

CSE225

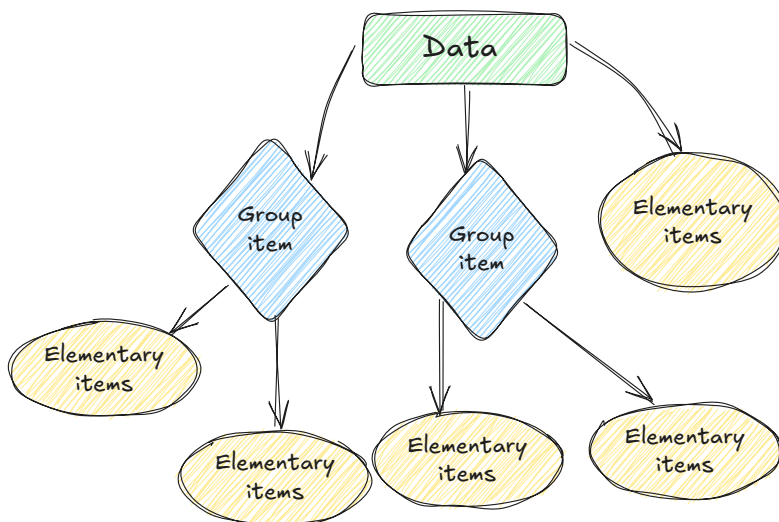
CSE 225 - Data Structures and Algorithms

Lecture 1

Data

Defined as **sets of values**, where a single unit of value/fact is referred to as a **data item**.

Single data items are called **elementary items**, data items that are a collection of elementary items are called **group items**



Information

Defined as data that is organized according to some meaningful relation, usually thro. This is usually referred to as **processed data**.

Data is said to be **correctly** processed when:

- It arrives on **time**
- It is **accurate**
- It is **complete**

Algorithms

An Algorithm is a procedure that takes **data** as input and provides a correct **output** within a finite **time**

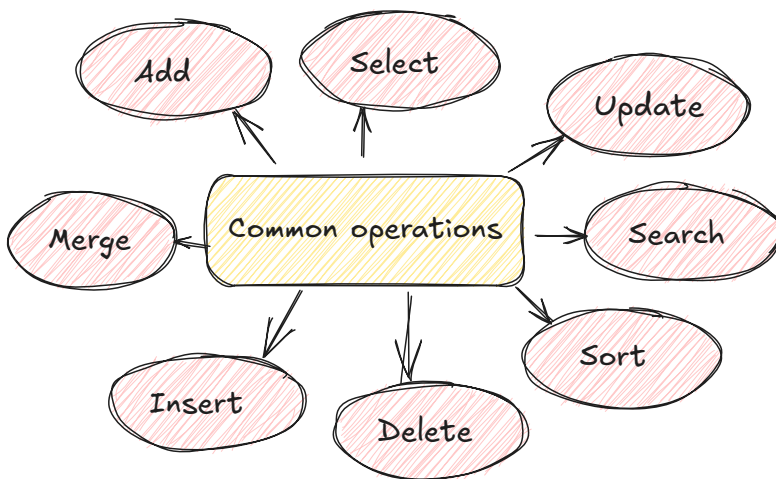
Algorithms are usually specified in :

