



西北工业大学
NORTHWESTERN POLYTECHNICAL UNIVERSITY

C程序设计 Programming in C



1011014

主讲：姜学锋，计算机学院

编程的理论基础

- ◆ 1、程序语言
- ◆ 2、计算机问题求解的基本特点

1.3.1 机器语言与汇编语言

- ▶ 机器语言是由二进制0和1按一定规则组成的、能被计算机直接理解和执行的指令集合。机器语言中的每一条语句实质上是一条指令。

```
10110000 00010000 ;往寄存器AL送16 (10H)
00000100 00001010 ;寄存器AL加10 (0AH)，且送回AL中
11110100           ;结束，停机
```

1.3.1 机器语言与汇编语言

- ▶ 汇编语言，将机器指令的代码用英文助记符来表示，如MOV表示数据传送、ADD表示加、JMP表示程序跳转、HLT表示停机等。

MOV	AL, 10	;往寄存器AL送16 (10H)
ADD	AL, 0A	;寄存器AL加10 (0AH)，且送回到AL中
HLT		;结束，停机

1.3.2 高级语言

- ▶ 高级语言是接近人的自然语言和数学公式的程序设计语言。
- ▶ 分为编译型和解释型两种。

1.3.2 高级语言

- ▶ 编译（compile）是用编译器（compiler）程序把高级语言所编写的源程序（source code）翻译成用机器指令表示的目标代码，使目标代码和源程序在功能上完全等价，通过连接器（linker）程序将目标程序与相关库连接成一个完整的可执行程序。
- ▶ 优点是执行速度快，产生的可执行程序可以脱离编译器和源程序独立存在，反复执行。

1.3.2 高级语言


- ▶ 解释（interpret）是用解释器（interpreter）程序将高级语言编写的源程序逐句进行分析翻译，解释一句，执行一句。当源程序解释完成时目标程序也执行结束，下次运行程序时还需要重新解释执行。
- ▶ 优点是移植到不同平台时不用修改程序代码，只要有合适的解释器即可。



1.3.2 高级语言

计算机编程语言的演化

YEAR: 1957
LANGUAGE: FORTRAN



Tim Jenner / Shutterstock.com

FORMulaTRANslation, is the oldest language still in use. Created by John Backus, the language was developed to perform high-level scientific, mathematical, statistical computations.

The language is still used in aerospace, automotive industries, government, and research institutions.

» Used by
NATIONAL WEATHER SERVICE

Created in 1874 to increase typing speed, the QWERTY keyboard was responsible for the majority of computer languages ever created.

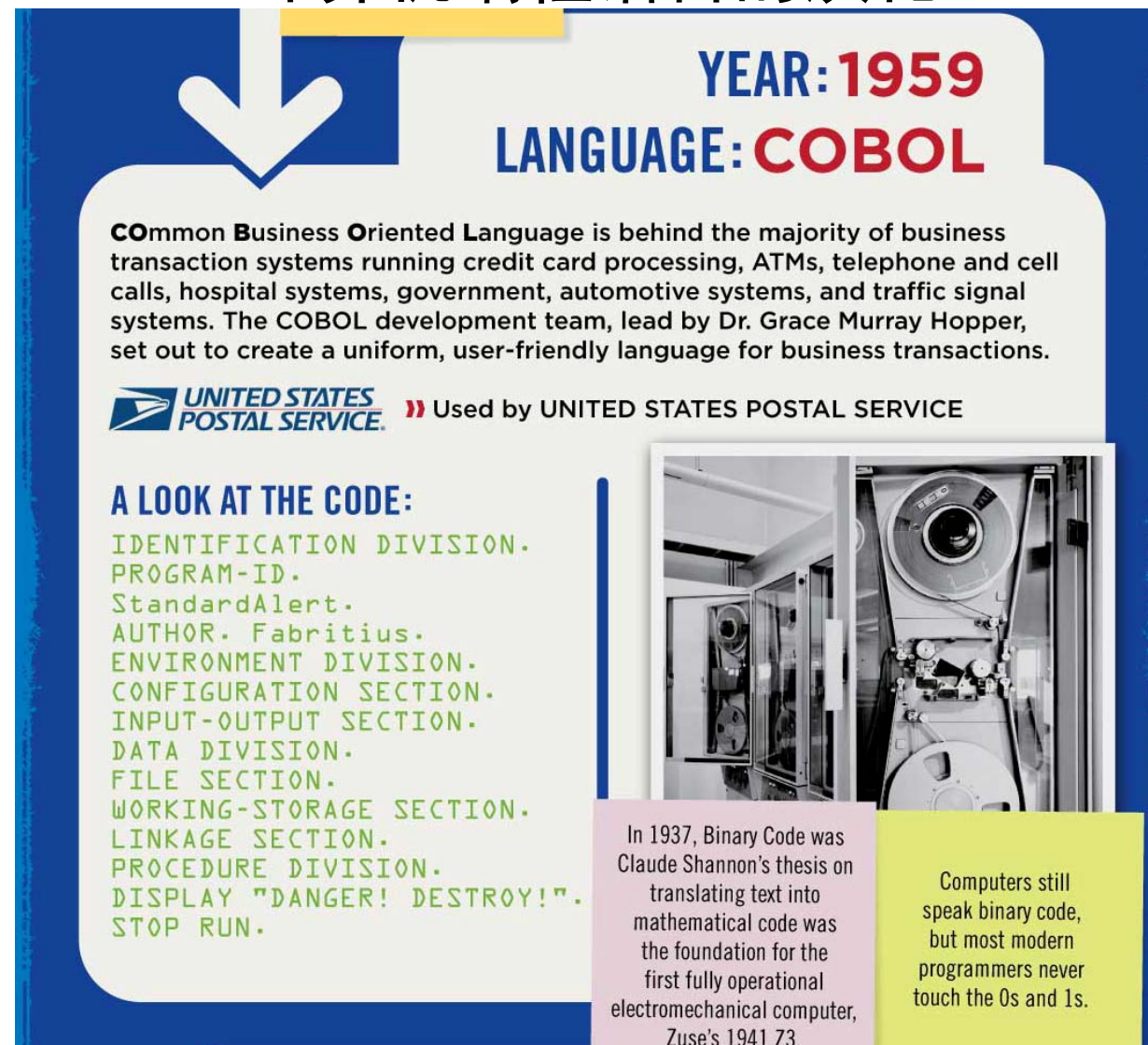
The arrangement was set based on an analysis of keys likely to cause jams and designing the QWERTY board to separate likely offenders, like T and H.

