



Linear List

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1. Array

1.1 Overview of Array

在本节中，我们首先来思考一下数组是什么？

3	1	4	5	6	7
---	---	---	---	---	---

这是一个数组:[3,1,4,5,6,7], 它本质上就是在一段连续的内存片段上存储的一串数据, 由于 int 占了四个字节, 所以每一个数组元素的地址相差四位。

接下来分析数组中常见的操作的算法复杂度:

- Lookup $O(1)$ 根据索引去查找元素, 由于数组中可以通过中括号访问符进行访问, 所以不论访问哪一个元素, 算法复杂度均为 $O(1)$
- Insert $O(n)$ 进行元素插入, 如果在末尾进行元素插入, 算法复杂度为 $O(1)$, 但是如果在第一位插入, 我们就需要将每一位都往后挪动一位, 所以复杂度为 $O(n)$, 通常我们都考虑最坏的情况, 所以算法复杂度为 $O(n)$
- Delete $O(n)$ 无论删除哪一个元素, 其他元素都需要往前移动一位, 所以最终算法复杂度为 $O(n)$

1.2 Practice: To create an Array Class with Java

■ **Example 1.1** 在 Java 中, 创建一个 MikeArray 类型, 要求要满足以下几点, 1. 具有 insert 方法, 可以在数组末尾插入元素, 2. 具有 removeAt(int index) 方法, 在 index 处删除对应的元素, 3. 实现 print 方法, 打印出数组中所有的元素 4. indexOf 方法, 返回目标元素第一次出现在数组中的索引, 如果没有出现元素, 则返回索引-1, 4. 动态扩充, 在使用 insert 方法的时候如果超出了数组本身的长度, 扩容到原数组容量的 2 倍, 5. 构造方法是给出数组的长度 length 进行数组构造的。 ■

```
public class MArray {
    private int[] items;
    private int count=0;
    public MArray(int length){
        items=new int[length];
    }

    public void print(){
        for(int i=0;i<count;i++){
            System.out.println(items[i]);
        }
    }

    public void insert(int element){
        //if the array is full
        if(items.length==count){
            //Create a new array (twice the size)
            int array[]=new int[count*2];
            //Copy all the items into new Array
            for(int i=0;i<count;i++){
                array[i]=items[i];
            }
            //set the items to the new array
            items=array;
        }
        items[count++]=element;
    }
}
```


```
        public void removeAt(int index){
            if(index<0||index>=count){
                throw new IllegalArgumentException();
            }
            else{
                //[10,20,30,40]
                // index:1
                for(int i=index;i<count;i++){
                    items[i]=items[i+1];
                }
                count--;
            }
        }

        public int indexOf(int item){
            //获取元素的位置
            //肯定是有可能遍历完整个都没有存在的
            for(int i=0;i<count;i++){
                if(items[i]==item){
                    return i;
                }
            }
            return -1;
        }
    }
```




Part One Title

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2. Sectioning Examples

2.1 Section Title

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2.1.1 Subsection Title

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Unnumbered Section

Unnumbered Subsection

Unnumbered Subsubsection



3. In-text Element Examples

3.1 Referencing Publications

This statement requires citation [Smith:2022jd]; this one is more specific [Smith:2021qr].

3.2 Link Examples

This is a URL link: [LaTeX Templates](#). This is an email link: example@example.com.
This is a monospaced URL link: `https://www.LaTeXTemplates.com`.

3.3 Lists

Lists are useful to present information in a concise and/or ordered way.

3.3.1 Numbered List

1. First numbered item
 - a. First indented numbered item
 - b. Second indented numbered item
 - i. First second-level indented numbered item
2. Second numbered item
3. Third numbered item

3.3.2 Bullet Point List

- First bullet point item
 - First indented bullet point item
 - Second indented bullet point item
 - First second-level indented bullet point item
- Second bullet point item

- Third bullet point item

3.3.3 Descriptions and Definitions

Name Description

Word Definition

Comment Elaboration

3.4 International Support

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 ÀÁÂÃÄÅÈÉÊËÌÍÎÏÐÓÔÕÖØÙÚÛÜÝŸÑ
 ßÇÆĖČŠŽ

3.5 Ligatures

fi fj fl ffl ffi Ty



Part Two Title

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4. Mathematics

4.1 Theorems

4.1.1 Several equations

This is a theorem consisting of several equations.

