

Teacher's Guide

Hi! Welcome to the teacher's guide. Thanks for watching our lesson as your time is precious for us.

This lesson is designed for the students who have just started learning data structures & aims to provide the basic understanding & needs of it. They need to know that there are many ways to store data while processing in the memory & how these different implementations may be useful. We've tried to relate these implementations to real life needs when it comes to store different kinds of data by taking examples from a visit to a book shop.

The basic focusing points for the lesson are

- 1- The need of a list structure over an array.
- 2- Stack & its usages in computer programming.
- 3- Queue & its applications while working in computer science.
- 4- Choosing the right data structure for your problem.

Let's discuss the activities that can be performed in class.

1- In the first activity we want students to realize the need of an organized data structure & make them realize the importance of a list & its useful properties i.e. dynamic increase or decrease in size & insertion at any point with low cost.

Two activities will be performed in class.

i- Define an array of size 10 & fill it with some data. Then ask the students that if there is a need to insert one more element then what can be done? Of course a new array with bigger size will be declared, all the data will be copied in it & new data will be added after that.

ii- What if three elements are already added in array (say apple, banana & orange) keeping alphabetical order in mind. Now you want to insert another element "Mango" in it. In the case of an array, there is a need to move the entire list of elements one index further that comes after mango and place mango on its place.

Moving further with these two activities makes students realize the need of a structure that can increase or decrease its size dynamically & there is always a place to insert data anywhere without the need of disturbing the others.

2-For 2nd activity the teacher has to make students realize that how a linked list can be more useful in certain scenario by counting the steps that will be taken by the same two examples in the previous activity.

i- To evaluate the first clause i.e. the dynamic increase in size, take a bench where three students are sitting. (Denoting an array). What if another student comes and wants to sit with them. A new bigger bench will be brought, all three will shift to the new bench & the 4th will sit with them. But in case of linked list the students will be sitting on separate chairs & the next coming student just needs to bring his chair to join them. Count the steps in both implementations.

ii- To evaluate the second clause i.e. insertion in array, let some students stand next to each other (Denoting an array). If new data needs to be inserted at a certain point, all the data after the desired index needs to be shifted one location further. But in the case of a linked list, consider the chain of boys holding each other's hand to form links. If new data needs to be inserted then only the desired location will break its link & hold the hands of the upcoming boy or node. Let them count the steps here as well.

3- Third activity makes students realize the organization of a stack which opens the door of thought on students that there may be more than one data structures.

This activity will build upon the scenario presented in segment 3, and make students realize that the "list" that they are maintaining is starting to exhibit the properties of another data structure.

Suppose that we had to bring 3 different books for 3 friends that meet you on the way to the book store: we would obviously remember their requested books in the form of a list in our mind, and would also maintain that list in the order in which we met our friends.

Hence when we will ask for those books at the store, we would be going one by one following the list, and let's assume we place the books on top of each other as the shopkeeper hands them to us. Now we would have a pile of books.

When we would be taking those books back, we would be backtracking on the path we came from, and the friend that met us last, would come first, and the one that was first would now meet us last. Interestingly, this is the exact same order in which our books are piled up.

Now, as we meet our friends along the way, we would keep handing them the book at the top of our pile one by one and it would automatically be in order.

Here, we have interestingly encountered another data structure, whose properties have been demonstrated through the example presented.

Introduce students with the concept of stack & resume the lesson video.

4- In the 4th activity, define the usages of stack in computer science & allow the students to add their thoughts as well.

i- Write something on the board or type something on the key board. Then erase it. Ask the student which pattern is followed here. They'll notice that the last one to be written will be the first one to be erased.

ii- Repeat the same thing with opening the folders in windows. When backspace is pressed the latest open folder will be the first one to be closed. Same thing can be done with clicking the links on webpages.

Give them some time to think about more examples in computer science & resume the video.

5- The fifth activity aims to make them realize the limitation of stack & introduces the need of queues. Identify the flaw of stack if used in a scenario where a queue is needed.

Let them play an act of shopkeeper & customer.

One student may become shopkeeper & the others will be customers. After every 10 seconds a new customer will come & add himself in a stack. The shopkeeper serves the customer once every 15 seconds using the LIFO fashion.

Make them realize that in this fashion the one who came first may never get his turn & will be waiting forever.

6- The purpose of the sixth activity is to make students realize that each structure is used when it is needed only & there are more ways to store data other than those we discussed in the lesson.

This activity will be a short exercise & may be held as a voting session. You may ask the class that out of the three data structure list, stacks & queue, which will be the best one? Ask every student to share his views.

At the end make them realize that no data structure is best for everything. It depends what you need & structure will be used accordingly.

The course of computer is always being a tricky thing to understand yet engaging & interesting to deal with. If the examples made to learn this course can be related to real life; learning may become much easier.

In this lesson we have tried our best to bring up the knowledge of data structure at a very initial level encourage the students to explore more in this topic. & for that journey wish them good luck for more exploration.