



Operating System

Module-6 Notes

by pyqfort.com



Contents Covered:

- I/O Devices



- Device Controllers

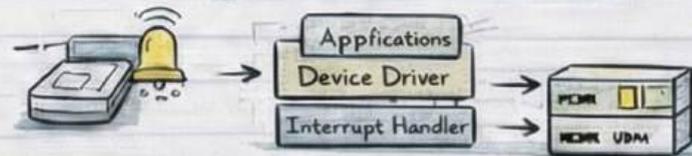


- DMA Data Transfer Process



- Principles of I/O Software

- I/O Software Layers



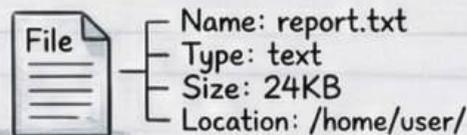
- Secondary-Storage Structure



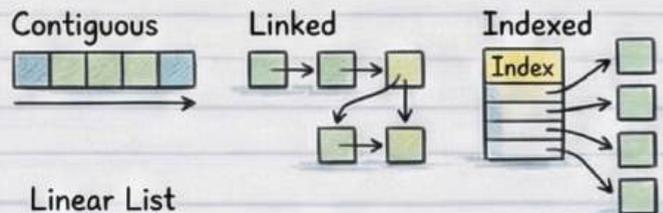
- Disc Scheduling Algorithm



- Concept of File



- File Allocation Methods



- Directory Implementation

Linear List

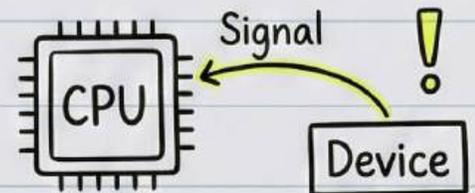
File Name	Pointer to Data
file1	ptr1
file2	ptr2
file3	ptr3

Module 6: I/O Hardware

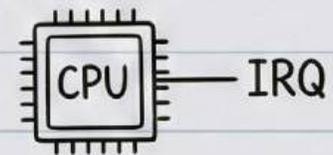
I/O Devices

Everything an OS does is **interrupt driven**.

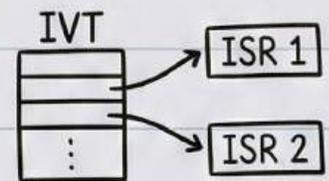
An **Interrupt** is a signal to the processor indicating an event needs attention.



The processor has an **interrupt-request (IRQ) line** to sense interrupts after each instruction.

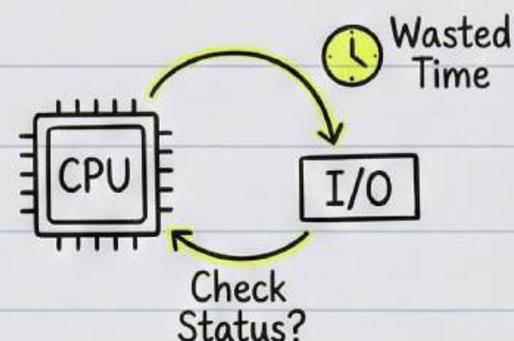


There is a program called **interrupt service routine (ISR)** for each interrupt. Addresses of all ISRs are in an **interrupt vector table (IVT)**.



