

Introduction to C Programming

Lecture 1: introduction

Wenjin Wang
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9-9-2022

About the course

- **Lecturer:** Wenjin Wang (Tom), associate professor of BME
- **Lecture time/location:** Friday 7-8 (三教102), 9-10 (三教508机房)
- **Office:** 工学院南楼 637 “无线健康感知” 实验室
- **Email:** wangwj3@sustech.edu.cn
- **Assistance:**
 - Dongfang Yu (Frank)
 - Dan Li
 - Tingdan Luo

Course instructor

University van Amsterdam

AI (2011 – 2013)

MSc with full scholarship



UNIVERSITY OF AMSTERDAM



Technische Universiteit Eindhoven

EE (2013 – 2017)

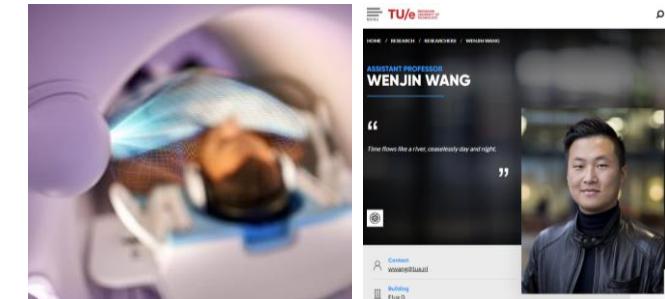
PhD supported by Philips



Philips & TU/e

Healthcare (2017 – 2021)

Across industry-academia



南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Course instructor



EINDHOVEN
UNIVERSITY OF
TECHNOLOGY

TU Eindhoven



- Host students (PhD & MSc)
- Provide daily supervision
- Teach MSc course



Philips Research



- Provide technology and platforms
- Define research projects



Catharina hospital



catharina
een santeon ziekenhuis

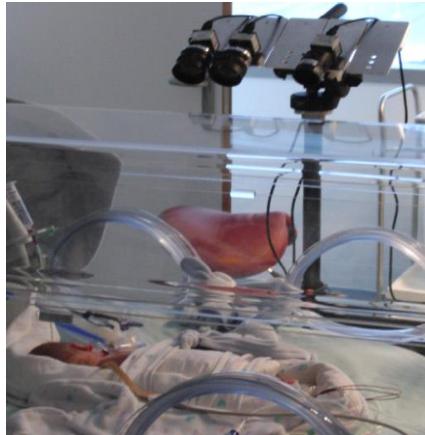
- Provide application scenario and needs
- Provide data source and clinical validations

Course instructor

生医工“无线健康感知实验室” BME Contactless Healthcare Lab

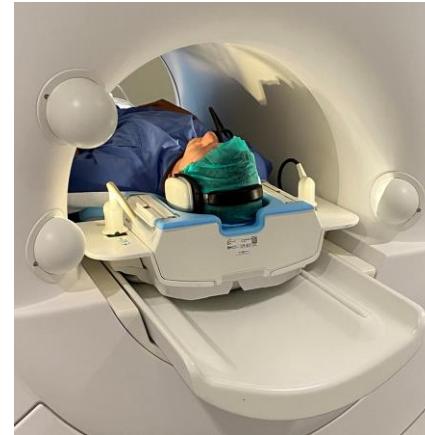
重症监护

Camera based monitoring in NICU and ICU, including HR, RR and SpO2. The solution can be extended to sleep centers and rehabilitation.



医疗器械

Camera based solution can be integrated with existing medical devices to improve their functionality, such as in medical imaging systems (MR and CT).



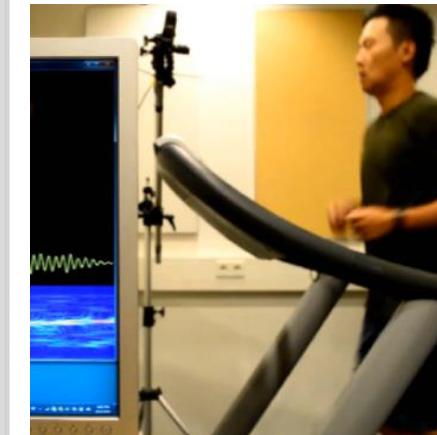
母婴养老

Baby and mother care is an important and matured market. The contactless and wearable monitoring techniques are needed for this population.