A LOOK AT THE CODE:

```
*
C Hello World in Fortran ??
C (lines must be 6 characters
  indented)
*
PROGRAM REELECT
WRITE(UNIT=*, FMT=*)
'I like Ike'
END
```

1.3.2 高级语言


计算机编程语言的演化



The infographic is titled "计算机编程语言的演化" (Evolution of Computer Programming Languages). It features a large white arrow pointing downwards from the top. To the right of the arrow, the text "YEAR: 1959" and "LANGUAGE: COBOL" is displayed in blue and red. Below this, a paragraph describes COBOL as a Common Business Oriented Language used in various systems like credit card processing, ATMs, and government systems, crediting Dr. Grace Murray Hopper. A logo for the United States Postal Service is shown with the text "Used by UNITED STATES POSTAL SERVICE". A section titled "A LOOK AT THE CODE:" displays a snippet of COBOL code in green text on a white background. To the right of the code is a photograph of an early computer system with large tape drives. Below the photo, two text boxes provide historical context: one about Claude Shannon's 1937 thesis and Zuse's 1941 Z3 computer, and another stating that modern programmers rarely touch binary code.

YEAR: 1959
LANGUAGE: COBOL

Common Business Oriented Language is behind the majority of business transaction systems running credit card processing, ATMs, telephone and cell calls, hospital systems, government, automotive systems, and traffic signal systems. The COBOL development team, lead by Dr. Grace Murray Hopper, set out to create a uniform, user-friendly language for business transactions.

 **Used by UNITED STATES POSTAL SERVICE**

A LOOK AT THE CODE:

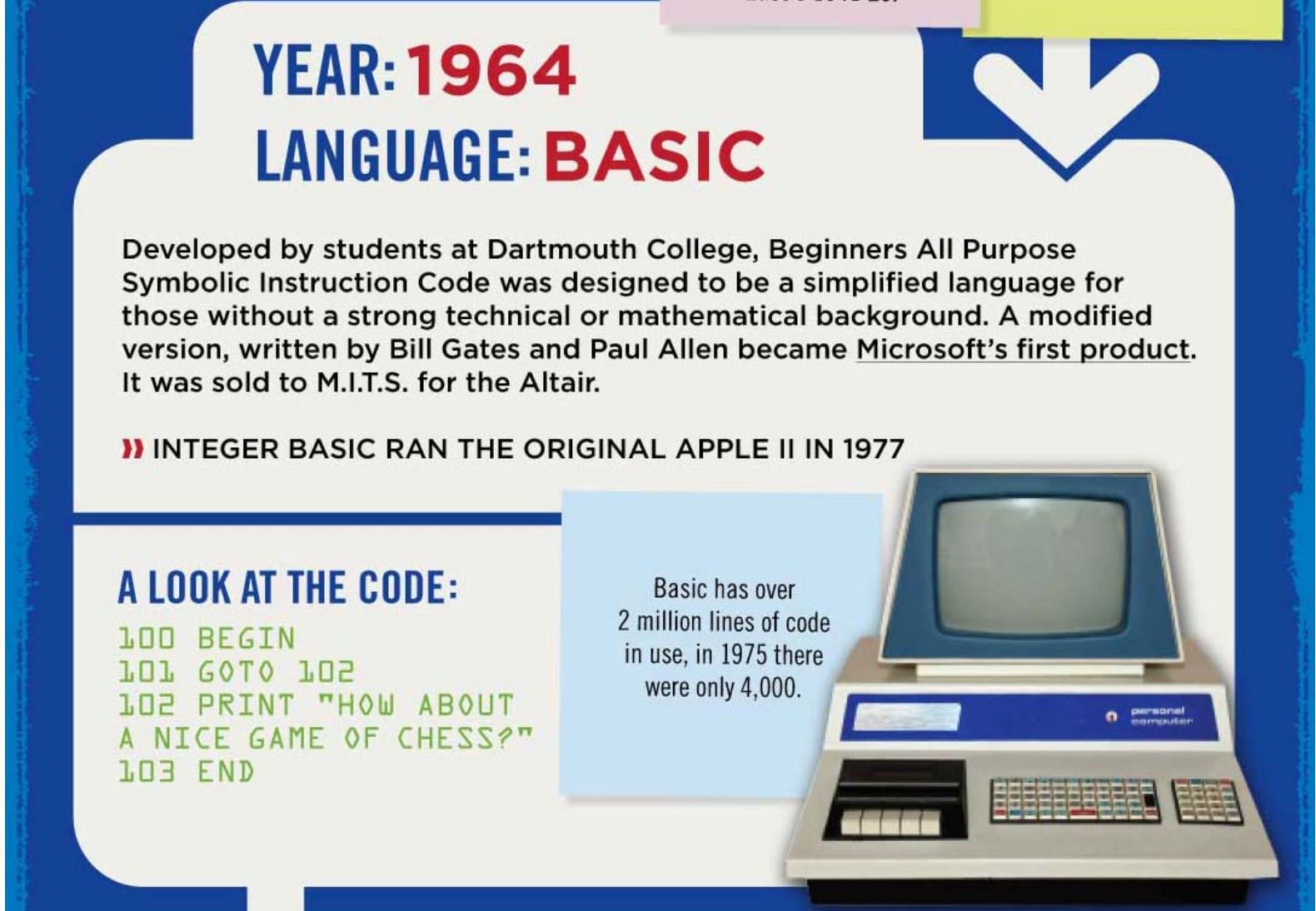
```
IDENTIFICATION DIVISION.  
PROGRAM-ID.  
StandardAlert.  
AUTHOR. Fabritius.  
ENVIRONMENT DIVISION.  
CONFIGURATION SECTION.  
INPUT-OUTPUT SECTION.  
DATA DIVISION.  
FILE SECTION.  
WORKING-STORAGE SECTION.  
LINKAGE SECTION.  
PROCEDURE DIVISION.  
DISPLAY "DANGER! DESTROY!".  
STOP RUN.
```

In 1937, Binary Code was Claude Shannon's thesis on translating text into mathematical code was the foundation for the first fully operational electromechanical computer, Zuse's 1941 Z3.

