What is an operating system?

→ An operating system (OS) is a software program that acts as an intermediary between computer hardware & software applications. It is a fundamental component of any computer system & provides a set of essential services & functionalities to manage computer resources & facilitate the execution of software programs.

Some Key functions & features of an operating system:

* process management
* Memory management
* File system management
* Device management
* User Interface
* Security & access control
* Networking

list & briefly define the Key services provided by an OS.

→ process management:

The OS manager the execution of processes by allocating system resources such as CPU time, memory & I/O devices. It handles process creations, termination, scheduling & synchronization.

Memory management:

This service is responsible for managing the computer's primary memory (RAM). It allocates & deallocates the memory space to processes & handles virtual memory management.

File system management:

The OS provides a file system that organizes & manages files on storage devices such as hard-drives / solid-state drives.

Device management:

The OS manager the computer's hardware devices including I/O devices.

User Interface:
The OS provides a user interface that enables users to interac
with the computer system.

Networking:
The OS supports network protocols, manages network connect
provides services such as file sharing, printing over a netwo
Internet connectivity.

Security:
The OS implements various security measures to protect the sy
& user data. & includes user authentication mechanisms.

Error Handling:
The OS monitors system activities, detect errors & provides error
handling mechanisms to prevent system crashes & data corrupti

Q.3. List & briefly define the major types of OS.

→ The major types of OS are:

* Windows: Developed by Microsoft
* macOS: Developed by Apple
* Linux: An open-source OS Kernel
* Android: Developed by Google
* iOS: Developed by Apple
* Unix: powerful, multi-user & multi-tasking OS
* Chrome OS: Developed by Google
* FreeBSD: free & open-source OS derived from Berkeley Software Distri
* Solaris: Unix-based OS developed by Oracle

Describe the work of OS as Resource Manager.

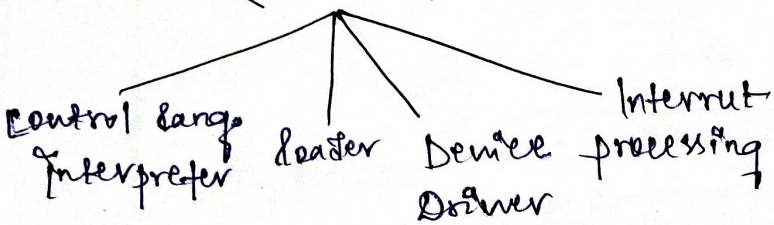
→ Operating System As A Resource Manager:

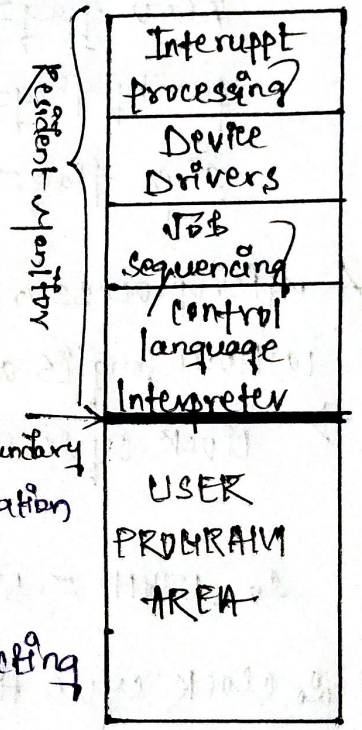
OS allows multiple programs to be in memory & run at the same time. Resource management includes multiplexing / sharing resources in two different ways : in time & in space.

As a resource manager, OS provides controlled allocation of the processors, memories & I/O devices among various programs.

Explain the memory layout for an resident monitor?

→ Resident monitors





* Control language Interpreter : Used to read & carry out the instruction from one level to the next level.

* loader : loads all necessary system & application programs into main memory.

* Device Driver : Used to manage the connecting input-output devices to system.

* Interrupt processing : processes all occurred interrupt to the system.

Explain the difference between uniprogramming & multiprogramming.

→ Uniprogramming refers to computer operating systems that use one thread at a time. Multiprogramming uses more than one thread at a time & involves multicore processors.

Q7. If the last operation performed on a computer with an 8-bit wo an addition in which the two operands were 00000010 & 00000 what would be the value of the following flags?

• carry • zero • parity • sign

→ The addition of the two operands is as follows:

```
  00000010
+ 00000011
----------
  00000101
```

∴ carry flag = 0

zero flag = 0

parity flag = 0

sign flag = 0

Q8. A microprocessor is clocked at a rate of 5 GHz.

(a) How long is a clock cycle?