- English
- Pseudocode
- Computer program

Data Structures

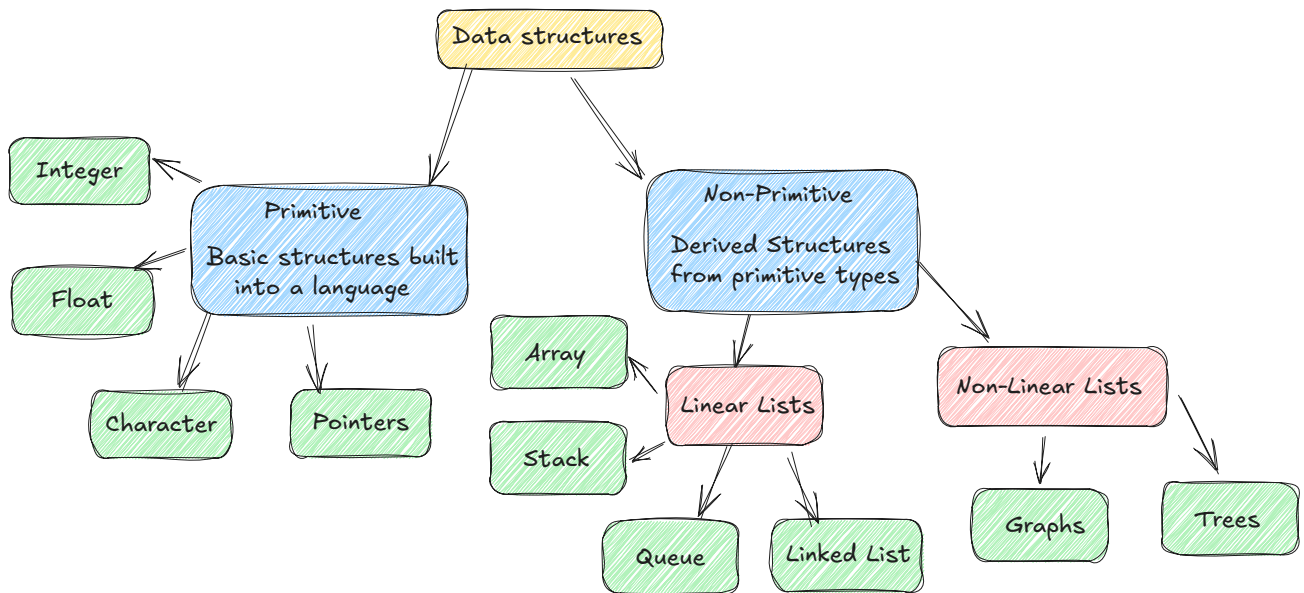
Storing information in a specific way according to a meaningful relation such that **efficient** and **effective** use of the data is possible.

An efficient data structure uses the minimum amount of memory and minimum amount of time to fetch data



Types of Data Structures

- Primitive Data Structures : Basic data types that are usually built into a language.
 - Integer
 - Float
 - Character
 - Pointers
- Non Primitive Data Structures : Built using primitive data types
 - Linear Lists: Location of an element is defined by its order
 - Arrays
 - Stack
 - Queue
 - Linked List
 - Non-Linear Lists: Location of an element is defined by it's neighboring elements and it's hierarchy
 - Graph
 - Trees



Characteristics of Data Structures

- Homogeneous - Consists of elements of the same data type
- Non-Homogeneous - Consists of elements of different data types
- Static - Memory is allocated at compilation time, fixed size
- Dynamic - Memory is allocated at runtime, variable size

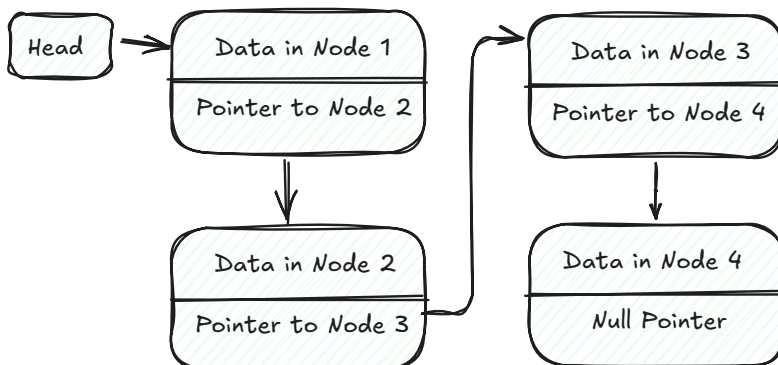
Arrays

An array is a **static linear** list containing a set of **homogeneous** elements.
A single fixed memory chunk is allocated to an array on compilation