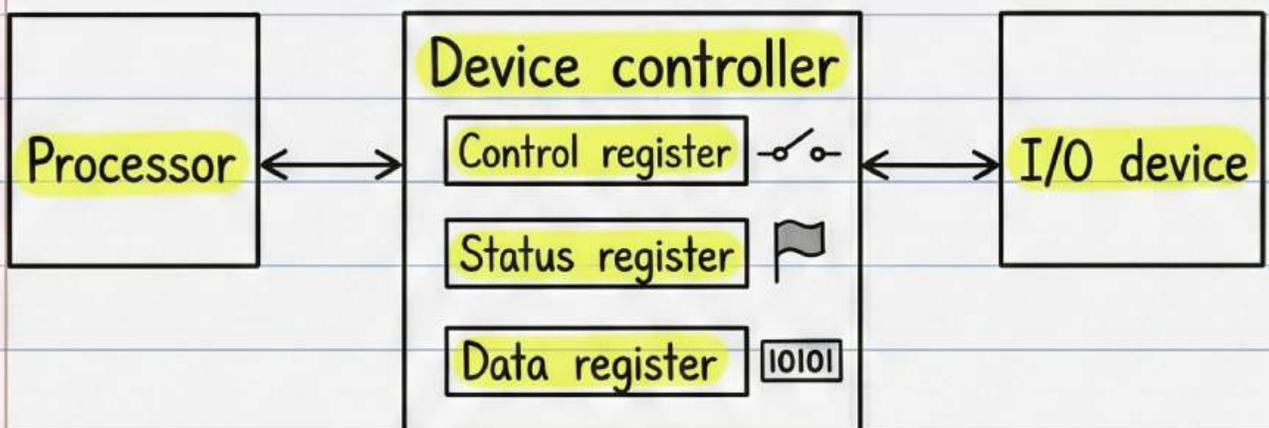
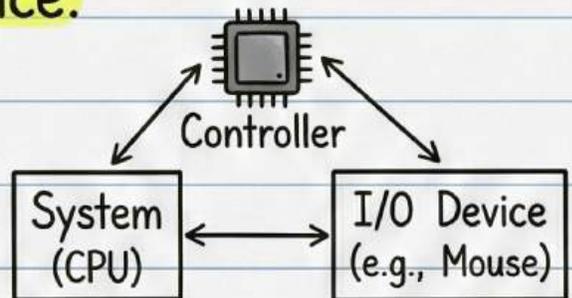
A **hardware interrupt** is from an external device (e.g., keyboard). **Software interrupts** are caused by exceptional conditions or special instructions.

- In **programmed I/O technique**, processor time is **wasted** as it **continually interrogates** the I/O status.



Device Controllers

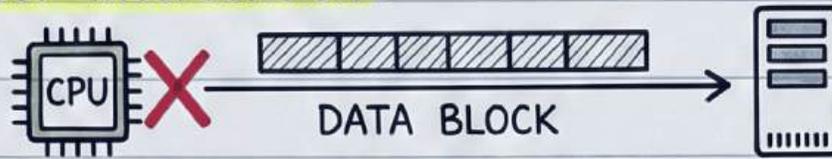
- A **Device controller** is an **electronic device** in the form of a **chip or circuit** that **controls the communication** between the **system** and the **I/O device**.



Direct Memory Access (DMA) Operation

Why DMA?

- Used for transferring 'blocks of characters' without 'processor intervention'.

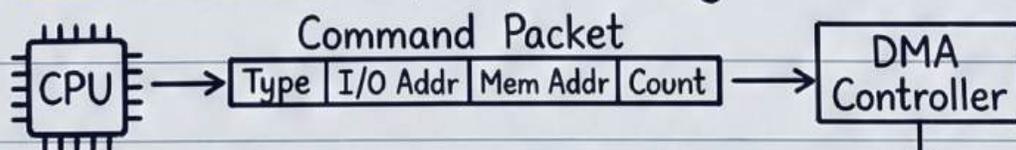


- Interrupt-driven I/O is 'not efficient' for large data due to a 'number of interrupts' (e.g., every 10ms for a character).

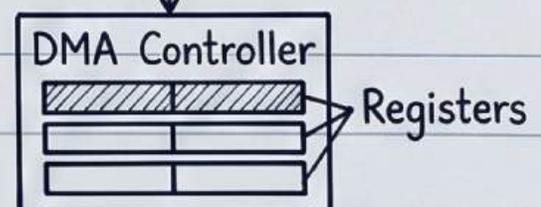


How it Works

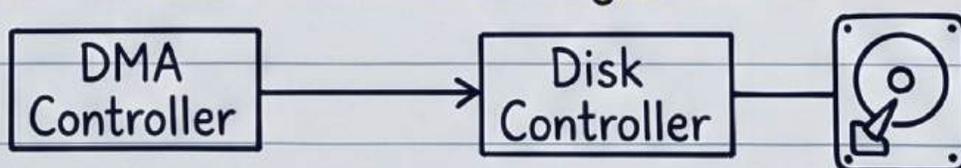
- Processor gives 'responsibility to do I/O' for a block to the 'DMA controller'.
- Processor sends to DMA controller:
 - 'Type of request' (read/write).
 - 'Address of the I/O device'.
 - 'Start address of the memory' & 'total number of words'.



- DMA controller copies this to 'its registers'.



- Example (Disk Read): CPU sends info to DMA, which stores it in 'disk controller registers'.



