

Data Structures

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Who am I?

- ▶ Master of Engineering: Computer Science (KUL)
 - ▶ Computational informatics
- ▶ Realdolmen: acADDemICT in 09/2015
- ▶ Current project: Planning infrastructure @ Infrabel



Outline

- 1 Introductory Data Structures
 - Array
 - Linked List
 - Hash Table
 - Heap
 - Red-Black Tree
- 2 Java Collection API & Map API
 - Java Collection API
 - Java Map API
- 3 Advanced Data Structures
 - Stuff. . .



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What are Data Structures?

Data Structure¹

A way in which data are stored for efficient search and retrieval. Different data structures are suited for different problems.

- ▶ Data type \neq data structure
- ▶ `java.util.HashSet` vs. hash table
- ▶ array vs. array

¹Encyclopædia Britannica

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Array

Definition

- ▶ An indexed set of related elements²
- ▶ An assemblage of items that are randomly accessible by integers, the index³
- ▶ Example: linear array



² Oxford Dictionary

³ National Institute of Standards & Technology

Array

Operations

- ▶ `get`
- ▶ `set`
- ▶ `indexOf`



Array

Operations

- ▶ `get`
- ▶ `set`
- ▶ `indexOf`



`get(1)`

Array

Operations

- ▶ `get`
- ▶ `set`
- ▶ `indexOf`



`get(1)`

Array

Operations

- ▶ `get` $O(1)$
- ▶ `set`
- ▶ `indexOf`



`get(1)`

Array

Operations

- ▶ `get` $O(1)$
- ▶ `set`
- ▶ `indexOf`



`set(2)`

Array

Operations

- ▶ `get` $O(1)$
- ▶ `set`
- ▶ `indexOf`



`set(2)`

Array

Operations

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- ▶ `set` $O(1)$
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`set(2)`

Array

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`indexOf(object)`

Array

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- ▶ `get` $O(1)$
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`indexOf(object)`

Array

Operations

- ▶ `get` $O(1)$
- ▶ `set` $O(1)$
- ▶ `indexOf` $O(n)$



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Linked List

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Linked List

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Stuff...

Hash Table

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Hash Table

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Tree

...



Binary Heap

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Binary Min-Heap

...



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Red-Black Tree

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Red-Black Tree

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Java Collection API

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Java Collection API

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Java Map API

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Java Map API

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