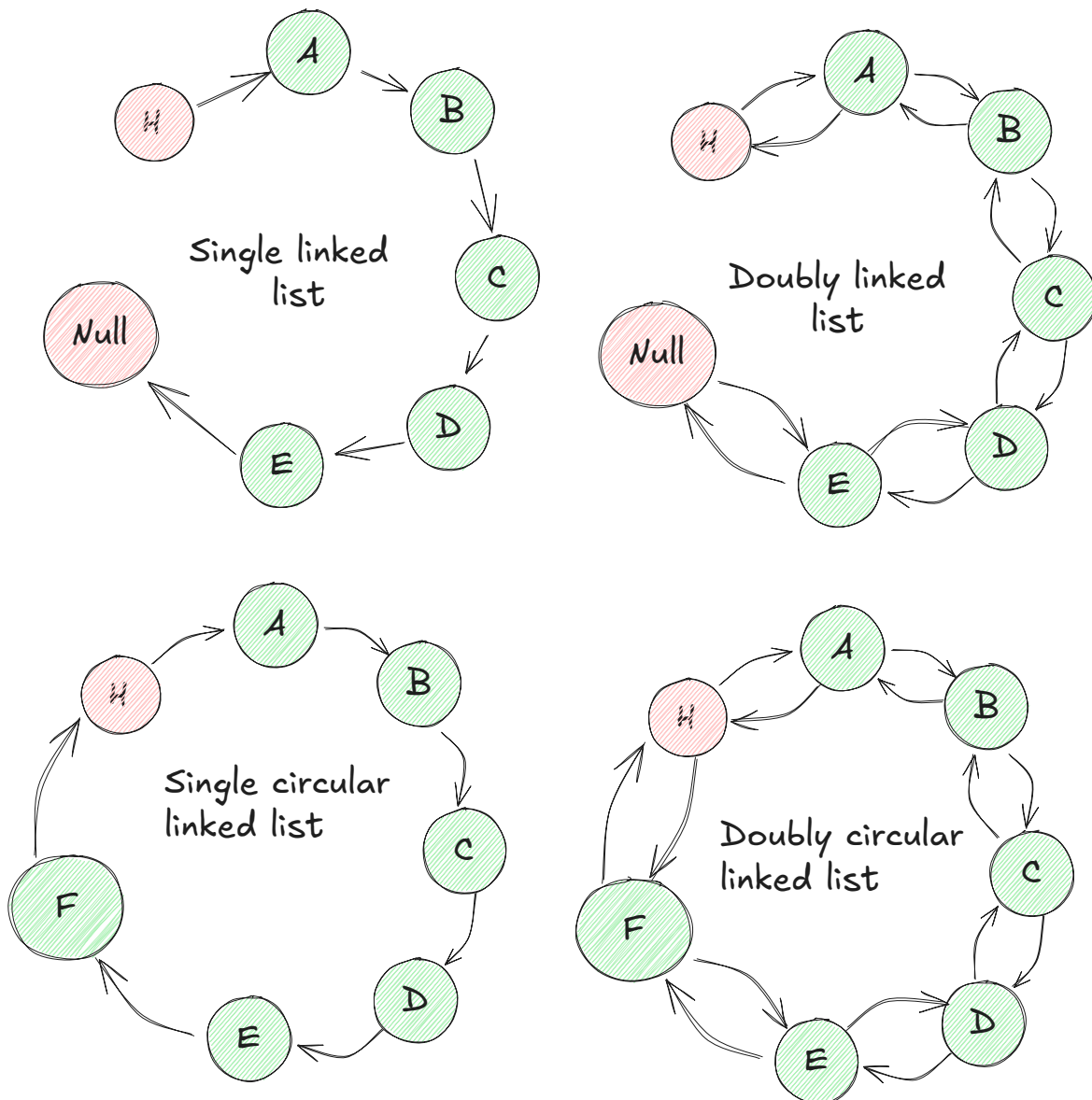
Linked Lists

A linked list is a **dynamic linear** list where an element along with its own data, contains the memory address of the next element.

Unlike arrays, the size of a linked list is variable.



