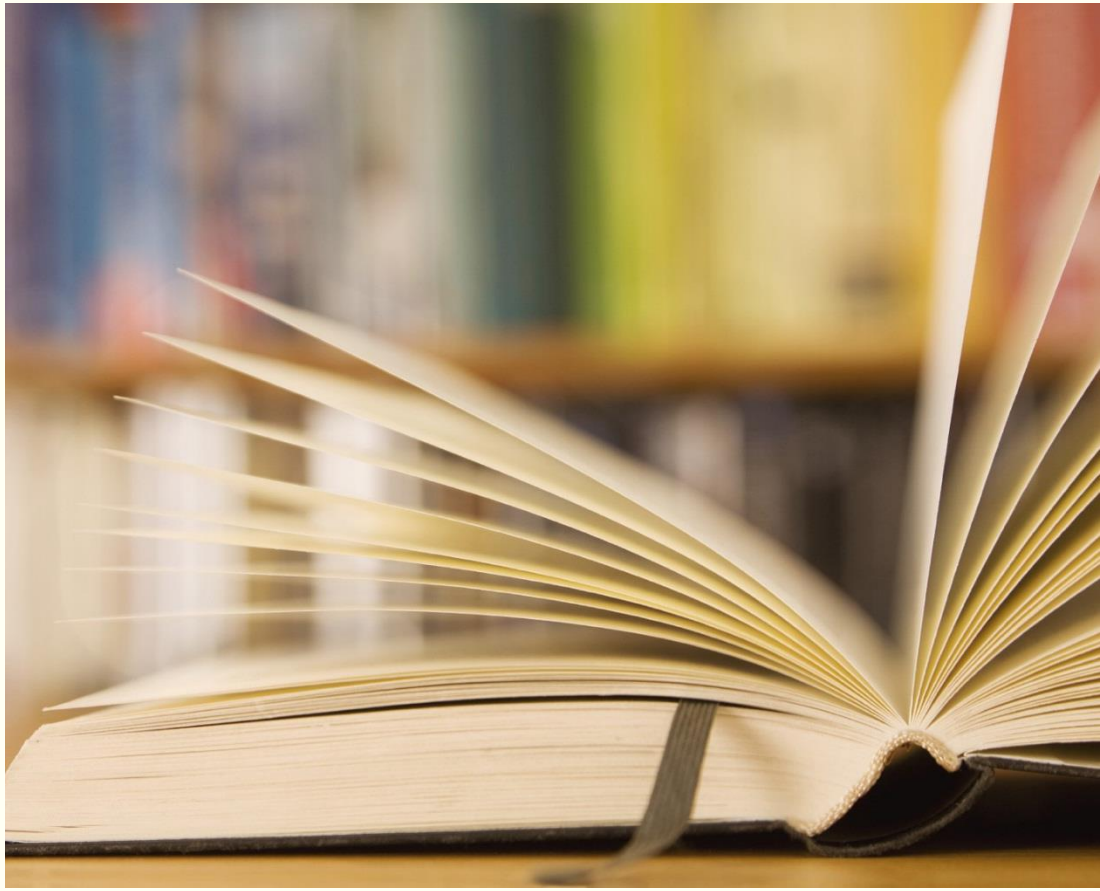
01

INTRODUCTION TO DATA STRUCTURES



Topic Name

1.1 Introduction

- 1.1.1 Need of Data Structure
- 1.1.2 Definitions - Data and information, Data type, Data object, ADT, Data Structure
- 1.1.3 Types of Data Structures

1.2 Algorithm analysis

- 1.2.1 Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic, quadratic loop etc.
- 1.2.2 Best, Worst, Average case analysis, Asymptotic notations (Big O, Omega Ω, Theta), Problems on time complexity calculation.

Introduction

What is Computer ????

- Computers are electronic Machine.
- They are capable of performing complex operations but they are ‘dumb’ machines.
- So we have to give some instructions to computer to perform task.
- This instructions are given in a program , in the form of input data and according to our input computer display output

What is Computer Science ???

Computer science can be defined as the **study of data**, its **representation** and **transformation**.

