

CPS 181 INTRODUCTION TO DATA STRUCTURES

DATA STRUCTURE

- Computer has to process lots and lots of data.
- To systematically process those data efficiently, those data are organized as a whole, appropriate for the application, called a data structure.

DATA STRUCTURES

Data Structures deals about

- data,
- storage of data,
- data access
- improving the efficiency of data processing,
- securing the data used by users.

Example:

Day-to-day activities
like storing the contacts of people and
accessing their information to email
them or make a phone-call to them.

TYPES OF DATA STRUCTURES

LINEAR DATA STRUCTURES

- Arrays
- Stacks
- Queues
- Linked lists
- Array, stack and queue are examples of linear data structures, where data is stored and accessed sequentially.

An appropriate data structure is also the key to manage huge amounts of data, such as large databases, the backbone of today's information age.

NON-LINEAR DATA STRUCTURES

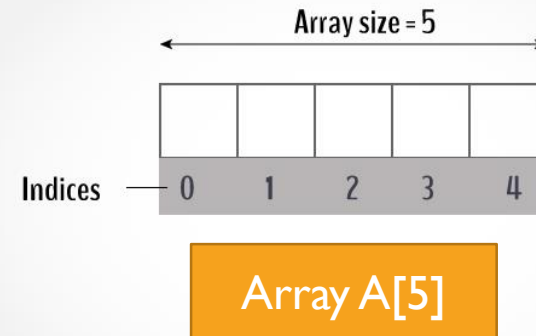
- Trees
- Graphs
- Heaps
- Trees, graphs and heaps are examples of non-linear data structures where data is stored and accessed hierarchically.

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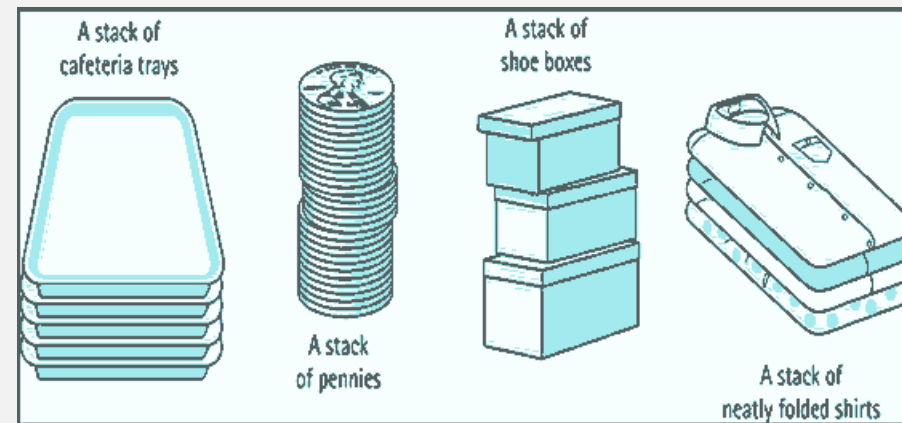
ARRAYS

- Most used data structure.
- An array is a special variable having one name, but storing a list of data items, with each item being directly accessible.
- Truck, train, cargo planes which carry data are examples of arrays in everyday activities.
- In an array, each element's location number is called the index. The array index usually starts with a zero.



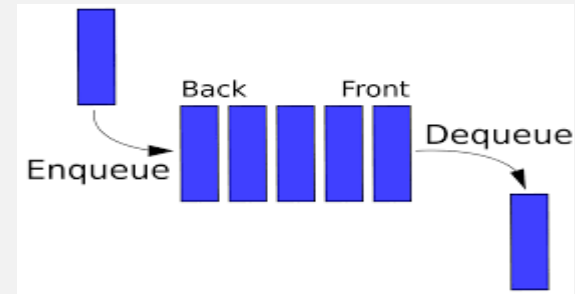
STACKS

- Stack is a linear data structure which follows a particular order in which the operations are performed.
- A stack data structure is closed at one end and is open at the other end.
- The order may be LIFO (Last In First Out)
- Examples are a pile of books, a box of pringles potato chips.
- The operations performed on a stack are Push (to insert an element) and Pop (to remove an element).



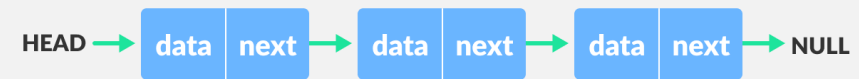
QUEUES

- Queue is an abstract data structure, somewhat similar to Stacks.
- Unlike stacks, a queue is open at both its ends.
- The operations performed on a queue data structure are Enqueue (inserting data into the queue) and Dequeue (removing data from the queue).
- Enqueue is performed at one end of the queue and Dequeue is always performed at the other end of the queue.
- Queue follows First-In-First-Out methodology, i.e., the data item stored first will be accessed first.
- Real life example is people waiting in a queue in a grocery store.



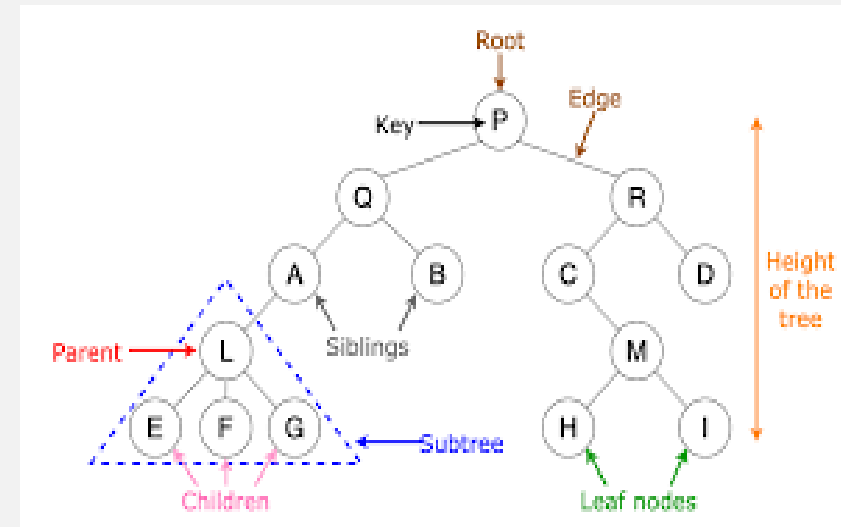
LINKED LISTS

- A linked list is a linear collection of data elements whose order is not given by their physical placement in memory.
- Instead, each element points to the next element.
- It is a data structure consisting of a collection of nodes which together represent a sequence.
- Head points to the first element in the linked list. The next field of the last element is made null.
- Each node in a linked list has two fields namely, data and next.
- The next field points to the next element if present otherwise the next field is set to null.
- Types of linked lists are Singly linked list, Doubly linked list, circular linked list.



TREES

- A tree is a non-linear data structure that can be defined as a collection of nodes.
- The root node is the start node
- Each node is a data structure consisting of a value, together with a list of references to nodes (the "children"), with the constraints that no reference is duplicated, and none points to the root.



GRAPHS

- A Graph is a non-linear data structure consisting of nodes and edges.
- The nodes are sometimes also referred to as vertices.
- Edges are lines or arcs that connect any two nodes in the graph.
- The graph could be a directed graph or undirected graph.

