Data Structures

Prof. Dr. Aybars UĞUR

Course 1 : 02.10.2023

1. Data Structures Course

- **Data Structures** is one of the most important courses in **Computer Engineering**, Computer Science, and Software Engineering Departments.

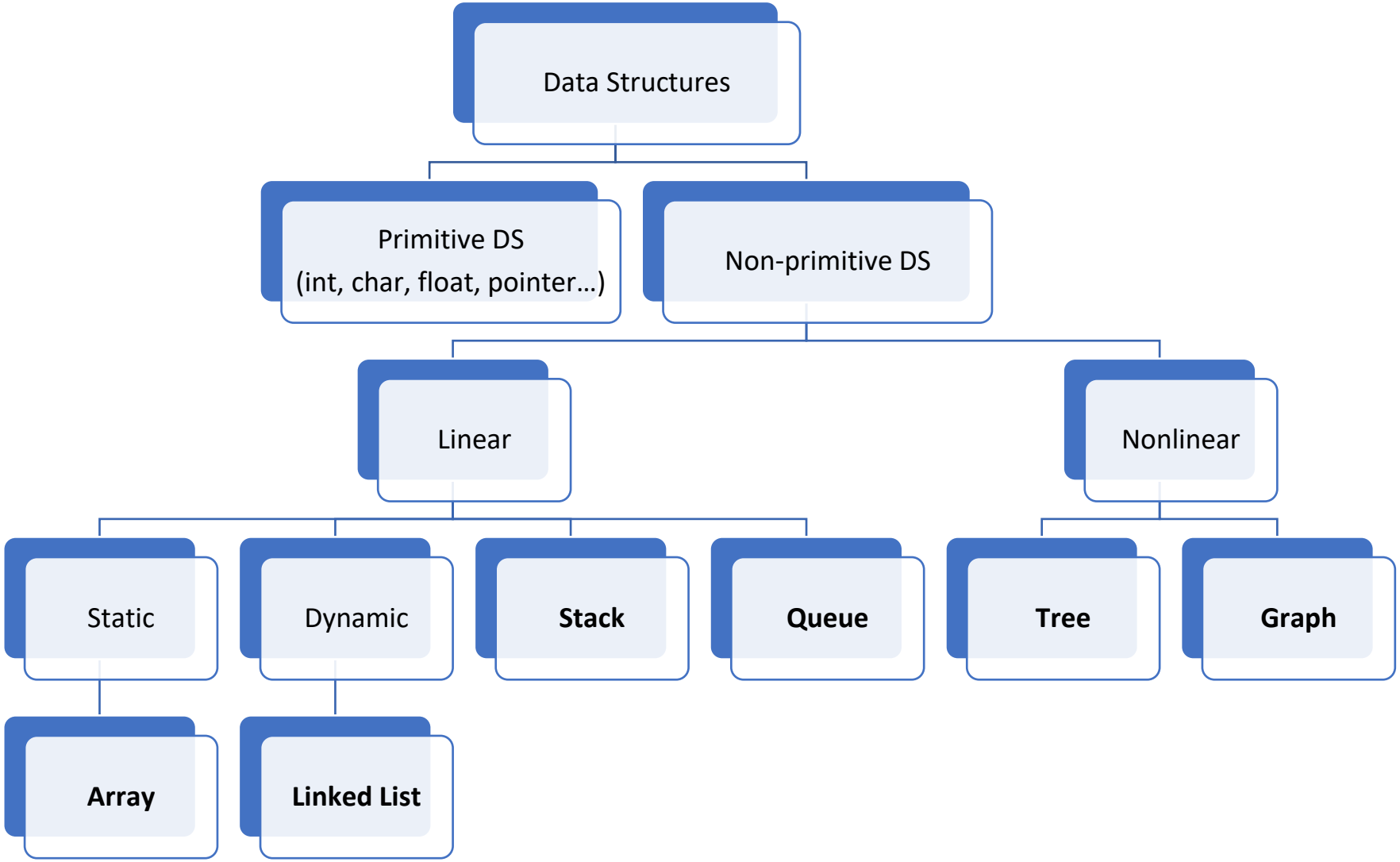
- Data Structures Course is about how data is organized and stored in memory.

- Data Structures is taken generally after the basic algorithms and programming courses.

2. What is Data Structure (DS)

- *A data structure is a data organization and storage format and is a collection of data values.*
  - *Stack*
  - *Queue*
  - *Linked List*
  - *Tree*
  - *Graph*
  - *Hash Table*
  - *…*

3. Classification of Data Structures



Primitive Data Types (~Structures)

- Character
- Integer
- Floating Point Number
- Boolean

…

Composite Types (Non-primitive Types)

- **Array :** Data structure consisting of elements of homogeneous data type. Elements are identified by indices (index). Dimension: number of indices needed to get or set value, etc.

- One-dimensional Arrays (for example int A[5])

A	5	0	13	-4	2

- Multidimensional Arrays (for example two-dimensional array is called matrix -> float B[5,3])

-1.2	13.7	…
60.8	49.5	…
…	…	…
…	…	…
…	…	…

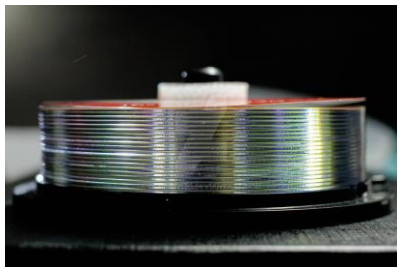
- **Structure :** Data structure consisting of elements of heterogeneous data type.

Age : 73
Name: Charles
Height: 1.78
Title : King

Stack and Queue

Stack DS

- To access the stack items, the LIFO "**Last-In-First-Out**" principle
- Most recent item added is first item to be removed.
- Examples:
  - Dinner of plates
  - CD Stack
  - …



Queue DS

- Implements FIFO "**First-In-First-Out**" principle
- Items are removed in the same order that they are added.
- Examples:
  - Ticket queue or line
  - Cashier lines in any store
  - Access the shared resources (e.g. printer) …

Linked List and Tree

Linked List

- Linear Data Structure
- Dynamic DS
- Each node contains data and a pointer / reference to the next node (for singly link list)

Tree

- Nonlinear two-dimensional data structure
- Dynamic DS
- Represents Hierarchical tree structure
- And also used for searching
- Nodes can be connected to many children.

Graphs

- Non-linear DS made up of a finite number of nodes or vertices and links that connect the vertices are called edges.

- Application Areas:
  - Shortest Path Algorithms
  - Minimum Spanning Tree
  - …