运动康复

Camera-based physiological measurement has shown its great potential for fitness and exercise, including HR, temperature, skin water, exercise intensity, etc.



移动健康

Mobile healthcare will be a ubiquitous application to assist human life and manage chronic disease, including the mobile phone, driver applications.



Course objectives

- Learn the concepts of programming
- Learn how to program in C
- Learn how to use C to create AI applications (C+AI!)
- Create a mindset for R&D and prepare for your future

Course syllabus

Nr.	Lecture	Date
1	Introduction	2022.9.9
2	Basics	2022.9.16
3	Decision and looping	2022.9.23
4	Array & string	2022.9.30
5	Functions	2022.10.9
6	Pointer	2022.10.14
7	Self-defined types	2022.10.21
8	Memory control & file I/O	2022.10.28

Nr.	Lecture	Date
9	Head files & pre-processors	2022.11.4
10	Review of lectures	2022.11.11
11	Soul of programming: Algorithms I	2022.11.25
12	Soul of programming: Algorithms II	2022.12.2
13	R&D project	2022.12.9
14	R&D project	2022.12.16
15	R&D project	2022.12.23
16	Summary	2023.12.30

Grading

- **Final exam: 40%**
(you will find most answers in the slides and assignments)
- **Assignments: 50%**
(5 +1 programming tasks released per lecture, try to finish in the lab)
- **Course/lab attendance: 10%**
(easiest way to earn credits!)

Policies

- Lecture will be in English (with Chinese), try to practice your both languages (C and English) in the class
- Slides will be released on Thursday (before lecture)
- Assignment needs to be submitted on Monday, needs to be finished individually
- Assignment will be reviewed in the lab session a week later

Policies

Essence

e.g. `printf()` writes to the standard output stream and produces output according to a format provided.

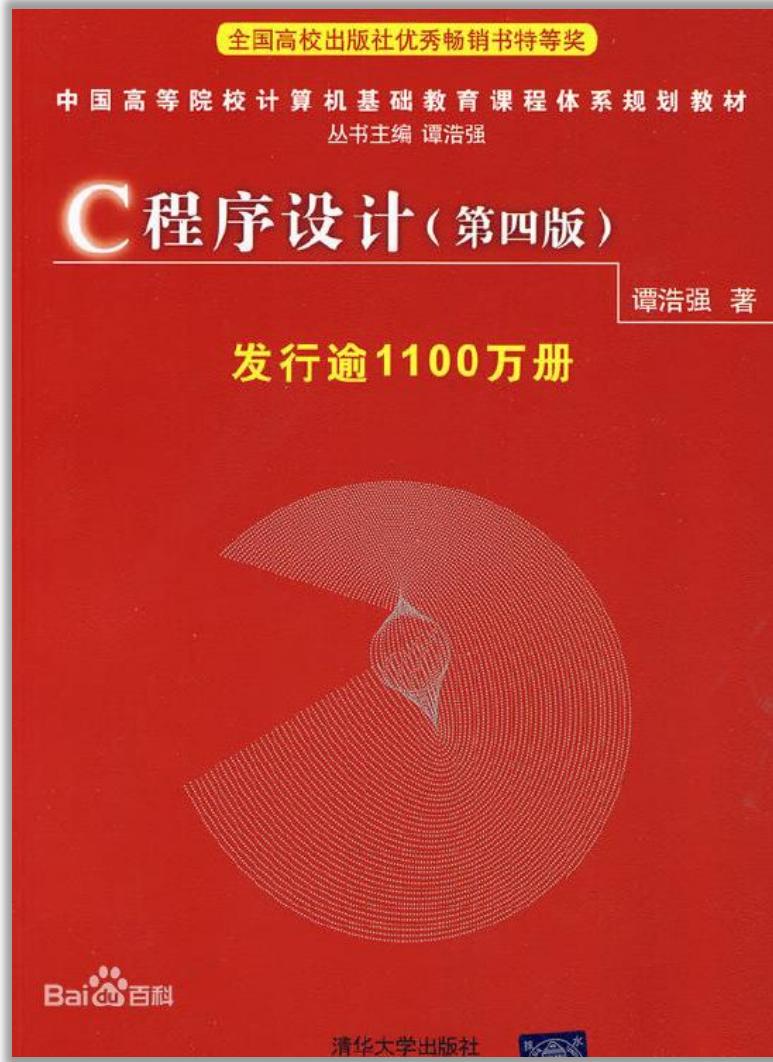
Syntax (句法)