Computers still speak binary code, but most modern programmers never touch the 0s and 1s.

1.3.2 高级语言

计算机编程语言的演化



YEAR: 1964
LANGUAGE: BASIC


Developed by students at Dartmouth College, Beginners All Purpose Symbolic Instruction Code was designed to be a simplified language for those without a strong technical or mathematical background. A modified version, written by Bill Gates and Paul Allen became Microsoft's first product. It was sold to M.I.T.S. for the Altair.

» INTEGER BASIC RAN THE ORIGINAL APPLE II IN 1977

A LOOK AT THE CODE:

```
100 BEGIN
101 GOTO 102
102 PRINT "HOW ABOUT
A NICE GAME OF CHESS?"
103 END
```

Basic has over 2 million lines of code in use, in 1975 there were only 4,000.



1.3.2 高级语言

计算机编程语言的演化




The infographic is set against a blue background with a white arrow pointing down from the top. It features a white box containing text about the C language, a Linux penguin icon, a code snippet, and an image of a vintage computer terminal.

YEAR: 1969
LANGUAGE: C

C was developed between 1969 and 1973 by Dennis Ritchie at the Bell Telephone Laboratories for use with the Unix operating system. It was named "C" because its features were derived from an earlier language called "B."

C had become powerful enough that most of the Unix kernel was rewritten in C - one of the first operating system kernels implemented in a language other than assembly.

 **» LINUX TODAY IS BASED ON C**

A LOOK AT THE CODE:


```
#include <stdio.h>

main()
{
    puts ("your first C
program");
}
```



1.3.2 高级语言

计算机编程语言的演化




YEAR: 1970
LANGUAGE: PASCAL

The language was named for Blaise Pascal, credited for inventing the first adding machine in 1641. Niklaus Wirth created Pascal as a teaching tool and it grew to into widespread commercial use.

» Used by SKYPE (OBJECT PASCAL)

A LOOK AT THE CODE:

```
PROGRAM SageAdvice (OUTPUT);  
BEGIN  
  WRITELN('If you spent all those  
  hours');  
  WRITELN('Learning C instead of  
  Pascal');  
  WRITELN('you might have a job  
  now.');
```



```
END.
```

The first version of Word had 27,000 lines of code. Today, the current version of Office has over 30 million.

1.3.2 高级语言

计算机编程语言的演化

YEAR: 1983
LANGUAGE: C++

From Bell Labs, Bjarne Stroustrup modified the C language to C++ and created what many consider the most popular programming language ever. It's been listed in the top ten programming languages since 1986 and achieved Hall of Fame status in 2003.

 » Used by MS OFFICE;
ADOBE PDF READER; FIREFOX

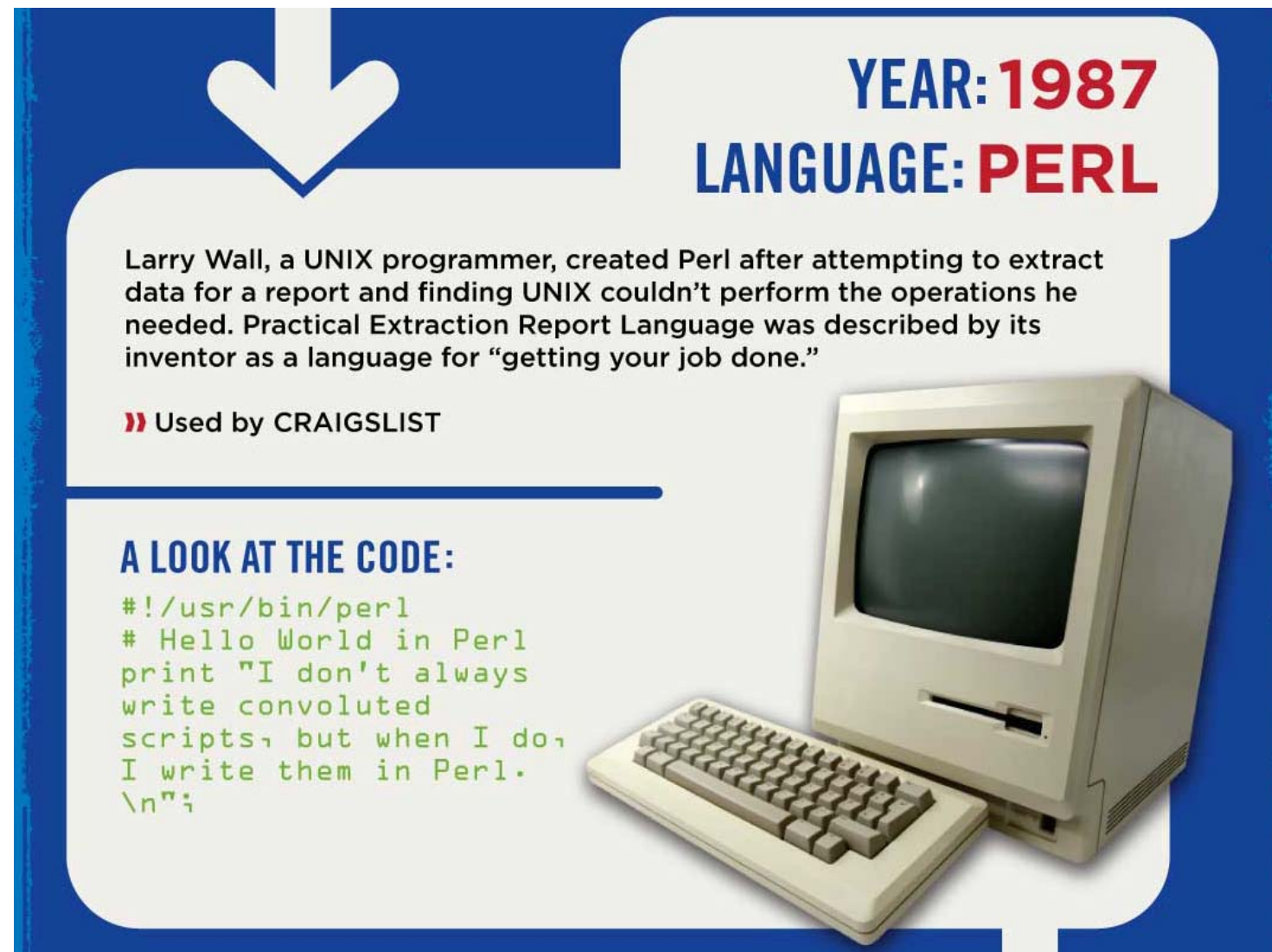
A LOOK AT THE CODE:

```
#include<iostream>
using namespace std;
int main()
{
    cout<< "C++ is the grade
you get when you're very,
very slightly above
average." <<endl;
    return 0;
}
```