THE HISTORY OF THE UNITED STATES

CHAPTER I

THE HISTORY OF THE UNITED STATES

THE EARLY PERIOD

THE EARLY PERIOD OF THE HISTORY OF THE UNITED STATES

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CHAPTER II

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CHAPTER III

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CHAPTER IV

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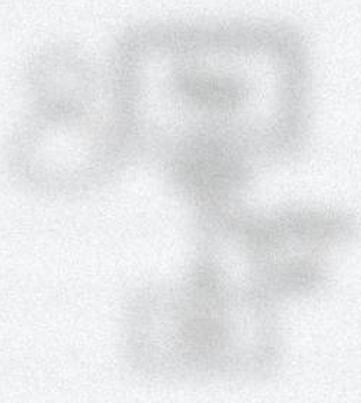


Introduction to the course

The purpose of this course is to provide a comprehensive overview of the field of **Computer Science**. We will explore the fundamental concepts and principles that underpin the design and development of **software systems**. The course is structured to provide a solid foundation in the theory and practice of **computer science**, with a focus on the **design and analysis of algorithms**.

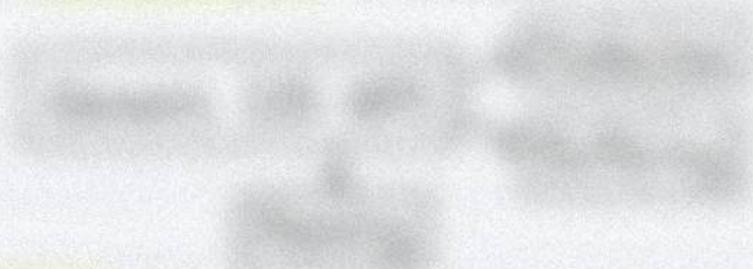
1. The foundations of computer science

The foundations of computer science are rooted in the study of **mathematics** and **logic**. We will explore the concepts of **sets**, **relations**, and **functions**, which are essential for understanding the structure of **data** and the **operation of computers**. We will also discuss the **history of computing** and the **evolution of computer science**.



2. The theory of computation

The theory of computation is a branch of computer science that deals with the **limits of what can be computed**. We will explore the concepts of **computability** and **complexity**, and the **design and analysis of algorithms**. We will also discuss the **history of the theory of computation** and the **evolution of the field**.



3. Data structures and algorithms

Data structures and algorithms are the core of computer science. We will explore the concepts of **arrays**, **lists**, **trees**, and **graphs**, and the **design and analysis of algorithms**. We will also discuss the **history of data structures and algorithms** and the **evolution of the field**.



The **design and analysis of algorithms** is a central theme of this course. We will explore the concepts of **time complexity** and **space complexity**, and the **design and analysis of algorithms**. We will also discuss the **history of the design and analysis of algorithms** and the **evolution of the field**.



THEORY OF THE MIND

QUESTION 1

1. What is the main purpose of the **WISC-III** and **WISC-IV** tests?

WISC-III and **WISC-IV** are **Intelligence Scales** used to measure **general intelligence**.

2. How do you calculate the **Full Scale IQ** score from the **WISC-III** subtests?

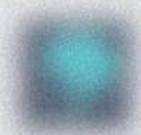


QUESTION 2

1. What is the difference between **Verbal IQ** and **Performance IQ** scores?



2. How do you calculate the **Verbal IQ** score from the **WISC-III** subtests?



THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first people who lived on this continent, and continues through the years of exploration, settlement, and the struggle for independence. The story is one of a people who have built a nation of freedom and opportunity.



The story of the United States is a story of a people who have built a nation of freedom and opportunity. It is a story of a people who have fought for their rights and their principles, and who have built a nation that has become a model for the world.



The story of the United States is a story of a people who have built a nation of freedom and opportunity. It is a story of a people who have fought for their rights and their principles, and who have built a nation that has become a model for the world.

Year	Event
1492	Columbus discovers America
1607	First English settlement in America
1776	Declaration of Independence
1787	Constitution signed
1862	Emancipation Proclamation
1865	End of Civil War
1898	Spanish-American War
1914	World War I begins
1945	World War II ends
1954	Supreme Court decision on desegregation
1963	John F. Kennedy assassinated
1968	Richard Nixon becomes President
1973	Oil crisis
1981	Iranian Revolution
1989	Soviet Union collapses
1991	World War II ends
1993	World Trade Center attacks
2001	9/11 attacks
2008	Financial crisis
2009	Obama becomes President
2013	Arab Spring
2014	Ukraine crisis
2015	Paris Agreement
2016	Trump becomes President
2017	Brexit
2018	North Korea crisis
2019	COVID-19 pandemic

1492

1607

1776

1787

The story of the United States is a story of a people who have built a nation of freedom and opportunity. It is a story of a people who have fought for their rights and their principles, and who have built a nation that has become a model for the world.