e.g. `printf("number is %d", 5);`

C program

```
#include <stdio.h>
int main()
{
    printf("Hello World"); return 0;
}
```

Reference books



- K. N. King, C语言程序设计现代方法 (第2版), 人民邮电出版社
- 谭浩强, C程序设计 (第五版), 清华大学出版社

Content

- 1. What is programming?**
- 2. What is C language?**
- 3. A first example in C**
- 4. Summary**

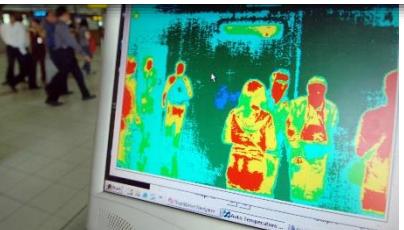
Content

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Machine intelligence are everywhere

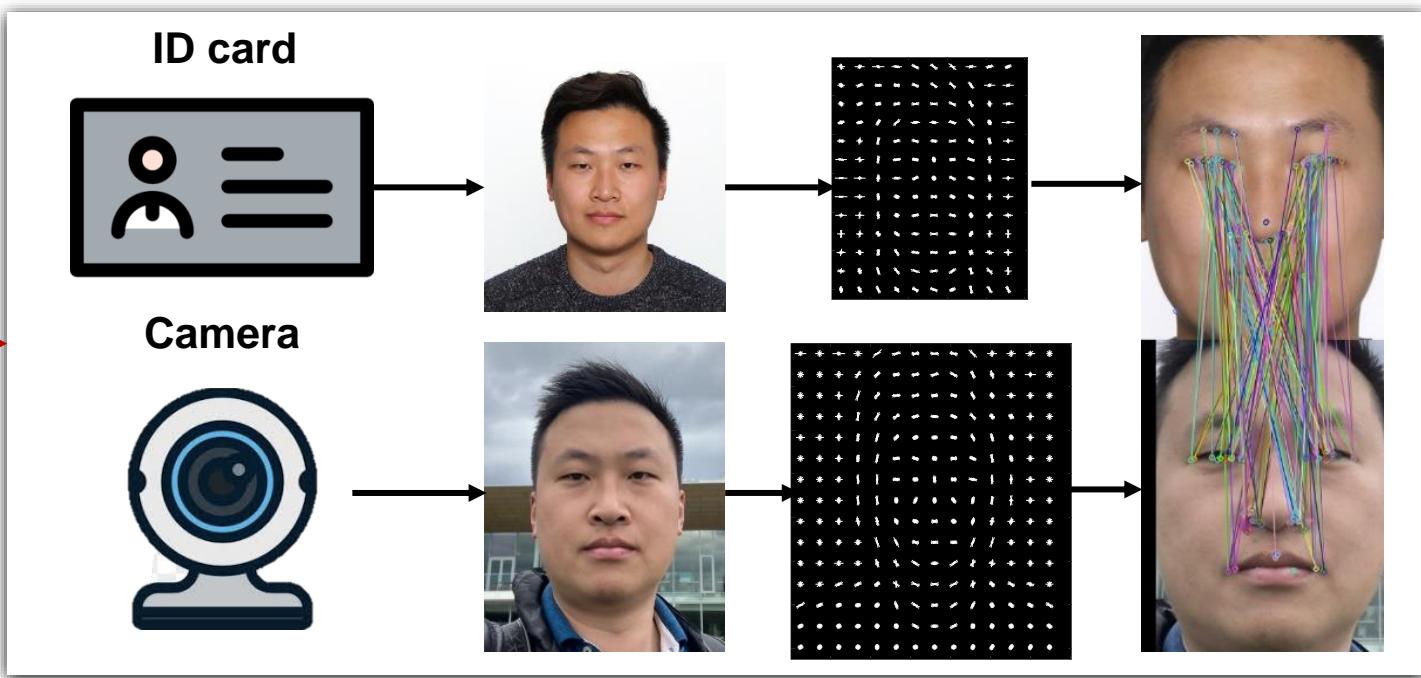


High-tech for anti-COVID



Machines are controlled by programs

Every time when you enter 深圳北站, following happens...

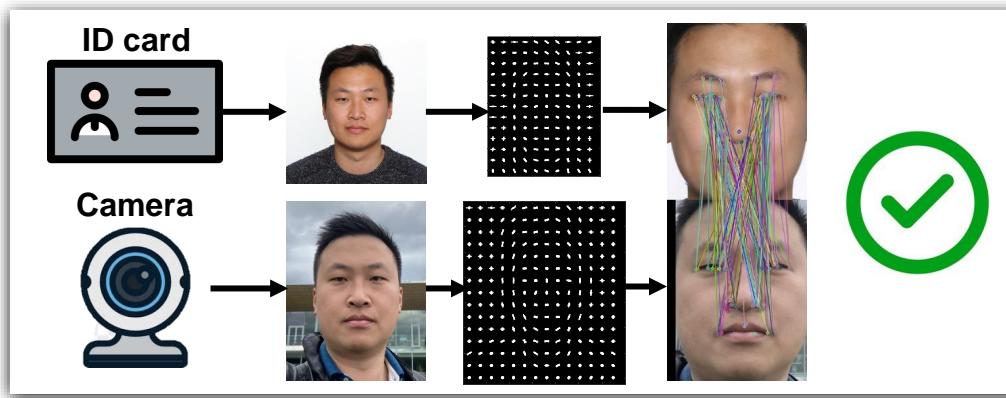


C + AI



Machines are controlled by programs

How to build this application?