- Data is stored in memory device in form of bits.
- To access and store this data each programming language provide some mechanisms. i.e. Built in Data Type.
- The language also provide operators to perform operations on this data.
- But now a days to solve **complex and large** problems, the basic data type are not sufficient **So there is need of data structures.**

Need of Data Structures

- **Definition of DS(General)**

It is Collections of Basic Data Type with their properties and operations.

Need of DS

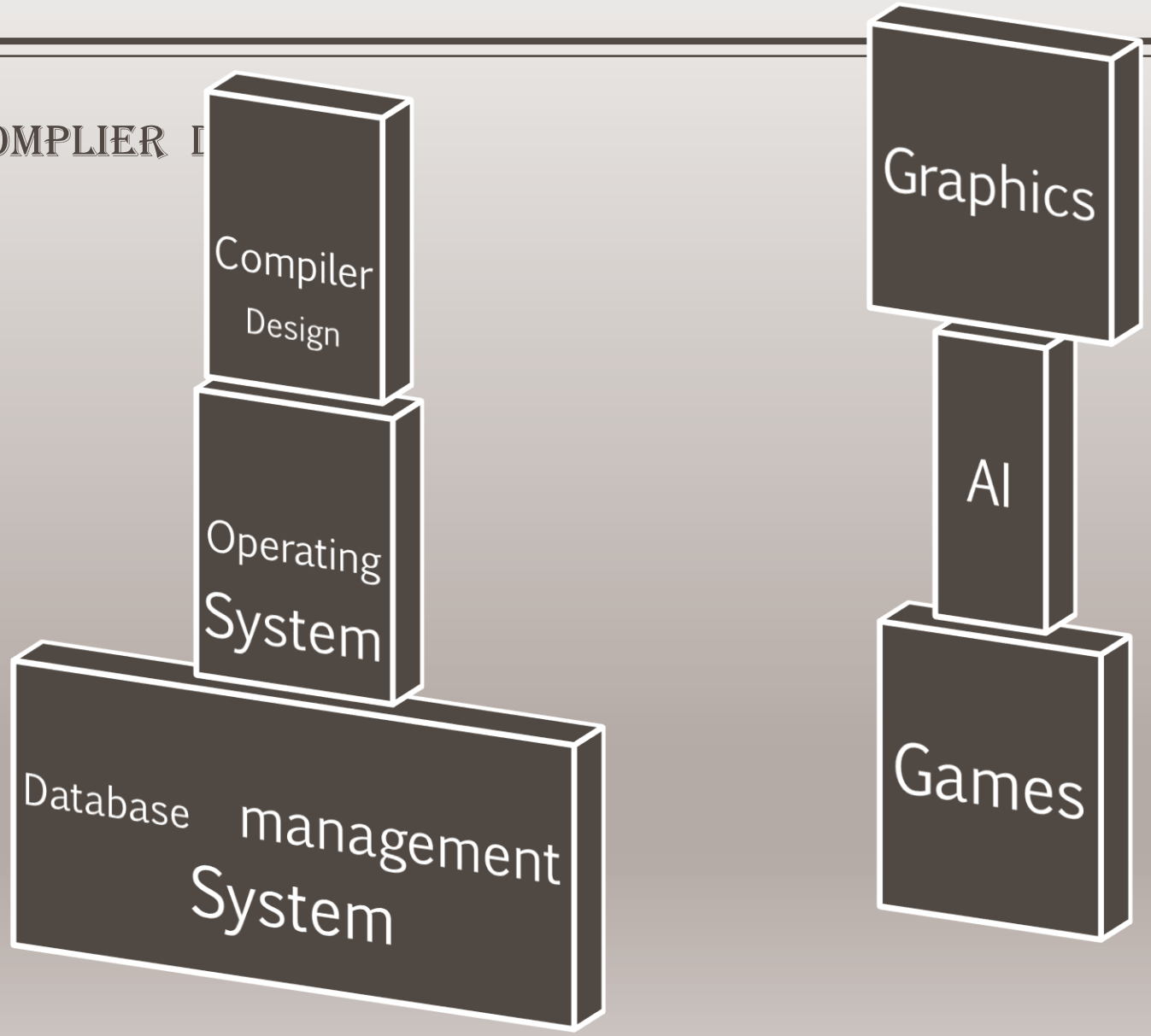
1. **Modern day computing problem are complex and large.**
2. **There is need to store and process information of various type like char, numeric,audio,video,graphics**
3. **Data has to be stored such that the logical relationship between the data elements is retained**