THE HISTORY OF THE UNITED STATES

THE EARLY YEARS

The first European settlers in North America were the Pilgrims who arrived in 1620. They were followed by other groups of settlers, including the Puritans and the Quakers. The colonies grew and developed, and by the 1700s they were becoming more independent of Britain.

The American Revolution began in 1775 and ended in 1783. The colonists fought for their independence from Britain and won. The new nation was founded on the principles of liberty and democracy. The Constitution was written in 1787 and established the framework of the government.

THE 19TH CENTURY

The 19th century was a time of rapid growth and change. The Industrial Revolution brought new technologies and increased production. The westward expansion of the United States led to the discovery of gold and the settlement of the frontier. The Civil War was fought between 1861 and 1865, ending slavery and preserving the Union.

The late 19th and early 20th centuries saw the rise of big business and the Progressive Era. Reformers fought for social and political changes, including the establishment of labor unions and the passage of antitrust laws. The United States emerged as a world power after World War I.



CHAPTER 10

THE FIRST PART OF THE CHAPTER

CONSIDERS THE



THE SECOND PART OF THE CHAPTER

CONSIDERS THE

THE THIRD PART OF THE CHAPTER

CONSIDERS THE

THE FOURTH PART OF THE CHAPTER

THE FIFTH PART OF THE CHAPTER

THE SIXTH PART OF THE CHAPTER



THE SEVENTH PART OF THE CHAPTER

THE EIGHTH PART OF THE CHAPTER

THE NINTH PART OF THE CHAPTER

THE TENTH PART OF THE CHAPTER

THE ELEVENTH PART OF THE CHAPTER

THE TWELFTH PART OF THE CHAPTER

THE THIRTEENTH PART OF THE CHAPTER

THE FOURTEENTH PART OF THE CHAPTER



Introduction to the History of the World

The history of the world is a complex and multifaceted subject that encompasses the entire human experience. It is a story of the rise and fall of civilizations, the discovery of new lands, and the evolution of human societies over time.

The Prehistoric World



The prehistoric world is divided into three main periods: the Paleolithic, the Mesolithic, and the Neolithic. The Paleolithic period is characterized by the use of simple stone tools and a nomadic lifestyle. The Mesolithic period is a transitional phase, and the Neolithic period is marked by the invention of agriculture and the establishment of permanent settlements.



The Neolithic Revolution, also known as the Agricultural Revolution, was a major turning point in human history. It led to the development of agriculture, which allowed humans to produce their own food and settle in one place. This led to the growth of larger, more complex societies.



The ancient world is a period of great achievement and innovation. It was during this time that many of the foundations of modern society were laid, including the development of writing, the invention of the wheel, and the establishment of the first major empires.



The Middle Ages, also known as the medieval period, was a time of great cultural and intellectual achievement. It was during this time that the foundations of modern Europe were laid, and the great cathedrals and castles of the period were built.



THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first settlers who came to the continent in search of a better life. Over time, the colonies grew into a nation, and the people fought for their independence from Great Britain. The American Revolution was a turning point in the country's history, leading to the creation of a new government and the signing of the Declaration of Independence.

The early years of the United States were marked by westward expansion and the search for new lands. The Louisiana Purchase of 1803 was a major event that doubled the size of the country. The War of 1812 further solidified the nation's independence and led to a period of national pride and unity.

The mid-19th century was a time of great social and political change. The abolitionist movement gained momentum, and the Civil War broke out in 1861. The war was a defining moment in American history, as it led to the end of slavery and the preservation of the Union.

The Reconstruction era followed the Civil War, as the country sought to rebuild and reunite. The Reconstruction Amendments were passed, guaranteeing equal rights and citizenship for all. However, the era was also marked by the rise of the Ku Klux Klan and the struggle for civil rights.

The late 19th and early 20th centuries saw the rise of industrialization and the growth of the United States into a world power. The Progressive Era was a time of reform and social change, as people fought for better working conditions and social justice.

The 1920s and 1930s were a period of economic hardship and social change. The Great Depression led to the New Deal, a series of programs and reforms that helped the country recover. The rise of the American Dream and the growth of the middle class were also significant features of this era.

The mid-20th century was a time of global conflict and social change. World War II was a defining moment in American history, as the United States emerged as a superpower. The Civil Rights Movement and the Vietnam War were also major events of this era.

The late 20th and early 21st centuries have seen the United States continue to grow and change. The end of the Cold War and the rise of the Internet have shaped the modern world. The 9/11 attacks and the War on Terror have also been significant events in recent history.

