Dynamic Array Implementation using C++

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***Abstract*—This paper discusses the significance of data structures, specifically Dynamic Arrays and their implementation of using C++**

I. Introduction

Data structures are used to organize and manage data while enabling efficient access and modification.They are a collection of data values, the relationships among them, and the functions or operations that can be applied to the data. **Dynamic Arrays** are similar to generally implemented arrays but with a big improvement: Automatic resizing. They expand as you add more elements. So one doesn't need to determine the size ahead of time.

II. TIME COMPLEXITY

A. Dynamic Array

The dynamic array introduces some important overhead in both time and space. If the dynamic array moves itself so that the entire array is contiguous (and so lookup is constant time), growing and moving the array will still take time. In the worst case asymptotically, inserting a new element takes O(n)O(n). However, it's important to look at the amortized analysis to see that the runtime is actually smaller; specifically, O(1)O(1).

III. Implementation

The following methods were employed to implement the two data structures using C++

A. Implementation: Dynamic Array

- Through the use of vitual functions and abstract classes the implementation was structured.
- As the array size was a variable with constanly changing values, the array had to be allocated dynamically using the **new** keyword.
- While insertion operation, every time the array reaches it's maximum capacity, a new array with double the capacity is allocated and the contents of the previous array is copied onto the new array.
- The size of the dynamic array refers to the number of elements currently in the array whereas the capacity of the array denotes the total size of the array i.e the total number of elements the array can actually accomodate.
- While removal, once the capacity decreases after pop operation, according to the decrease decrease factor, we reduce the size of the array.

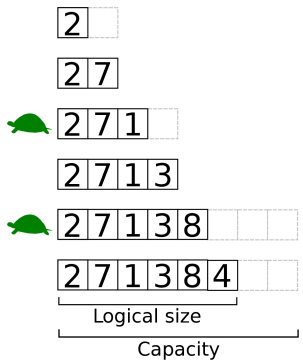

Fig. 1. An image of a insert operations on a Dynamic Array

IV. Applications

Data Structures form the building blocks of every program and have unimaginably infinite number of applications. Few of the applications of Dynamic Array are as follows

- Dynamic arrays benefit from many of the advantages of arrays, including good locality of reference and data cache utilization, compactness (low memory use), and random access. They usually have only a small fixed additional overhead for storing information about the size and capacity. This makes dynamic arrays an attractive tool for building cache-friendly data structures.

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