Types of linked Lists



Stacks

A stack is a specialized array where both insertion and deletion operations can be done only from the top of the stack. **LIFO** (Last in, First out)

PUSH : Inserting an element to the top of the stack

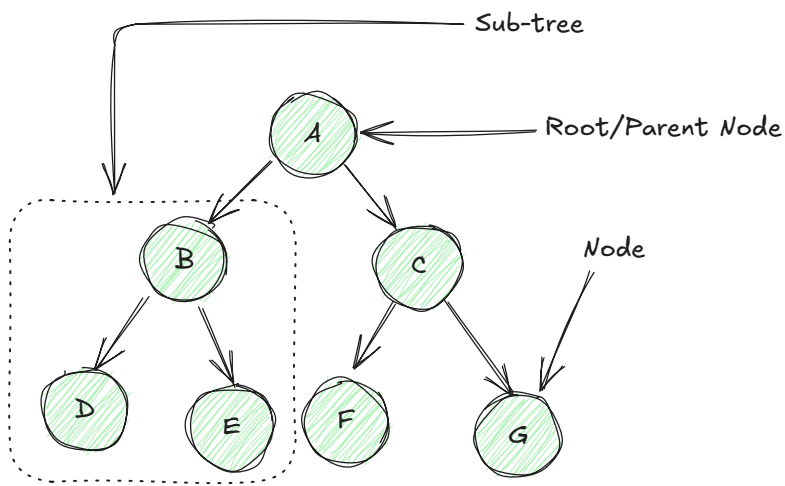
POP : Removing an element from the top of the stack

Queue

A queue is a specialized array where insertion is done from the end of the queue and deletion is done from the top of the queue. **FIFO** (First in, First out)

Trees

A tree is a non-linear data structure where elements are identified by their hierarchical relationships between each other. The top-most element of a tree is called the Root of the tree.

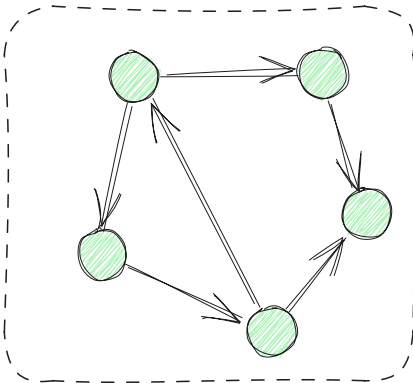


Graph

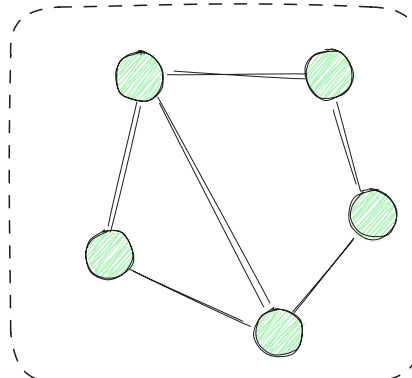
A graph is a non-linear data structure defined by a set of vertices and set of edges

Types of graphs

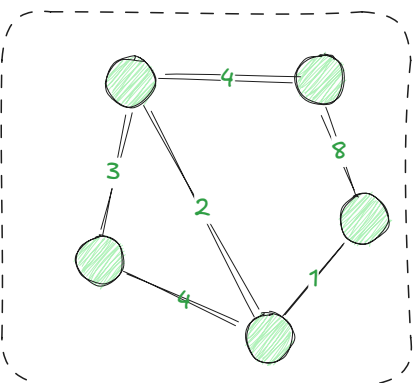
Directed Graph



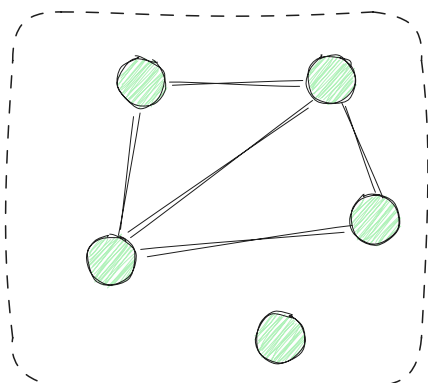
Undirected Graph



Weighted Graph



Non-Connected Graph



These properties are not mutually exclusive,
A graph can be weighted, undirected and non-connected
at the same time

Abstract Data Type

ADT are concepts/models that represent a data structure. The type of data stored and the allowed operations are specified

Lecture-2