Advantages of DS

- Structured data make it easier to access and manipulates information.
- A variety of operations are possible.
- Related data can be stored together
- Better algorithm can be used on organized data –which improve program efficiency

Application Areas

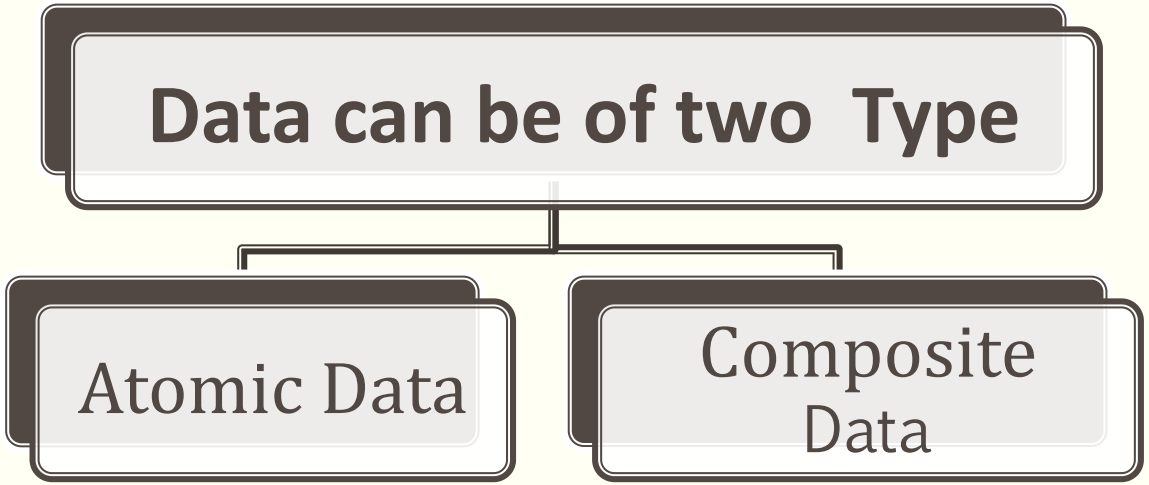
- COMPLIER D



BASIC TERMS

- **Data** :

Data is input given to a System Which the system process.



Atomic data is Single data, which cannot further decomposed. Example , the character a, number 10.

Composite data is grouped data which can be further decomposed. Example DOB

Basic Terms

- **Data Type : ->**

It describe the information type that can be processed by a computer and which is supported by any programming language.

Data Types can be of three types

1	**Simple Data Type**	**Built in data types supported by language ex. Int ,char**
2	Derived Data Type	Constructed from fundamental data types **ex. Array, structure**
3	User defined data Type	Data type are created by the programmer **ex. Enum,typedef.**

▪ Data Object :

It refer to a set of elements(D) of a specific data type. This set may be finite and infinite.

Example 1) set of integer. 2) set of English alphabet.

▪ Data Structure :

It consist of set of domain D,(Data Object)

a set of functions F,(functions)

set of axioms A (Rule of operations).

It is also called as Abstract data Type.(D,F,A)

Types Of Data Structures

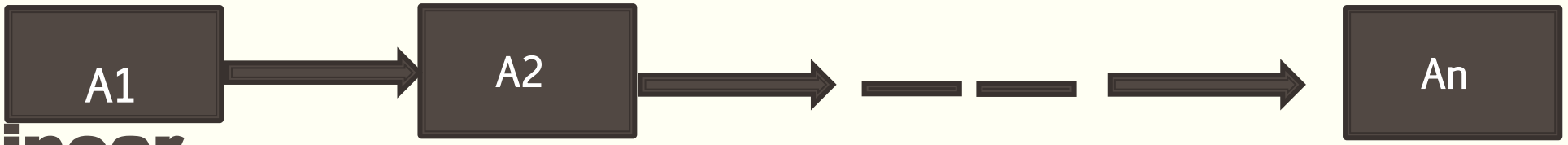
Linear and Non Linear Data structures

➢Linear :