1.3.2 高级语言

计算机编程语言的演化




YEAR: 1987
LANGUAGE: PERL

Larry Wall, a UNIX programmer, created Perl after attempting to extract data for a report and finding UNIX couldn't perform the operations he needed. Practical Extraction Report Language was described by its inventor as a language for "getting your job done."

» Used by CRAIGSLIST

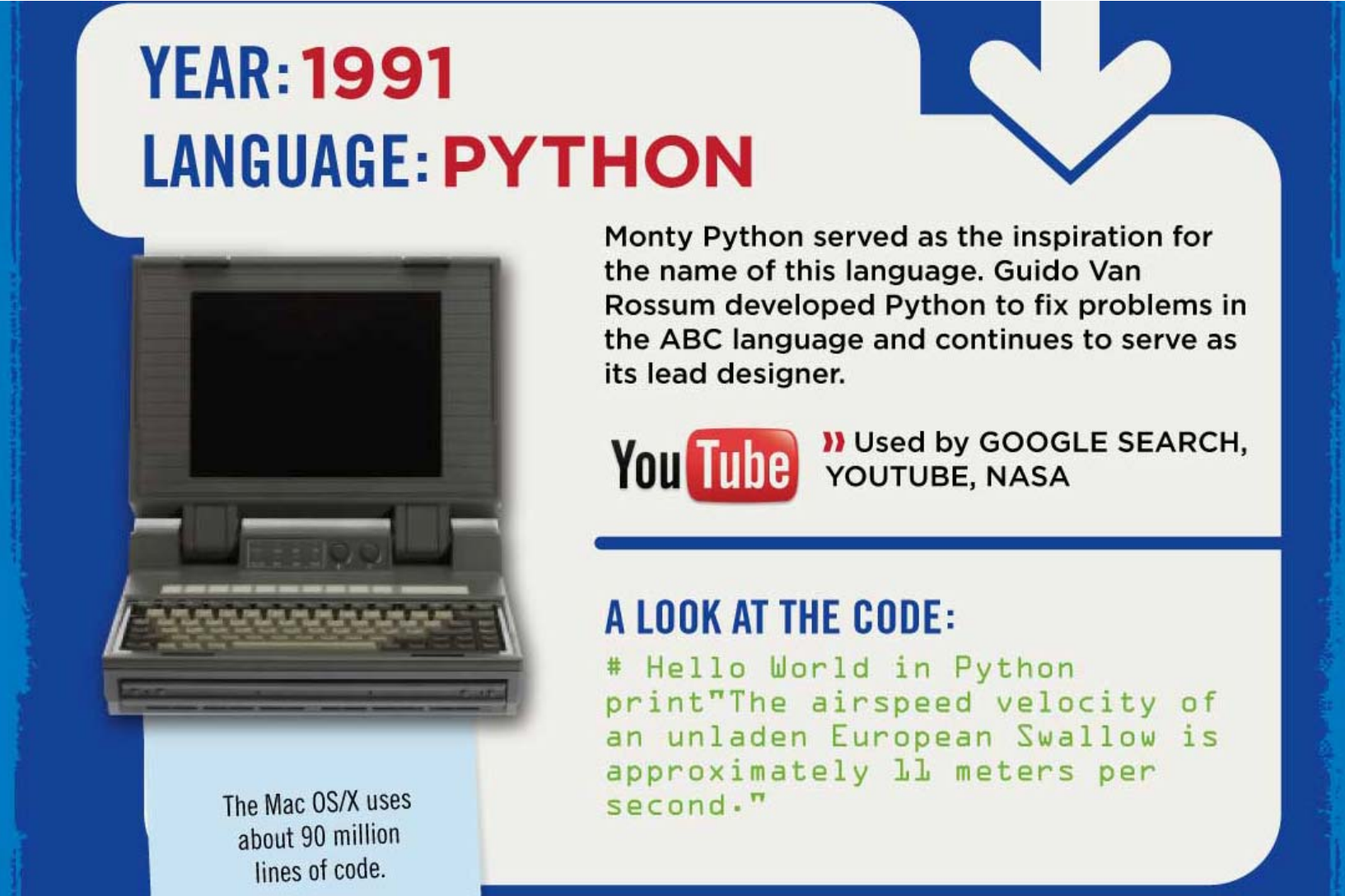
A LOOK AT THE CODE:

```
#!/usr/bin/perl  
# Hello World in Perl  
print "I don't always  
write convoluted  
scripts, but when I do,  
I write them in Perl.  
\n";
```



1.3.2 高级语言

计算机编程语言的演化



YEAR: 1991
LANGUAGE: PYTHON

Monty Python served as the inspiration for the name of this language. Guido Van Rossum developed Python to fix problems in the ABC language and continues to serve as its lead designer.

