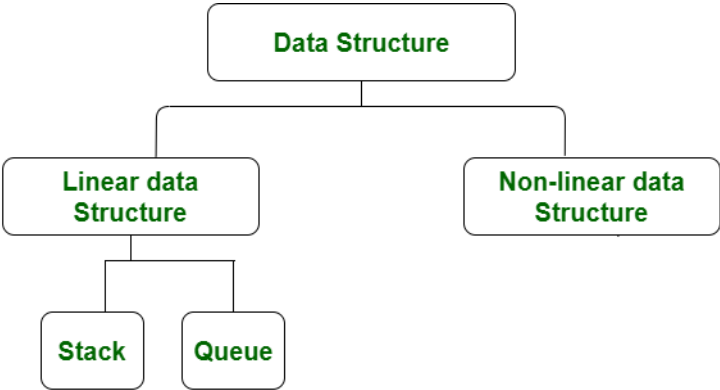


Compare and contrast between linear and non-linear data structure and Stack and Queue.

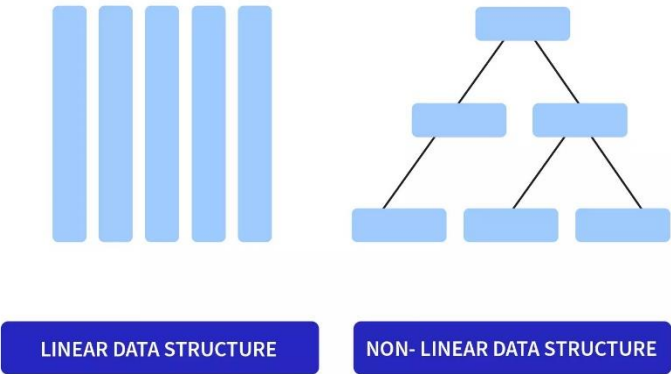
A data structure is a method of storing and organising data in a computer so that it can be used effectively. A data structure is a unique format used to manage and store data, and examples include arrays, files, linked lists, stacks, queues, trees, graphs, and other general data structure types (Karumanchi, 2015). For instance, data structures are classified into two types based on how the elements are organised:

- 1. Linear data structures store elements sequentially, and linked Lists, Stacks, and Queues are some examples.
- 2. Non-linear data structures store elements hierarchically or interconnectedly. Trees and graphs are two examples.



(GeeksforGeeks, 2019).

Stack and queue are two linear data structures commonly used in computer science. A stack is a Last-In-First-Out (LIFO) data structure, whereas a queue is a First-In-First-Out (FIFO) data structure (Lee & Hubbard, 2015).



(Chattopadhyay, 2022).

The following are some critical distinctions between linear and non-linear data structures, as well as stack and queue:

Data Structures that are Linear:

- Elements are kept in sequential order.
- Arrays, linked lists, stacks, and queues are some examples.
- It is relatively easier to navigate through elements.
- Element insertion and deletion can be more complicated depending on the data structure.

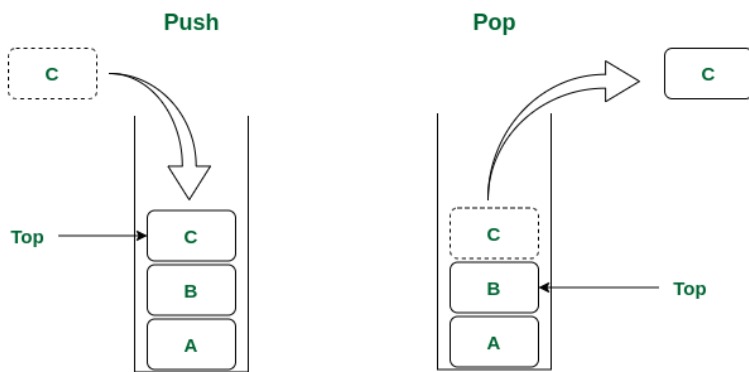
Data Structures that are not Linear:

- Elements are organised in a hierarchical or interconnected fashion.
- Trees, graphs, and heaps are some examples.
- It can be more challenging to navigate through elements.
- Depending on the data structure, element insertion and deletion can be easier or more difficult.

A stack is a data structure that only allows access at one end of the sequence. New values are pushed onto the stack to be added to the sequence and popped off the stack to be removed.

Stacks are Last-In-First-Out (LIFO) data structures, and the first item popped is the last item pushed. A Stack class can be implemented in at least two ways to achieve the computation complexities in this table. It is sufficient to use either a list or a linked list (Lee & Hubbard, 2015).

- The last element added to the stack will be the first one removed in a LIFO data structure.
- Push (adding an element to the top of the stack) and pop (removing the top element from the stack) are two operations.
- An array or a linked list can be used to implement this.
- Function calls, undo/redo functionality, and infix to postfix conversion are all standard applications.

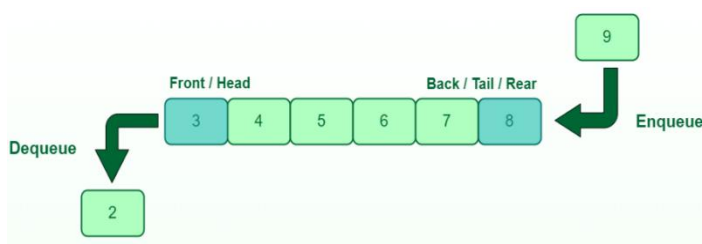


Stack Data Structure

(GeeksforGeeks, 2015).

A queue is similar to a stack in many ways, except that queues are FIFO or First-In-First-Out data structures instead of a LIFO data structure. The first thing pushed is the first thing popped. When working with a queue, we refer to an item as enqueueing rather than pushing it. When removing an item from the queue, we refer to it as dequeuing rather than popping it as we would from a stack (Lee & Hubbard, 2015).

- A FIFO data structure means that the first element added to the queue is the first one removed.
- Enqueue (adding an element to the end of the queue) and dequeue (removing the first element from the queue) are two operations.
- It can be done with an array or a linked list.
- Job scheduling, breadth-first search algorithms, and printer queues are typical applications.



Queue Data Structure

(GeeksforGeeks, 2015).

To summarise, linear data structures store elements sequentially, whereas non-linear data structures store elements hierarchically or interconnectedly. The stack and the

queue are linear data structures, with the stack being a LIFO data structure and the queue being a FIFO data structure.

References:

Karumanchi, N. (2015). *Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles*. CareerMonk Publications.

Lee, K.D., & Hubbard, H. (2015). *Data Structures and Algorithms with Python*. Springer.

GeeksforGeeks (2019). *Difference between Linear and Non-linear Data Structures*. [online] Available at: <https://www.geeksforgeeks.org/difference-between-linear-and-non-linear-data-structures/>.

Chattopadhyay, S. (2022). *Scaler Topics*. [online] www.scaler.com. Available at: <https://www.scaler.com/topics/non-linear-data-structure/>.

GeeksforGeeks. (2015). *Stack Data Structure - GeeksforGeeks*. [online] Available at: <https://www.geeksforgeeks.org/stack-data-structure/>.

GeeksforGeeks (2015). *Queue Data Structure - GeeksforGeeks*. [online]

GeeksforGeeks. Available at: <https://www.geeksforgeeks.org/queue-data-structure/>.