→ Clock cycle time = 1/clock frequency

= 1/5 GHz

So, 5 GHz = 5×10^9 Hz

∴ clock cycle time = $1/(5 \times 10^9)$ Hz

= 0.2 nanoseconds (ns)

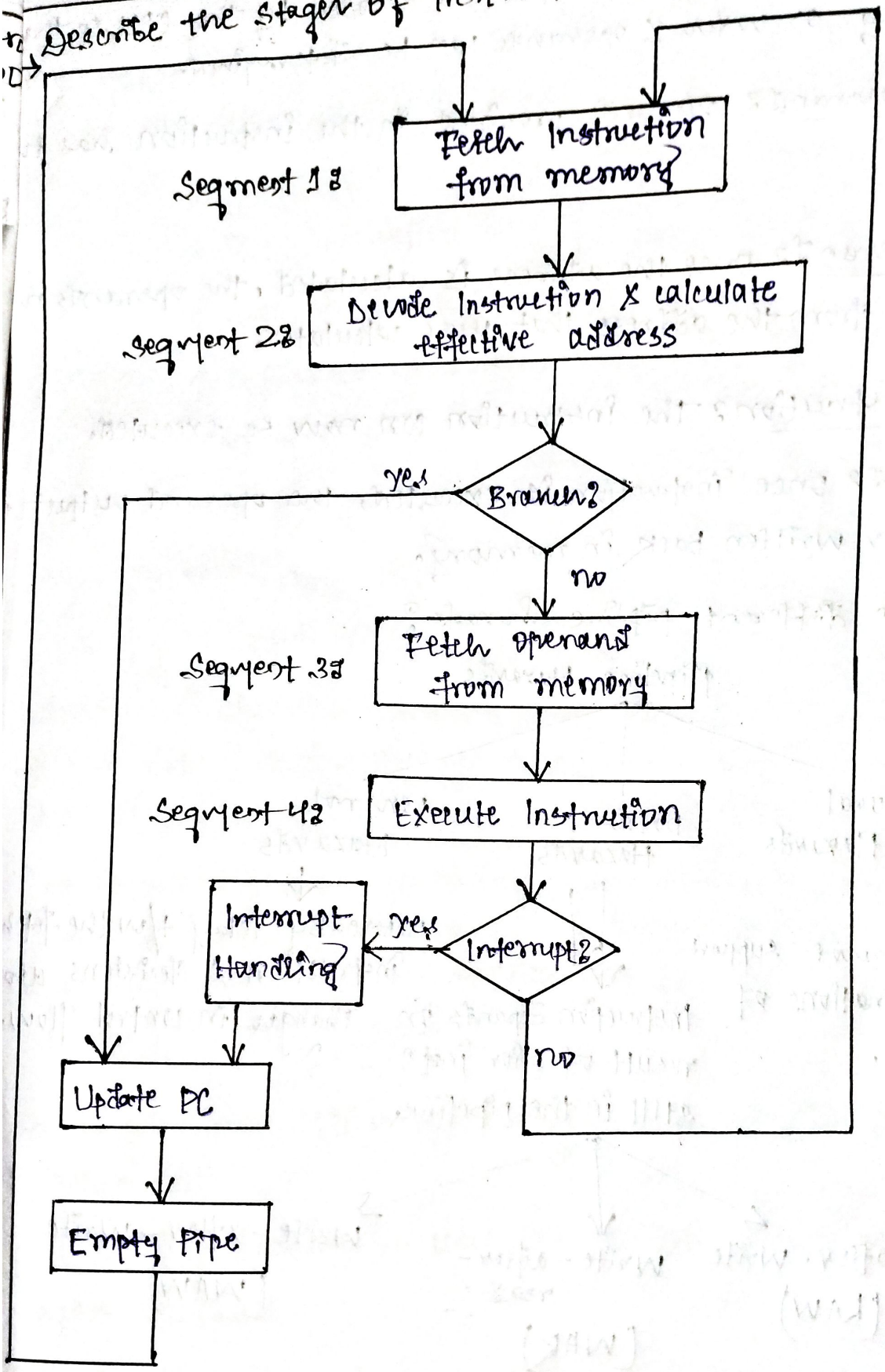
(b) What is the duration of a particular type of machine instruction consisting of three clock cycles?

→ Instruction Duration = clock cycle time × No. of cycles

= (0.2 ns/cycle) × (3 cycles)

= 0.6 ns

Describe the Stages of Instruction pipeline?



Write the flowchart for six-stage CPU Instruction pipeline?

→ Same as Question 9.

Fetch Instruction: Instruction are fetched from the memory to a temporary buffer before it gets executed.

Decode Instruction: Instruction is decoded by the CPU so that the necessary op code & operands can be determined.

Calculate operand: operands provided in the instruction has to be calculated.