You Tube » Used by GOOGLE SEARCH, YOUTUBE, NASA

A LOOK AT THE CODE:

```
# Hello World in Python
print "The airspeed velocity of
an unladen European Swallow is
approximately 11 meters per
second."
```

The Mac OS/X uses about 90 million lines of code.

1.3.2 高级语言

计算机编程语言的演化



YEAR: 1993
LANGUAGE: RUBY

Yukihiro “matz” Matsumoto named Ruby for July’s birthstone. HE developed the language by blending parts of his favorite languages, Perl, Smalltalk, Eiffel, Ada, and Lisp.

» Used by BASECAMP

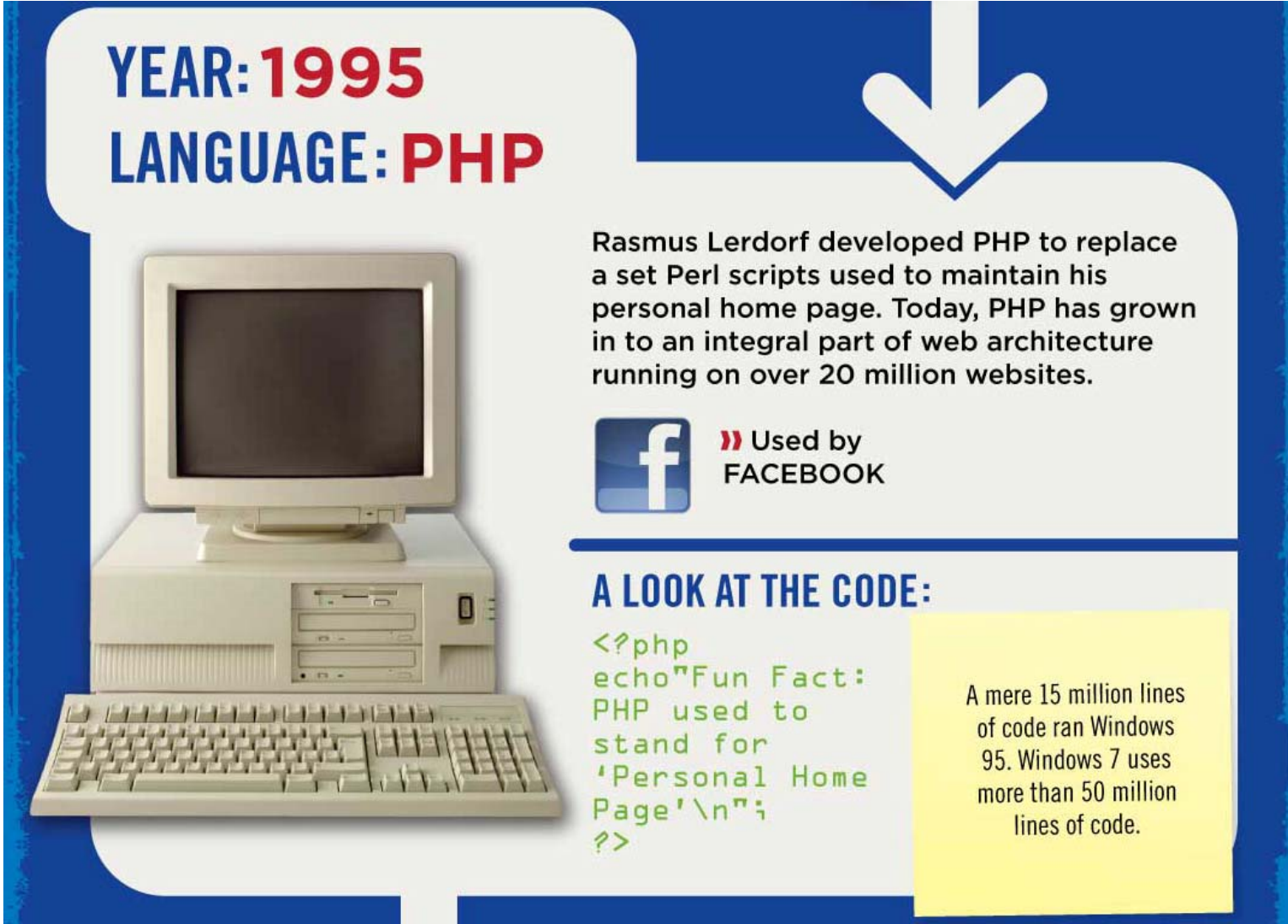
A LOOK AT THE CODE:

```
"I'd rather be  
writing this in  
Java.\n".display
```



1.3.2 高级语言

计算机编程语言的演化



The infographic features a large white arrow pointing downwards from the top right. On the left, there is an image of a vintage beige computer system with a monitor, tower unit, and keyboard. The text is arranged in a clean, modern layout with a blue and white color scheme.

YEAR: 1995
LANGUAGE: PHP

Rasmus Lerdorf developed PHP to replace a set Perl scripts used to maintain his personal home page. Today, PHP has grown in to an integral part of web architecture running on over 20 million websites.

 » Used by FACEBOOK


A LOOK AT THE CODE:

```
<?php  
echo"Fun Fact:  
PHP used to  
stand for  
'Personal Home  
Page'\n";  
?>
```

A mere 15 million lines of code ran Windows 95. Windows 7 uses more than 50 million lines of code.

1.3.2 高级语言

计算机编程语言的演化




YEAR: 1995
LANGUAGE: JAVA

A team of Sun Microsystems developers lead by James Gosling created Java to run set top boxes for interactive television. Java now runs on over 1.1 billion PCs worldwide and many websites can't function without it.

