



Data structures

Agenda



1. Definition
2. Array
3. Single Linked List
4. Stack
5. Queue

What is a data structure?

- A data structure is a particular way of organizing data so it can be used effectively by the algorithm.
- A data structure is a specialised form of organizing, processing and retrieving data.
- Data structures are structures programmes to store ordered data.
- A data structure is designed to arrange data in a specific way that will suit a specific purpose.





Arrays

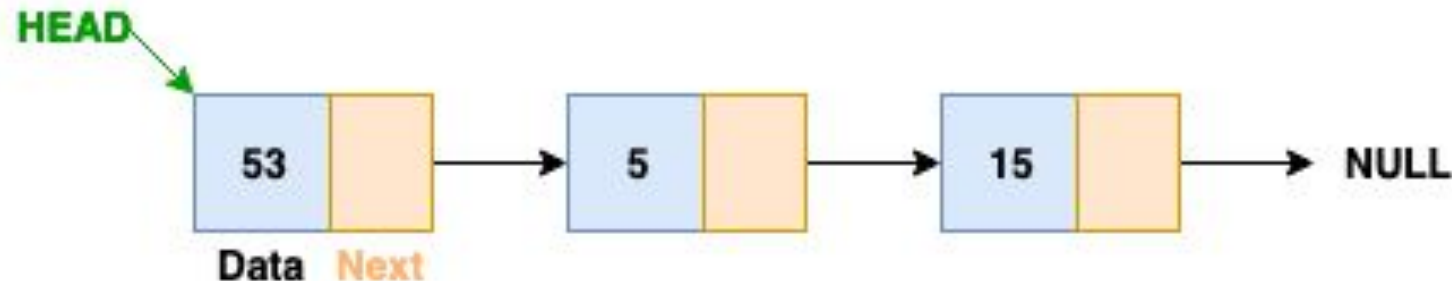
- The array is a linear data structure - a structure in which the elements are linked one after the other.
- The array elements are stored at a contiguous memory location which means consecutive memory blocks (memory blocks that have consecutive addresses).
- This data structure offers the possibility to access any element by its index. This operation has **$O(1)$** complexity so it is preferred to be used when a lot of reading/access of elements operations are done.

Index	0	1	2	3
Values	12	7	5	23



Single linked list

- The linked list is a linear data structure - a structure in which the elements are linked one after the other.
- The linked list elements are **not** stored at a contiguous memory location. The elements are linked using references as shown below.
- Linked lists are quick in adding and removing elements from the list (**$O(1)$** complexity).