THE FUTURE OF THE WORLD

Year	Scenario	Key Features
2025	Stagnation	Low growth, high inequality, climate change impacts
2030	Fragmentation	Geopolitical tensions, digital divide, environmental stress
2040	Transformation	AI integration, renewable energy, global cooperation
2050	Globalization	Unified markets, space exploration, advanced AI
2060	Post-Scarcity	Universal basic income, automation, sustainable living
2070	Planetary Stewardship	Climate resilience, space colonization, ethical AI
2080	Human Evolution	Genetic engineering, space habitats, AI consciousness
2090	Global Unity	World government, universal education, sustainable development
2100	Transhumanism	AI-human hybrids, space exploration, ethical dilemmas



Concept of File & Access Methods

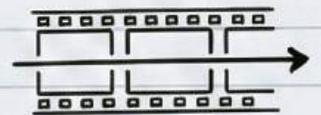
Concept of File

- A file is a sequence of 'blocks'. This is called 'record blocking'.
- Larger 'block size' = more records per block.

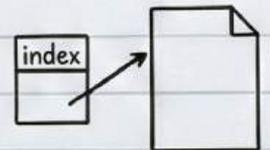


Access Methods

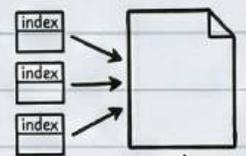
1. 'Sequential file access': Information is accessed in the 'stored order'.



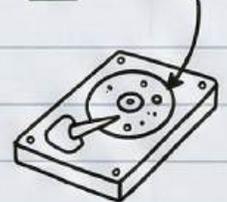
2. 'Indexed sequential file access': Uses 'random access approach' with an 'index' (stores 'key field' & 'pointer' to main file).



3. 'Indexed file access': Prepares 'multiple indexes' to search by attributes.

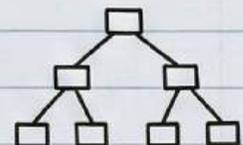


4. 'Direct file access': For 'random structure' of secondary storage like a disk.



Directory Structure

Logical structures: 'single level', 'two level', 'tree structure'.



Paths: 'Absolute path' starts from 'root directory'.

'Relative path' starts from 'current/working directory'.

'Tree structure' does not allow sharing.

'Acyclic graph' allows sharing.



THE HISTORY OF THE REPUBLIC

THE EARLY PERIOD

The early period of the Republic was characterized by the struggle for independence from British rule.

The first step was the signing of the Declaration of Independence in 1776.

The Continental Congress then established the new government under the Articles of Confederation.

The early years were marked by the Revolutionary War, which ended in 1781 with the Battle of Yorktown.

THE CONSTITUTION

The need for a stronger central government led to the drafting of the Constitution in 1787.

The Constitution established a system of checks and balances among the three branches of government.