Elements are arranged in line means in sequential manner

The elements have a one to one relationship with other elements

Example : Array, Linked list, stack

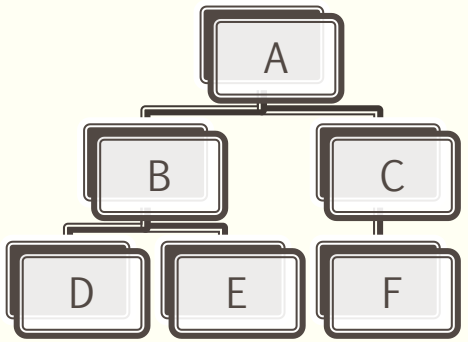


NonLinear :

Elements are arranged in NON sequential manner

The elements have a one to MANY relationship with other elements

Example : Tree,Graph



Static and Dynamic Data Structure

Static (Fixed)
1. The size of DS does not change during the entire program.
2.Means memory remain constant
3. Example : Array

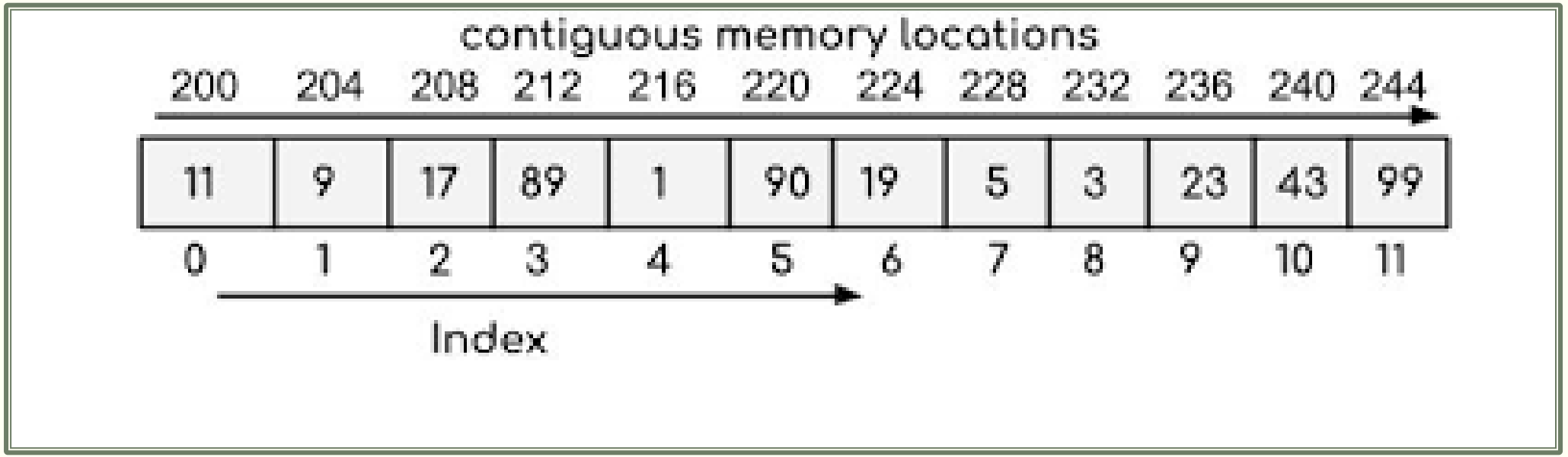
Dynamic (Variable)
1. The size of DS change during the entire program.
2.DS size may grows and shrink during run time.
3. Example : Linked list,stack

Sequential and Linked organizations

- **Sequential :**

In this Successive data elements are stored at fixed distance.

Example Array.