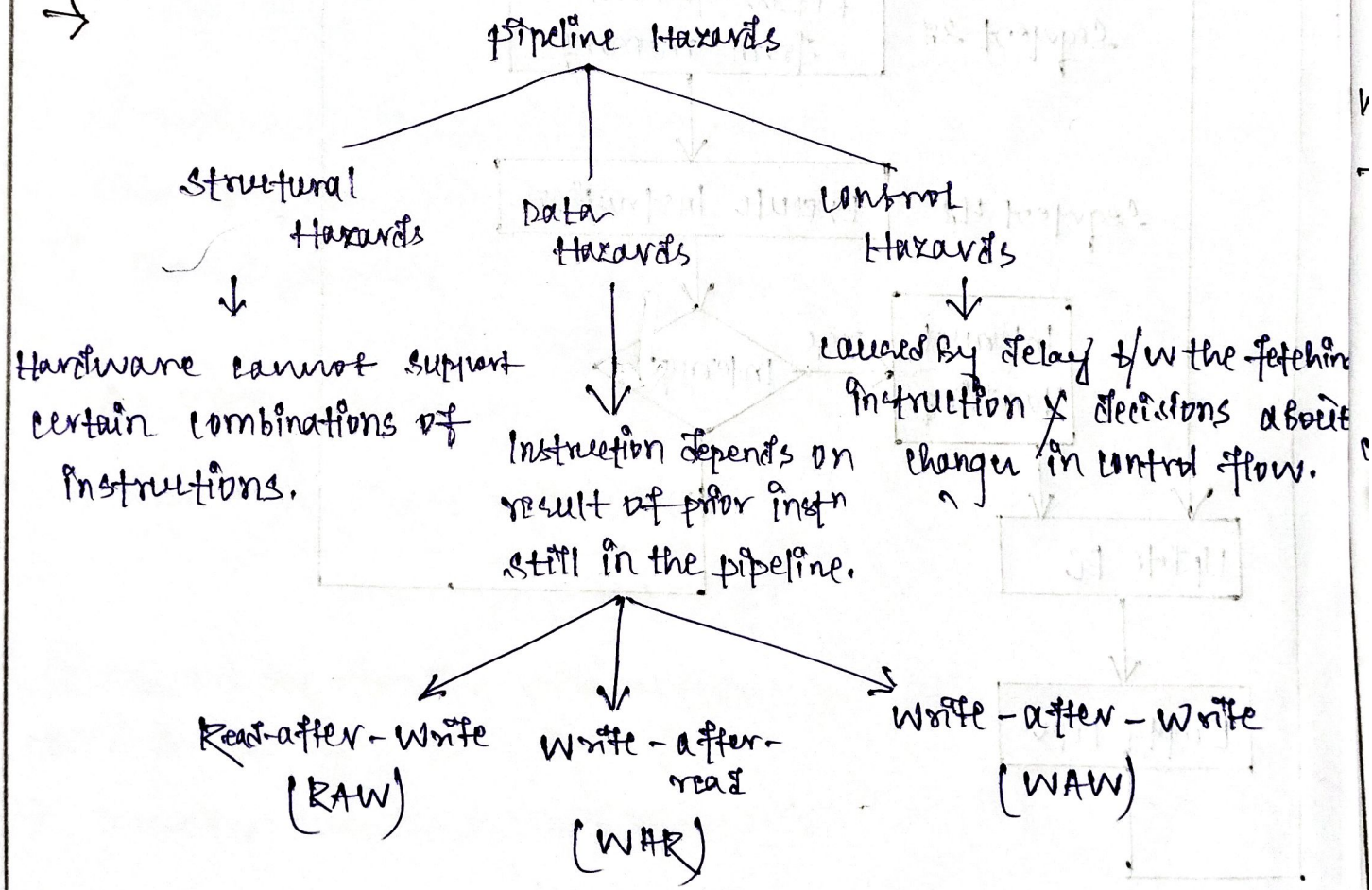
Fetch operand: Once the address is calculated, the operands need to be fetched from the address that was calculated.

Execute Instruction: The instruction can now be executed.

Write operand: Once instruction is executed, the operand output is stored or written back in memory.

Q11. Describe the different pipline hazards?

→



scribe the characteristics of Reduced Instruction Set Architecture
The characteristics of Reduced Instruction Set Architecture
are as follows:

* Simplicity
* Fixed Instruction length
* load/store Architecture
* Register-based operations
* pipelining
* Single-cycle Execution
* compiler-Friendly
* Reduced complexity & power consumption

What is the difference between RISC & CISC?

→ * RISC includes simple instructions & takes one cycle while the CISC includes complex instructions & takes multiple cycles.

* RISC architecture can be used with high-end applications like telecommunication, image processing, video processing etc. CISC architecture can be used with low-end applications like home automation, security system, etc.

For a pipelined CPU with a single ALU, consider the following situations:

1. The $i+1$ instruction uses the result of the i^{th} instruction as an operand.
2. The execution of a conditional jump instruction
3. The i^{th} & $i+1$ instruction require the ALU at the same time

→ All of the above

Q15. Comparing the time T_1 taken for a single instruction on a pipelined CPU with time T_2 taken on a non-pipelined but identical CPU, we say that

→ option (b) $T_1 \geq T_2$

In pipelined CPU, there will be buffer delay & stage delay. So for 1 instruction nonpipelined CPU takes less time compared to pipelined CPU.