DATA STRUCTURES

These are ways of organizing and storing data for easy accessibility which help programmers manage large amounts of data and perform operations such as sorting, deleting, searching and inserting effectively.

Applications:

1) Arrays (store data in continuous memory locations)
   - ✧ Storing students' marks
   - ✧ Storing daily temperature
   - ✧ Image processing

   Example: YouTube uses array to store lists of video suggestions.

- Why used : -allow fast access using index(0(1))
  -simple to implement and efficient for fixed size data
  -memory is allocated in continuous locations

2) Queue (***FIFO*** -first in first out)
   - ✧ Printer queue
   - ✧ Task scheduling
   - ✧ CPU scheduling

   Example :WhatsApp messages delivery system uses queues.

- Why used :-follow FIFO principle
  -ensure fair processing order
  -prevents stavartion of earlier tasks

3) Stack (***LIFO***- last in first out)
   - ✧ Undo/Redo operations
   - ✧ Function calls (call stack)
   - ✧ Expression evaluation

   Example: browser redo/back button works using stack.

- Why used:-follow LIFO principle
  -efficient for reversing operations
  -used automatically by the system to manage function execution

4) Linked list
   - ✧ Dynamic memory location
   - ✧ Music playlists
   - ✧ Navigation systems

   Example : Facebook friend lists

- Why used:-dynamic size (scalability)
  -insertion and deletion
  -no need of continuous memory

5) Tree

- ✧ Database indexing
- ✧ File systems
- ✧ HTML DOM structure

Example :folder structure in your computer

- ➢ Why used:-represent hierarchical relationships
  -allow fast searching
  -arrange data in parent-child structure

6) Graph
   - ✧ Social networks (Facebook, WhatsApp and YouTube
   - ✧ Relationship-based databases
   - ✧ GPS navigation
   - ✧ Network routing

   Example :Google maps

- ➢ Why used:-represent complex relationships
  -model real world networks
  Used in shortest path algorithms

How data structures and algorithms work with systems

i. Memory management
ii. Operating systems
iii. Databases
iv. Networks and communication systems
v. Application software

Different data structures are applied based on the nature of the problem. The choice of data structure depend on efficiency, memory usage , speed of access and type of data relationship. Selecting the best data `structure improves system performance and scalability.

GitHub Repository Link :
https://github.com/giftwilliams/Data-structures-and-algorithm.git