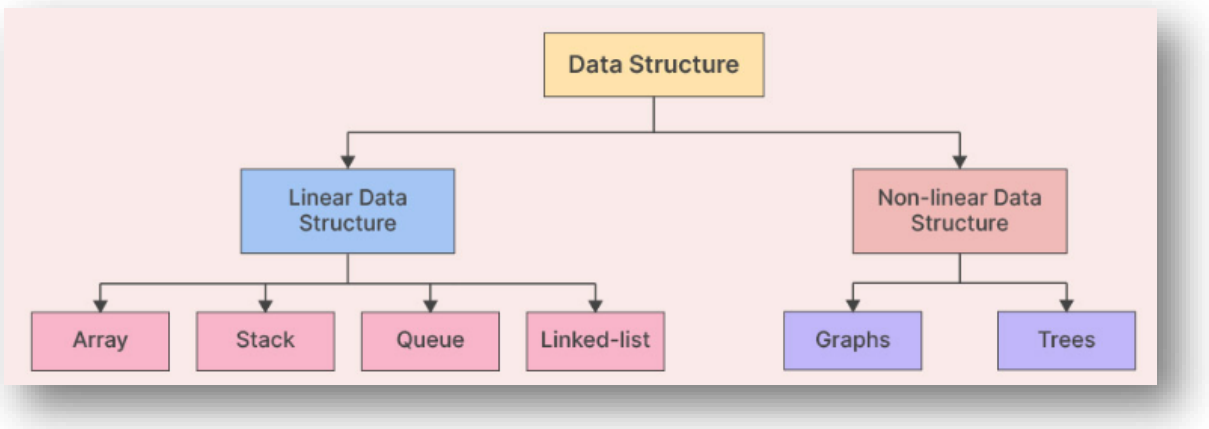
Chapter III: Stacks and Queues

1. Linear Data Structure Versus Non-linear Data Structure

A data structure refers to organizing and storing data in a computer's memory in a way that enables efficient access, manipulation, and retrieval of the data. Data structures are fundamental concepts in computer science and are extensively used in programming and software development to solve various computational problems.

There are two categories of data structure - **linear data structure and non-linear data structure. I**n real life, linear data structure is used to develop software, and non-linear data structure is used in image processing and artificial intelligence.



2. Definition of “Stack”:

A **stack** is a linear data structure (i.e a type of data structure that stores the data linearly or sequentially) that follows the **LIFO** (Last In, First Out) principle. This means the **last** element inserted is the **first** one to be removed.

Main operations for Stacks:

1) **push**: insert an element on top.
2) **pop:** remove the top element.
3) **peek or top:** view the top element without removing it.
4) **isEmpty:** check if the stack is empty.

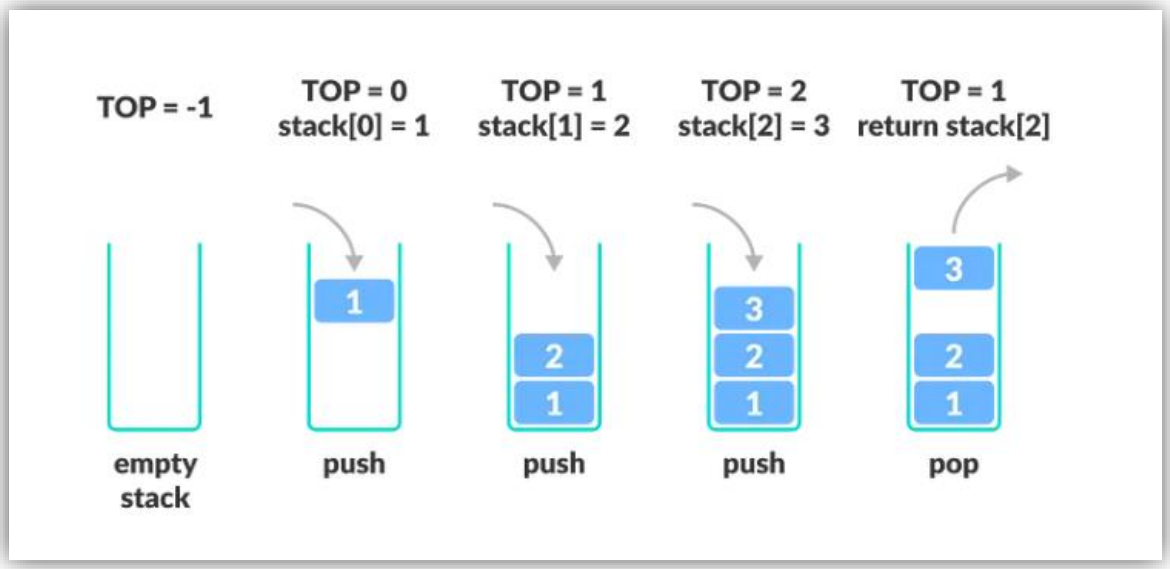


Figure 1. Presentation of Push Operation

Program in C Language to define, initialize and checking a Stack:

```c
#include <stdio.h>
#include <stdlib.h>

#define MAX 100

typedef struct {
    int data[MAX];
    int top;
} Stack;

void init(Stack *s) {
    s->top = -1;
}

int isEmpty(Stack *s) {
    return s->top == -1;
}

int isFull(Stack *s) {
    return s->top == MAX - 1;
```

1.