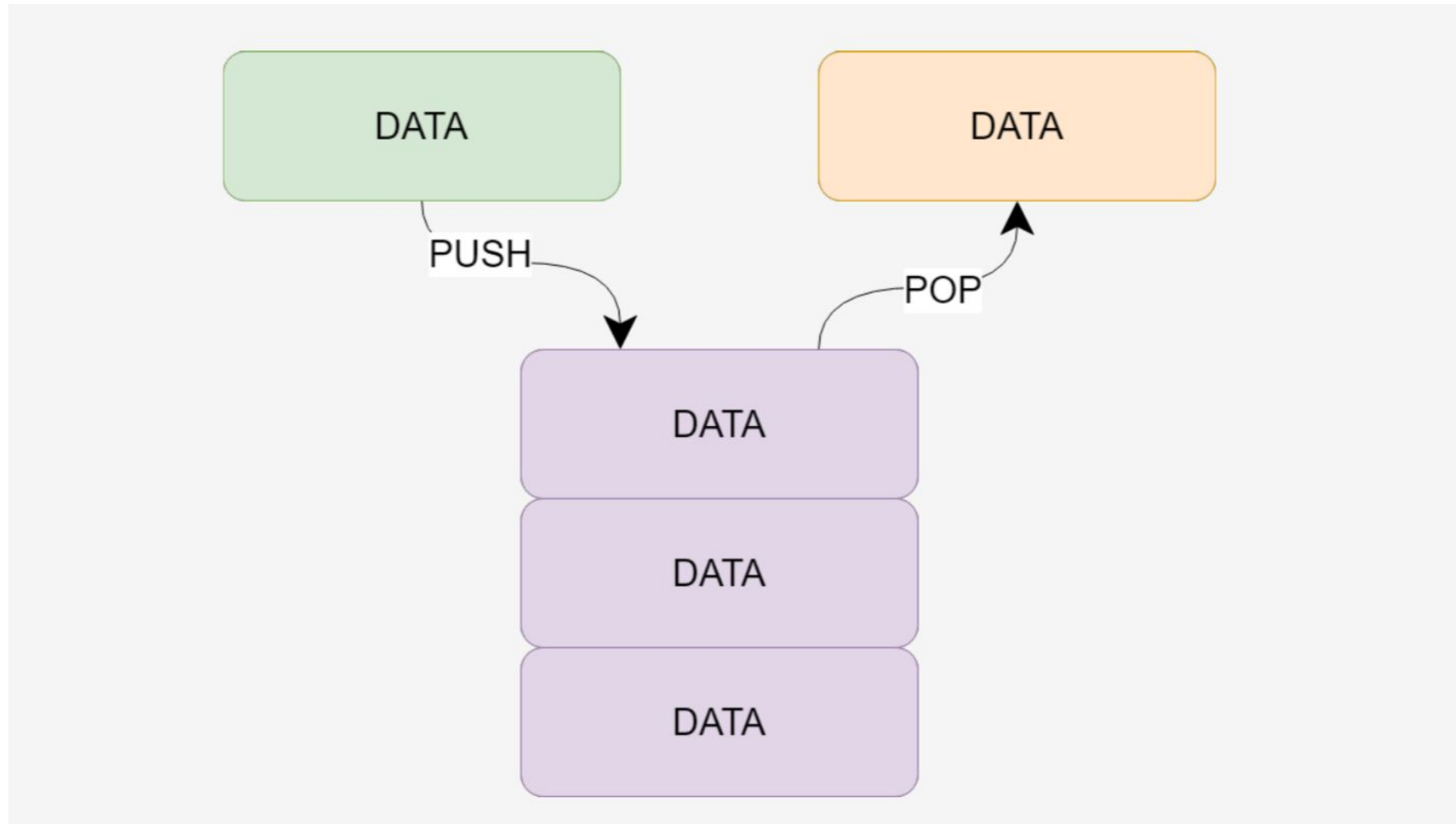


Stack - LIFO queue

- Data structure allowing to insert and pop elements from only one side.
- It is a linear data structure that respects the **LIFO** principle: **Last In First Out**.
- It has two main operations: **push** which is used to insert a new element in the stack and **pop** which is used to remove an element from the stack.
- A real life representation of this data structure would be a stack of plates as seen in the below image. Only the plate on top can be removed and a new plate can be added on top of the last one and not in between other two plates.



Stack - LIFO queue





Stack - methods

- **push(element)** - pushes a new element on top of the stack.
- **pop()** - removes and returns the top element of the stack.
- **peek()** - returns the top element of the stack but does not remove it.
- **empty()** - returns true if there is no element on top of the stack. Else returns false.



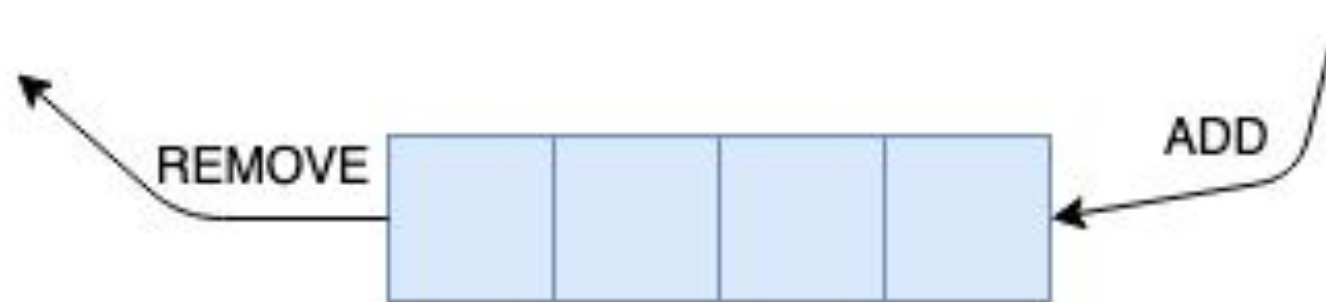
Queue - FIFO

- A data structure that permits the retrieval of data in the same order in which it was retrieved.
- **FIFO - First In First Out.**
- The queues are used most often to exchange data between the components of the application.
- It is a linear data structure - a structure in which the elements are linked one after the other.
- A real life example is the waiting line at the store. The one who came first will be served first.



Queue - methods

- **enqueue(element)** - adds a new element to the end of the queue.
- **dequeue()** - returns and removes the first element.
- **front()** - returns the first element without removing it.





Thank you for your attention!