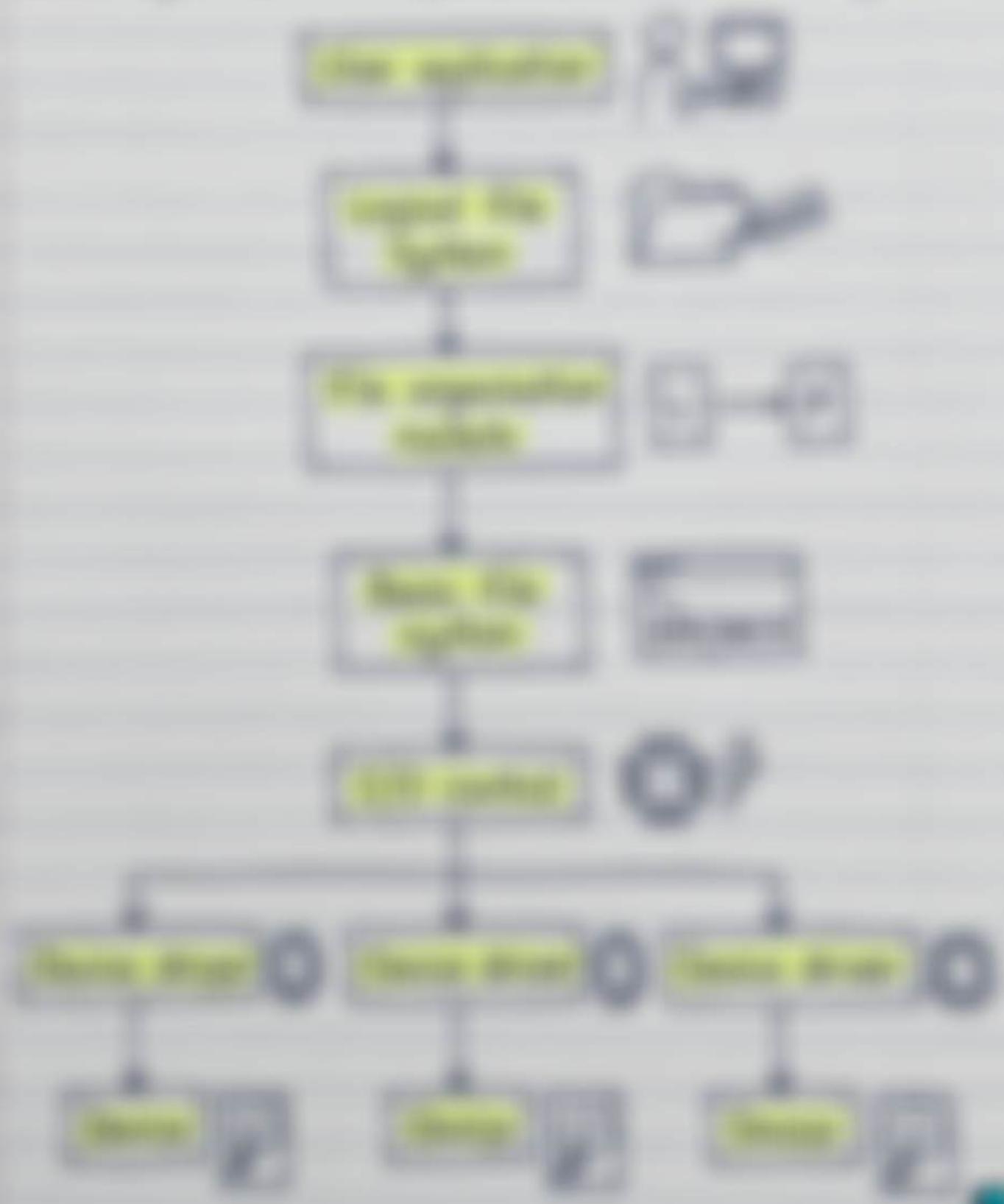
The Constitution was signed by the delegates to the Constitutional Convention in 1787.

The Constitution has since been amended to address the needs of the growing nation.

OS System Structure

The OS system is structured in **layers** to accomplish operations.

Each layer uses the operation of its **lower layer**.



Control File System & File Organization Methods

Control File System

- Concerned with the **logical structure** of the file. 
- Manages **all information about the structure**. 
- Represents the structure as a **file control block (FCB)**. 
- Manages **directory structure** & provides **file location** to the user module. 

File Organization Methods

- Translates **logical blocks** to **physical blocks**. 
- Needs **location of the file** & its **allocation type** for translation. 
- Disk space is allocated via **file allocation methods**.
- High level which **blocks are free**.
- The **free space manager** tracks **unallocated blocks** & provides this info. 

Chapter 10: The Nervous System

10.1: The Nervous System

The nervous system is the body's communication system. It consists of the brain, spinal cord, and peripheral nerves. The brain is the central control center, the spinal cord is the main pathway for information, and peripheral nerves connect the brain and spinal cord to the rest of the body.



10.2: The Brain

The brain is the central control center of the nervous system. It is divided into several regions: the cerebrum, cerebellum, and brainstem. The cerebrum is the largest part and is responsible for conscious thought, memory, and voluntary movement. The cerebellum is located at the back and bottom of the brain and is responsible for coordination and balance. The brainstem connects the brain to the spinal cord and is responsible for basic life functions like breathing and heart rate.

The brain is protected by the skull and meninges. The meninges consist of three layers: the dura mater, arachnoid mater, and pia mater. The cerebrospinal fluid is found between the arachnoid and pia mater, providing cushioning for the brain.

10.3: The Spinal Cord

The spinal cord is the main pathway for information between the brain and the rest of the body. It is located in the vertebral column and is protected by the vertebrae. The spinal cord is divided into cervical, thoracic, lumbar, and sacral regions. Each region contains a pair of spinal nerves that carry signals to and from the rest of the body.



File Allocation Methods

Files are a **logical concept** that exist in **memory** as **addresses** or secondary storage like a disk.

The file system is responsible for **mapping the user** to the file.



Types of File Allocation Methods

Contiguous Allocation Allocates the **entire file** if it fits in **contiguous** space on a storage.