Theorem 4.1 — **Name of the theorem.** In $E = \mathbb{R}^n$ all norms are equivalent. It has the properties:

$$||\mathbf{x}|| - ||\mathbf{y}|| \leq ||\mathbf{x} - \mathbf{y}|| \quad (4.1)$$

$$||\sum_{i=1}^n \mathbf{x}_i|| \leq \sum_{i=1}^n ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \quad (4.2)$$

4.1.2 Single Line

This is a theorem consisting of just one line.

Theorem 4.2 A set $\mathcal{D}(G)$ is dense in $L^2(G)$, $|\cdot|_0$.

4.2 Definitions

A definition can be mathematical or it could define a concept.

Definition 4.1 — **Definition name.** Given a vector space E , a norm on E is an application, denoted $||\cdot||$, E in $\mathbb{R}^+ = [0, +\infty[$ such that:

$$||\mathbf{x}|| = 0 \Rightarrow \mathbf{x} = \mathbf{0} \quad (4.3)$$

$$||\lambda \mathbf{x}|| = |\lambda| \cdot ||\mathbf{x}|| \quad (4.4)$$

$$||\mathbf{x} + \mathbf{y}|| \leq ||\mathbf{x}|| + ||\mathbf{y}|| \quad (4.5)$$

4.3 Notations

■ **Notation 4.1** Given an open subset G of \mathbb{R}^n , the set of functions φ are:

1. Bounded support G ;
2. Infinitely differentiable;

a vector space is denoted by $\mathcal{D}(G)$.

4.4 Remarks

This is an example of a remark.



The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

4.5 Corollaries

Corollary 4.1 — Corollary name. The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

4.6 Propositions

4.6.1 Several equations

Proposition 4.1 — Proposition name. It has the properties:

$$||\mathbf{x}| - |\mathbf{y}|| \leq |\mathbf{x} - \mathbf{y}| \quad (4.6)$$

$$||\sum_{i=1}^n \mathbf{x}_i|| \leq \sum_{i=1}^n ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \quad (4.7)$$

4.6.2 Single Line

Proposition 4.2 Let $f, g \in L^2(G)$; if $\forall \varphi \in \mathcal{D}(G)$, $(f, \varphi)_0 = (g, \varphi)_0$ then $f = g$.

4.7 Examples

4.7.1 Equation Example

■ **Example 4.1** Let $G = \{x \in \mathbb{R}^2 : |x| < 3\}$ and denoted by: $x^0 = (1, 1)$; consider the function:

$$f(x) = \begin{cases} e^{|x|} & \text{si } |x - x^0| \leq 1/2 \\ 0 & \text{si } |x - x^0| > 1/2 \end{cases} \quad (4.8)$$

The function f has bounded support, we can take $A = \{x \in \mathbb{R}^2 : |x - x^0| \leq 1/2 + \varepsilon\}$ for all $\varepsilon \in]0; 5/2 - \sqrt{2}[$. ■

4.7.2 Text Example

■ **Example 4.2 — Example name.** Aliquam arcu turpis, ultrices sed luctus ac, vehicula id metus. Morbi eu feugiat velit, et tempus augue. Proin ac mattis tortor. Donec tincidunt, ante rhoncus luctus semper, arcu lorem lobortis justo, nec convallis ante quam quis lectus. Aenean tincidunt sodales massa, et hendrerit tellus mattis ac. Sed non pretium nibh. Donec cursus maximus luctus. Vivamus lobortis eros et massa porta porttitor. ■

4.8 Exercises

Exercise 4.1 This is a good place to ask a question to test learning progress or further cement ideas into students' minds. ■

4.9 Problems

Problem 4.1 What is the average airspeed velocity of an unladen swallow?

4.10 Vocabulary

Define a word to improve a students' vocabulary.

■ **Vocabulary 4.1 — Word.** Definition of word.



5. Presenting Information and Results with a Long Chapter Title

5.1 Table

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Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

表 5.1: Table caption.

Referencing Table 5.1 in-text using its label.

5.2 Figure

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Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

表 5.2: Floating table.



图 5.1: Figure caption.

Referencing Figure 5.1 in-text using its label.



图 5.2: Floating figure.

Bibliography

Articles

Books



A. Appendix Chapter Title

A.1 Appendix Section Title

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B. Appendix Chapter Title

B.1 Appendix Section Title

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