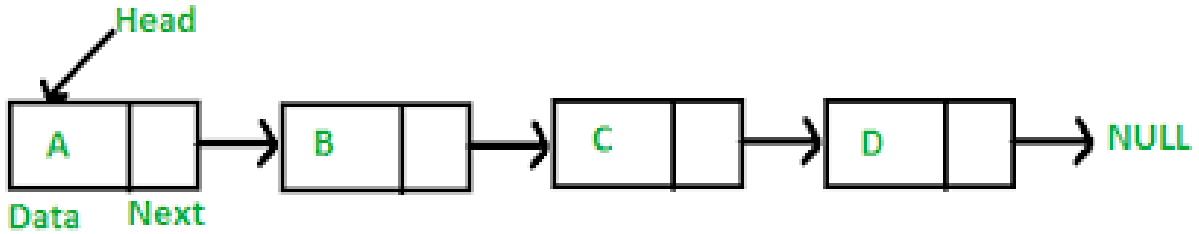


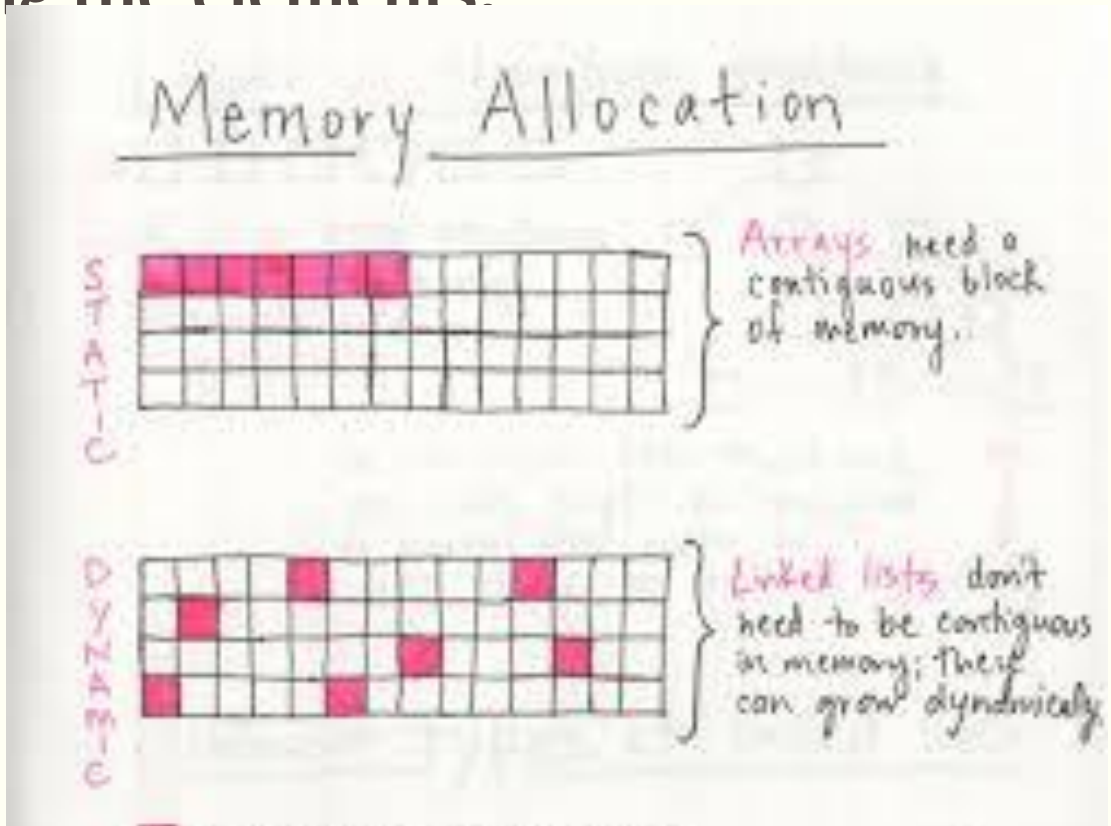
Sequential and Linked organizations

- **Linked**

In this elements of data structures can be stored at any memory location but their sequence is maintained by linking the elements.

Example Linked List.





Questions Related to above Topic

- 1) define data type?
- 2)define data object?
- 3)define data structure?
- 4)Define ADT?(imp)
- 5)What is linear and nonlinear DS? Give example of each.
- 6) What is static and dynamic DS? Example
- 7) What are advantages of ADT?
- 8)List out the areas in which DS are applied extensively

REFERENCES

1. DS AND ALGORITHM BY POONAM PONDE , VISION
2. WEBSITE WWW.GOOGLE.COM

Developed by Alka Mhetre