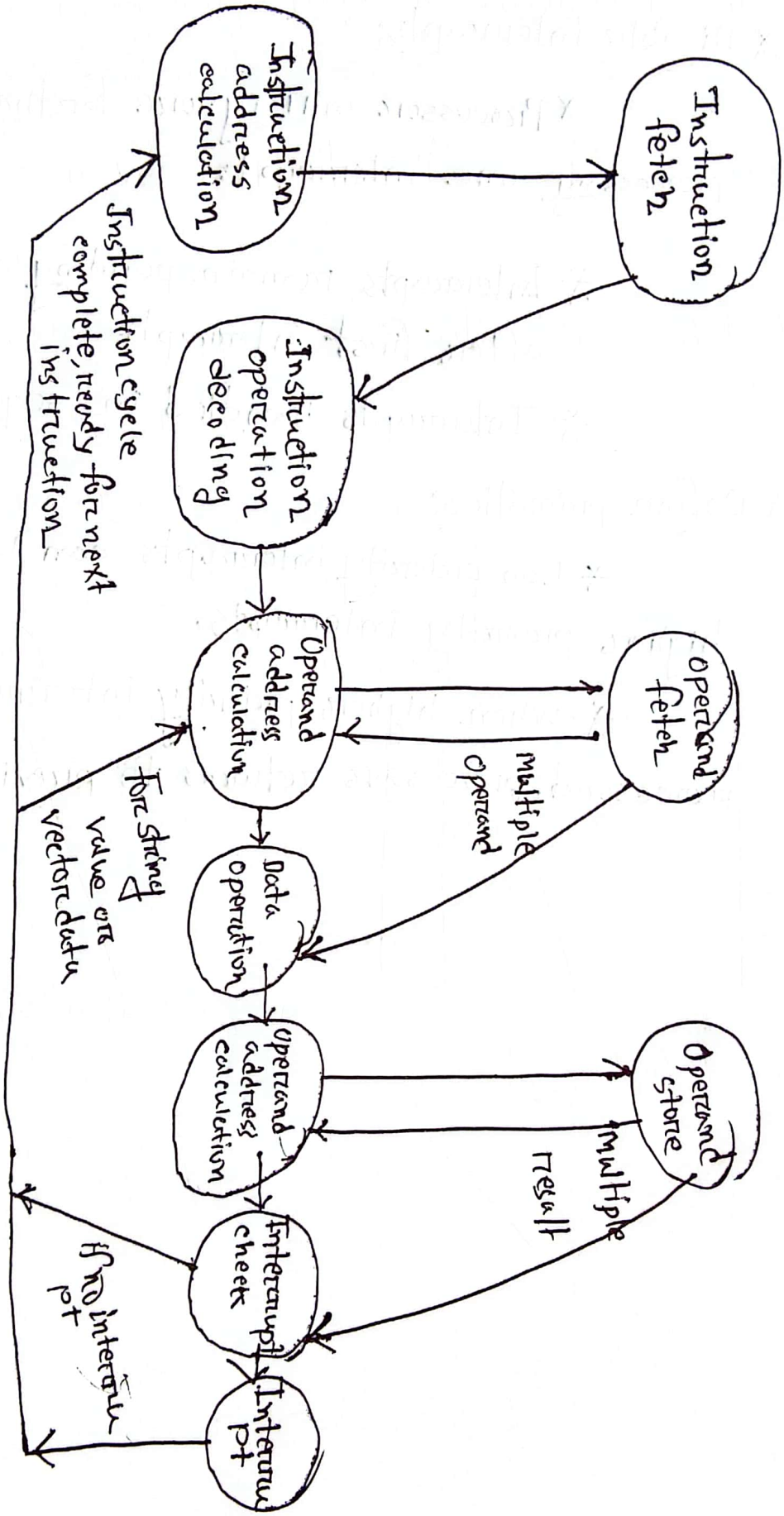
i) Timer:- Generated by a timer within the processor.

ii) I/O:- Generated by an I/O controller.

iii) Hardware Failure:- Generated by a failure such as power failure or memory parity error.

iv) Program:- Arithmetic overflow, division by zero. that occurs an interrupt in the result of an instruction.

Instruction cycle with Interrupts state diagram:-



Multiple Interrupts:

* Disable interrupts:

* Processor will ignore further interrupts while processing one interrupt.

* Interrupts remain pending and are checked after first interrupt.

* Interrupts handled in sequence as they occur.

* Define priorities:

* Low priority interrupts can be interrupted by higher priority interrupts.

* when higher priority interrupts has been processed, processor returns to previous interrupts.