» Used by 2004 MARS ROVERS

A LOOK AT THE CODE:

```
public class HelloWorld {  
    public static void  
    main(String[] args) {  
        System.out.println("I  
will now interrupt you  
with update notifications  
every other day for the  
rest of your life.");  
    }  
}
```



1.3.2 高级语言

计算机编程语言的演化



YEAR: 1995
LANGUAGE: JAVASCRIPT

Java and Javascript are unrelated and have very different semantics.

JavaScript was originally developed by Brendan Eich of Netscape under the name Mocha. JavaScript uses syntax influenced by that of C.

Although meant to run on the client (browser) it is now finding use on the server as node.js. Also, AJAX is dependent on Javascript.

 **Used by RACKSPACE (CLIENT SIDE)**

A LOOK AT THE CODE:

```
<html>
<body>

<script type="text/javascript">
document.write("<h1>This is a
heading</h1>");
document.write("<p>This is a
paragraph.</p>");
document.write("<p>This is
another paragraph.</p>");
</script>

</body>
</html>
```

1.3.2 高级语言

- ▶ 当前主流编程语言可以分为11个大类，分别为：
- ▶ 1.解释型(PHP,Perl,Python,Ruby,Tcl,Lua,JavaScript,Io)
- ▶ 2.操作系统自动化型(POSIX Shell,AppleScript,PowerShell)
- ▶ 3.C和C++风格(C,C++,Objective C,Java,C#)
- ▶ 4.Pascal风格(Pascal,Ada,PostgreSQL,MySQL)
- ▶ 5.Lisp类(Common Lisp,Scheme,Clojure,Emacs Lisp)

1.3.2 高级语言

- ▶ 当前主流编程语言可以分为11个大类，分别为：
- ▶ 6.类型推理类(Standard ML,OCaml,Scala,Haskell)
- ▶ 7.声明型(Prolog,Erlang,Oz)
- ▶ 8.堆栈式语言(Forth,PostScript,Factor)
- ▶ 9.数据转换(SQL,Awk,Pig,XSLT)
- ▶ 10.计算机代数(Maxima,Mathematica,Sage)
- ▶ 11.数字分析类(Fortran,MATLAB,R,NumPy)

1.3.2 高级语言

- ▶ TPCI (TIOBE Programming Community Index)
- ▶ 编程语言排行榜
- ▶ 编程语言流行程度的业内指标
 - 所依据的数据调查自世界范围内的资深软件工程师和软件厂商

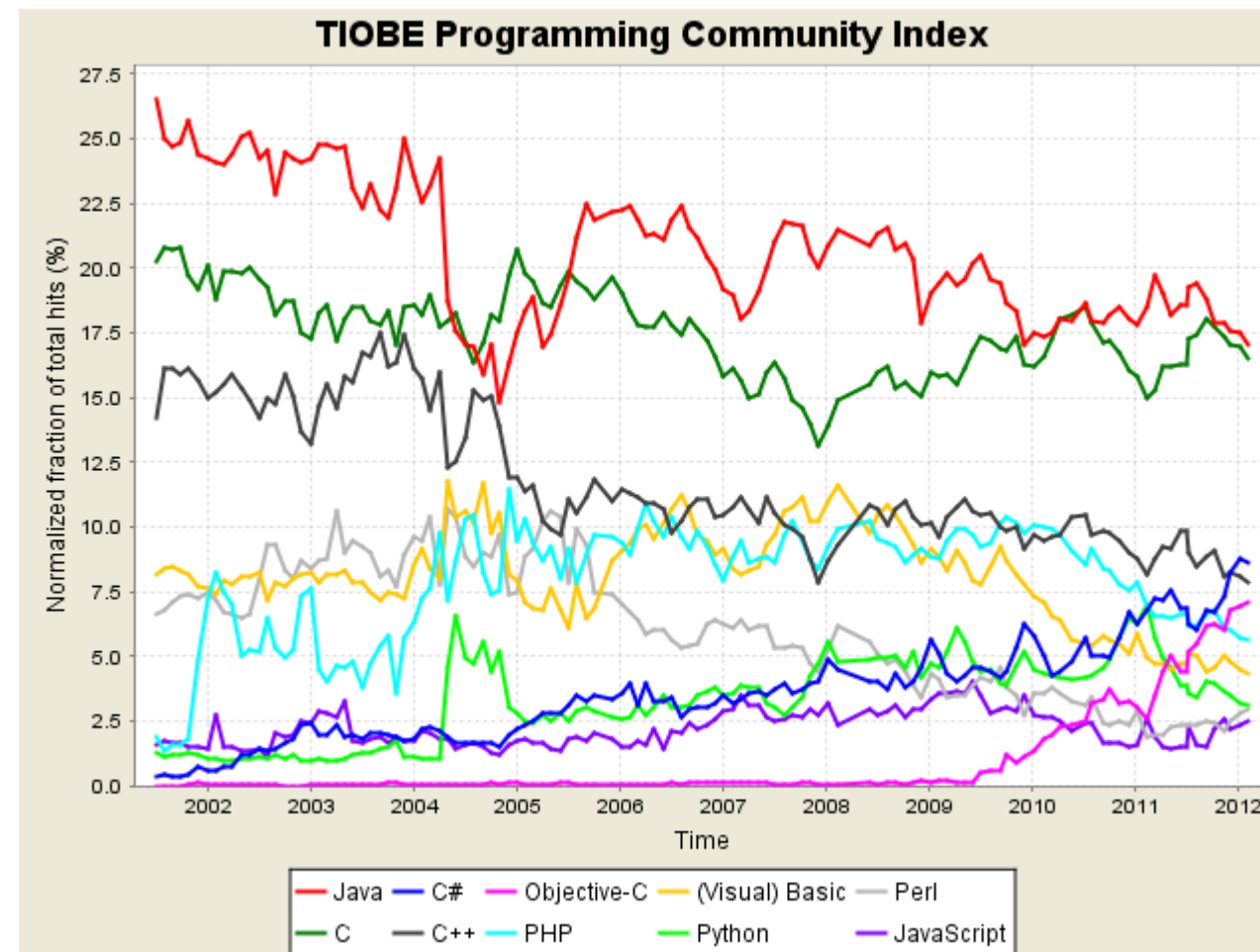
1.3.2 高级语言

- ▶ 2012年2月TPCI编程语言排行榜
- ▶ <http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html>