Linked Allocation Allocates the **blocks of a file** separately.



Indexed Allocation is used to store **secondary storage** in disks efficiently.

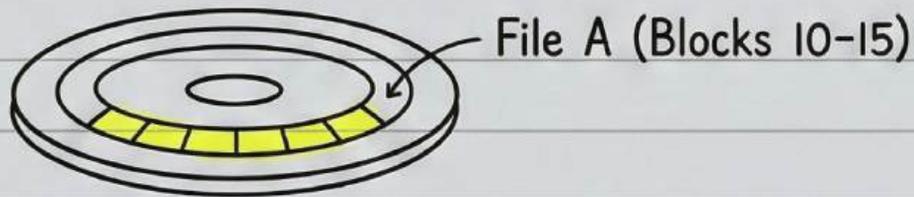
Advantages

- Access **quick access** to the contents of the file.
- Access **storage space is efficient**.
- There are **simple methods** of file allocation.



Contiguous File Allocation

In this method, each file occupies a **contiguous set of blocks** on the disk. This means the blocks are located **next to each other**.



For each file, the directory entry stores the **start address** and the **length** (number of blocks).

File	Start	Length
File A	10	6

Advantages:

- * Supports **sequential access**.
- * **Excellent performance** due to minimal head movement.



Disadvantages:

- * Suffering from **external fragmentation**.
- * **Difficult to find contiguous space** for new files.
- * File size must be **known in advance**.



Linked File Allocation

In this method, each file is a **linked list of disk blocks**. The blocks may be **scattered anywhere on the disk**.

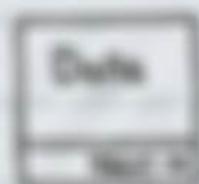


The directory contains a pointer to the **first and last** blocks of the file.



Each block contains:

- The **data**.
- A **pointer to the next block**.



Advantages:

- **No external fragmentation.**
- **Easy to grow a file.**



Disadvantages:

- **Slow for random access** (must traverse the list)
- **Space overhead** for the pointers.
- **Reliability issue:** If a pointer is lost or damaged, the rest of the file is lost.



Indexed File Allocation

In this method, each file is allocated a special block called an **index block**. The index contains all the **block addresses** (pointers) of the file.

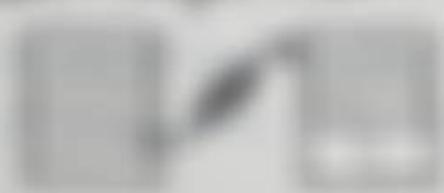


The directory contains the **address of the index block**. The *i*-th entry in the index block points to the *i*-th block of the file, allowing **direct access**.



Problems & Solution

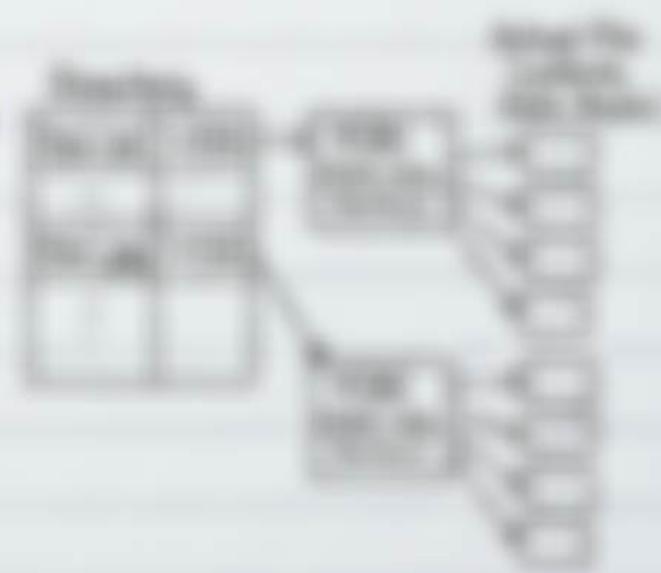
- Locating the **start of the index block** is a problem.
- If the index block is too large, space is **wasted** for small files.
- If it's too small, it can't hold all pointers for a large file.
- Solution: the index block can be **linked** to another index block to support large files.



Directory Implementation

A **directory** is used to **name and organize multiple files**.

- It manages a **list of files**, connecting each **name** with its **associated file**.



- The directory stores the **file name** and a **pointer to the PCB** (File Control Block).
- The **PCB** is the **handler**, storing **meta-information** and **pointers to the actual contents**.
- To find a file, the system searches for its **name as a key**, using the **PCB as a reference** to access the file's data.

