Container (abstract data type)

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"Container (computer science)" redirects here. For the abstract notion of containers in type theory, see Container (type theory).

This article **may require cleanup to meet Wikipedia's quality standards**. The specific problem is: **text is clunky**. Please help improve this article if you can. *(March 2012)*

In computer science, a **container** is a class, a data structure,[1][2] or an abstract data type (ADT) whose instances are collections of other objects. In other words, they store objects in an organized way that follows specific access rules. The size of the container depends on the number of objects (elements) it contains. Underlying implementation of various container types may vary in space and time complexity, which provides flexibility in choosing the right implementation for a given scenario.

Contents

Overview [edit]

Containers can be looked at in three ways:

- *Access* : Accessing the container elements. In the case of arrays, accessing is done with the array index. For stacks, access of elements is done using LIFO (Last In First Out) [3] (alternative name **FILO** (First In Last Out) and in queues it is done using FIFO (First In First Out)).[3][4]
- *Storage* : Storage includes storing items in containers. Some containers are finite and some are infinite.
- *Traversal* : This describes how the item can be traversed.

Container classes are expected to implement methods to do the following:

- create a new empty container,
- report the number of objects it stores (size),
- delete all the objects in the container (clear),
- insert new objects into the container,
- remove objects from it,
- provide access to the stored objects.

Containers are sometimes implemented in conjunction with iterators.

Types [edit]

Containers can be divided into two groups:

1. *Value based containers*
2. *Reference based containers*

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Edit links

Value based containers [edit]

Value based containers store copies of objects. If we access an object, the object returns a copy of it. If an external object changes after it has been inserted in the container, it does not affect the container's content.

Reference based containers [edit]

Reference based containers store pointers or references to the object. If we access an object, the object returns a reference to it. If an external object is changed after it has been inserted in the container, it affects the content of the container.

Single or associative [edit]

A container may be:

1. *Single value*
2. *Associative*

Single value containers [edit]

Each object is stored independently in the container and it is accessed directly or with an iterator.

Associative containers [edit]

An associative array, map, or dictionary is a container composed of (key,value) pairs, such that each key appears at most once in the container. The key is used to find the value, the object, if it is stored in the container.

Examples of containers [edit]

Containers are divided in the Standard Template Library into associative containers and standard sequence containers. Besides these two types, so-called container adaptors exist. Data structures that are implemented by containers include arrays, lists, maps, queues, sets, stacks, tables, trees, and vectors.

Graphic containers [edit]

Widget toolkits use special widgets also called *Containers* to group the other widgets together (windows, panels, ...). Apart from their graphical properties, they have the same type of behavior as **container classes**, as they keep a list of their child widgets, and allow to add, remove, or retrieve widgets amongst their children.

Implementations [edit]

- .NET: System.Collections (MSDN)
- ActionScript3: AS3Commons Collections Framework
- C++: C++ Standard Library (SC++L) or the obsolete Standard Template Library (STL)
- Java: Java collections framework (JCF)
- Objective-C: part of the Foundation Kit
- PL/SQL Collections[5]
- Python: collections module
- Scala Mutable and Immutable Collections in the packages `scala.collection.mutable` and `scala.collection.immutable`

See also [edit]

- List of data structures
- Standard Template Library#Containers
- Collection (abstract data type)
- Stack data structure

References [edit]

1. ^ Paul E. Black (ed.), entry for *data structure* in *Dictionary of Algorithms and Data Structures*. *US National Institute of Standards and Technology.15 December 2004. Accessed on Oct 04, 2011.*
2. ^ Entry *data structure* in the Encyclopædia Britannica (2009) Online entry Accessed on Oct 04, 2011.
3. ^ [a] [b] LIFO(investopedia.com)

4. ^ FIFO(businessdictionary.com)
5. ^ "PL/SQL Collections and Records". Retrieved 2013-04-20.

External links [edit]

- Container Data Structure Declaration and Initialization
- Container data structures
- Python SortedContainers module A fast implementation of sorted list, sorted dict, and sorted set data types in Python.

v · t · e	Data structures
Types	Collection · **Container**
Abstract	Associative array · Double-ended priority queue · Double-ended queue · List · Map · Multimap · Priority queue · Queue · Set (multiset) · Disjoint Sets · Stack
Arrays	Bit array · Circular buffer · Dynamic array · Hash table · Hashed array tree · Sparse array
Linked	Association list · Linked list · Skip list · Unrolled linked list · XOR linked list
Trees	B-tree · Binary search tree (AA · AVL · red-black · self-balancing · splay) · Heap (binary · binomial · Fibonacci) · R-tree (R* · R+ · Hilbert) · Trie (Hash tree)
Graphs	Binary decision diagram · Directed acyclic graph · Directed acyclic word graph
List of data structures	

v · t · e	Data types
Uninterpreted	Bit · Byte · Trit · Tryte · Word
Numeric	Bignum · Complex · Decimal · Fixed point · Floating point (Double precision · Extended precision · Half precision · Minifloat · Octuple precision · Quadruple precision · Single precision) · Integer (signedness) · Interval · Rational
Text	Character · String (null-terminated)
Pointer	Address (physical · virtual) · Reference
Composite	Algebraic data type (generalized) · Array · Associative array · Class · Dependent · Equality · Inductive · List · Object (metaobject) · Option type · Product · Record · Set · Union (tagged)
Other	Boolean · Bottom type · **Collection** · Enumerated type · Exception · Function type · Opaque data type · Recursive data type · Semaphore · Stream · Top type · Type class · Unit type · Void
Related topics	Abstract data type · Data structure · Generic · Kind (metaclass) · Parametric polymorphism · Primitive data type · Protocol (interface) · Subtyping · Type constructor · Type conversion · Type system

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