Position Feb 2012	Position Feb 2011	Delta in Position	Programming Language	Ratings Feb 2012	Delta Feb 2011	Status
1	1	=	Java	17.050%	-1.43%	A
2	2	=	C	16.523%	+1.54%	A
3	6	↑↑↑	C#	8.653%	+1.84%	A
4	3	↓	C++	7.853%	-0.33%	A
5	8	↑↑↑	Objective-C	7.062%	+4.49%	A
6	5	↓	PHP	5.641%	-1.33%	A
7	7	=	(Visual) Basic	4.315%	-0.61%	A
8	4	↓↓↓↓	Python	3.148%	-3.89%	A
9	10	↑	Perl	2.931%	+1.02%	A
10	9	↓	JavaScript	2.465%	-0.09%	A
11	13	↑↑	Delphi/Object Pascal	1.964%	+0.90%	A
12	11	↓	Ruby	1.558%	-0.06%	A
13	14	↑	Lisp	0.905%	-0.05%	A
14	26	↑↑↑↑↑↑↑↑	Transact-SQL	0.846%	+0.29%	A
15	17	↑↑	Pascal	0.813%	+0.08%	A

1.3.2 高级语言

- 在2002年到2012年间，排行前三位的始终是C、C++、Java语言



1.4 程序设计概述

- 利用计算机解决现实问题，称为问题求解（problem solving）