Linear List Directory Implementation

The **simplest technique** to implement a directory is to have a **linear list**



However, an **unsorted linear list** containing directory entries may become **inefficient** when there are **large numbers of the entries** as it needs to have a **scan of the entire directory**, thereby consuming a **significant amount of time**



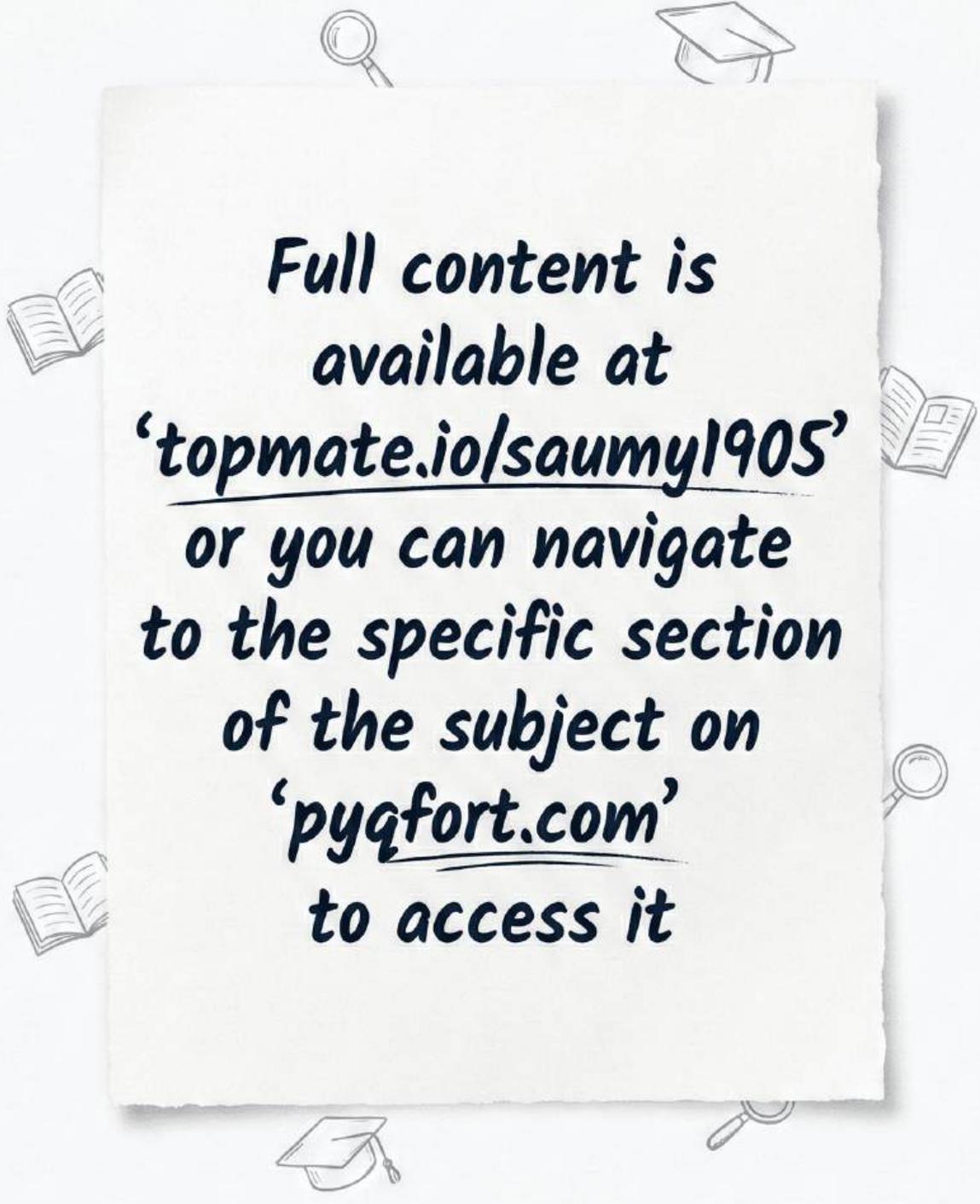
In spite of the drawbacks of linear list implementation, it is used widely due to its **simplicity**

Requirements for better data structures

- It should perform **efficient search** on the list.
- It should have **minimum cost for insertion or deletion** in the list.

Therefore, the directory implementation can be better done with **B-trees**, **hash tables**, or **other sorting methods**.





Full content is
available at
'topmate.io/saumy1905'
or you can navigate
to the specific section
of the subject on
'pyqfort.com'
to access it