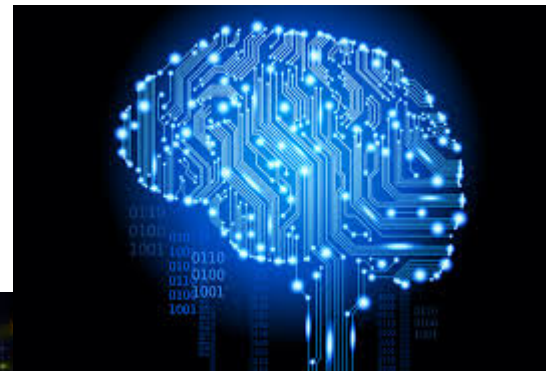


1.4.1 计算机问题求解的基本特点

- ▶ 计算机问题求解的基本步骤为：
- ▶ （1）确定数学模型或数据结构。
- ▶ （2）算法分析和描述。
- ▶ （3）编写程序。
- ▶ （4）程序测试。

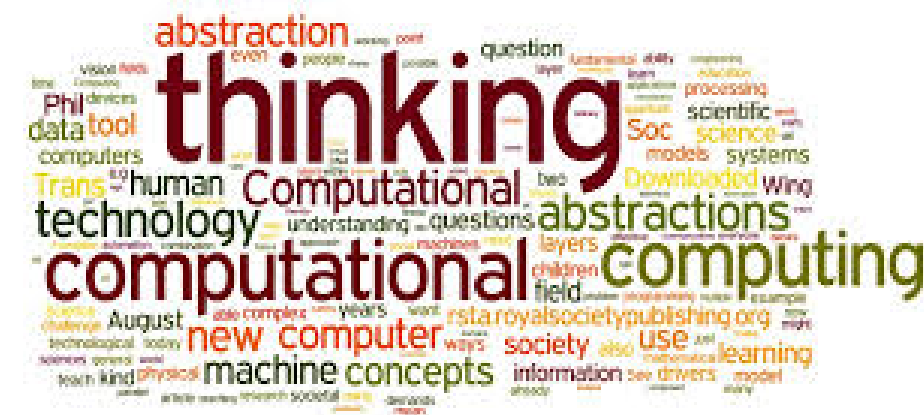
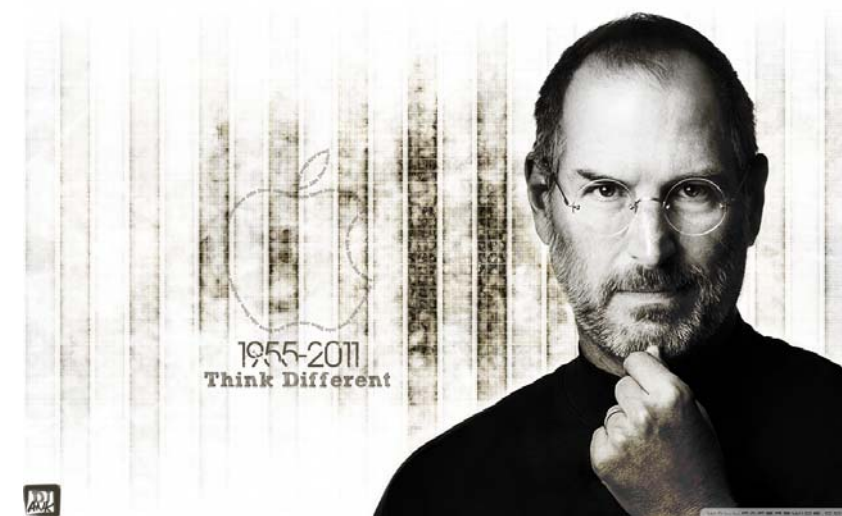
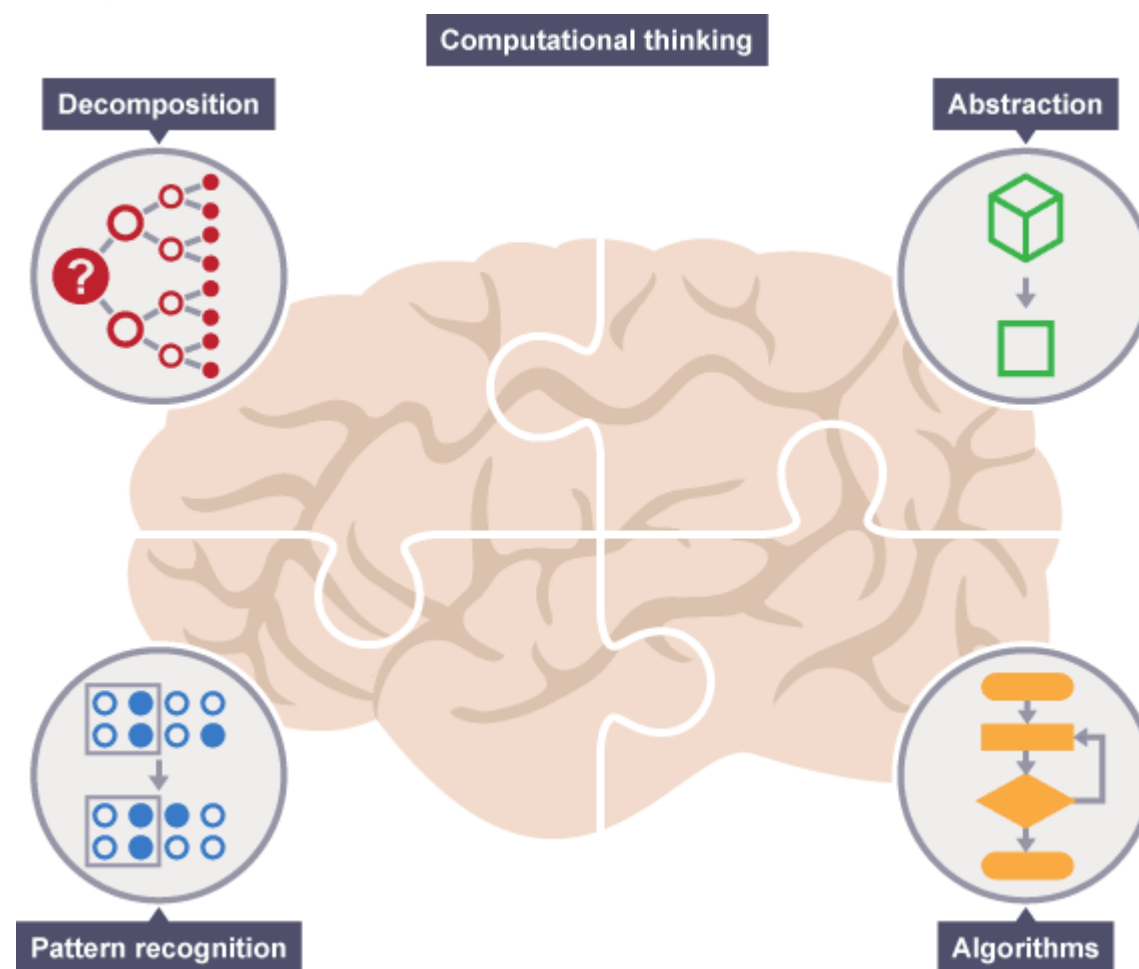
1.4.1 计算机问题求解的基本特点

- ▶ 计算科学思维是多维度的，例如基于计算技术的**普适思维**，特点是抽象和构造；基于算法思想的**数学思维**，特点是形式化和自动化；基于数据技术的**逻辑思维**，特点是因果关系和相关关系；基于系统结构的**应用思维**，特点是整体性和结构性。



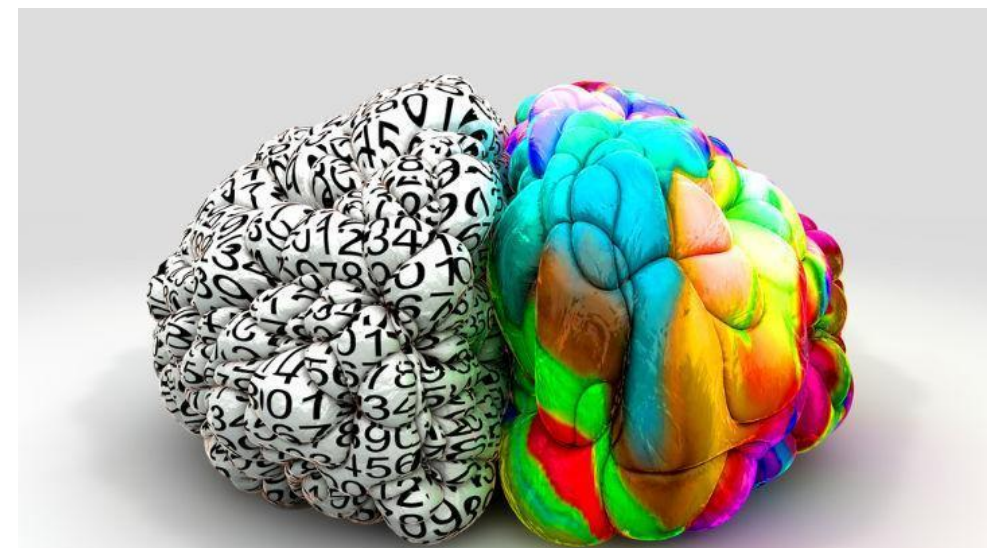
1.4.1 计算机问题求解的基本特点

▶ 计算思维



1.4.1 计算机问题求解的基本特点

- ▶ 程序最重要的两个基本要素是算法和数据结构，编程的难点不是算法或者数据结构本身，而是**如何理解和分解问题**，并将其映射到最合适的算法或数据结构上，这个映射本身不是程序要解决的问题，是**人脑在思维**，是构造性思维、逆向思维、猜想与试验、设计思维等**全脑思维的艺术**。



1.4.1 计算机问题求解的基本特点

- 编程是思维的体操。



CP 程序设计