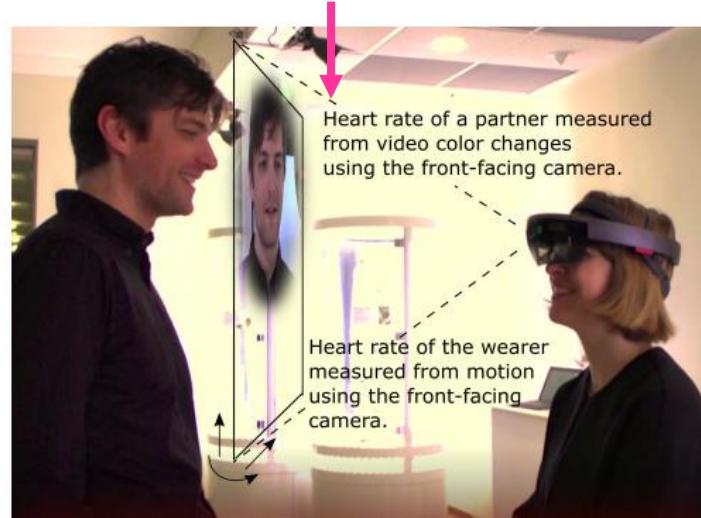


Intelligent edge devices are everywhere

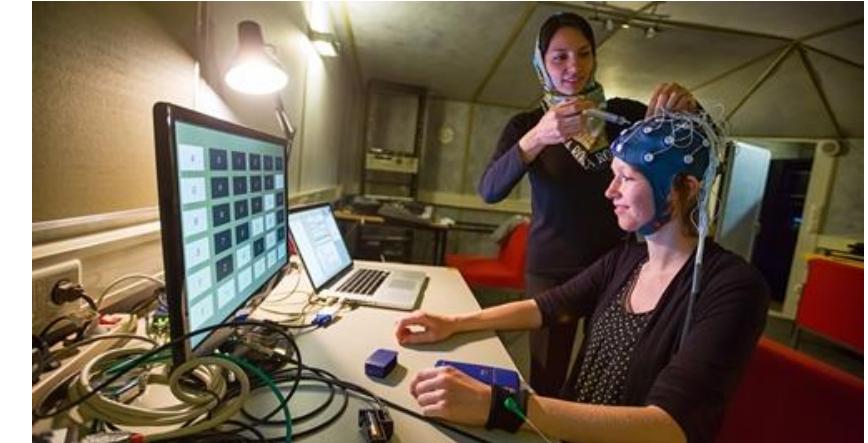
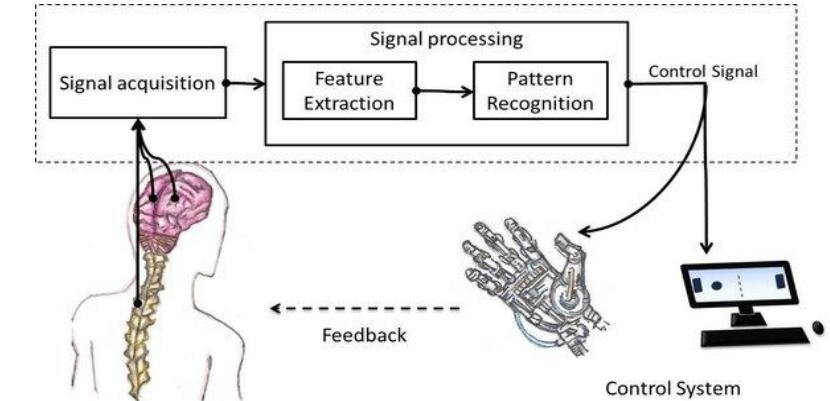
Intelligent AR/VR glasses (healthcare)



Read her heartbeat remotely!😊

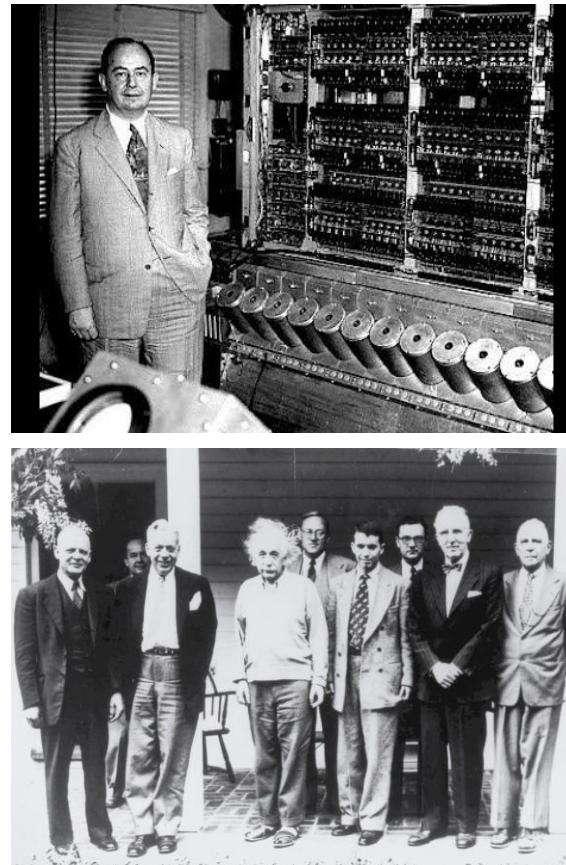


Brain Computer Interface



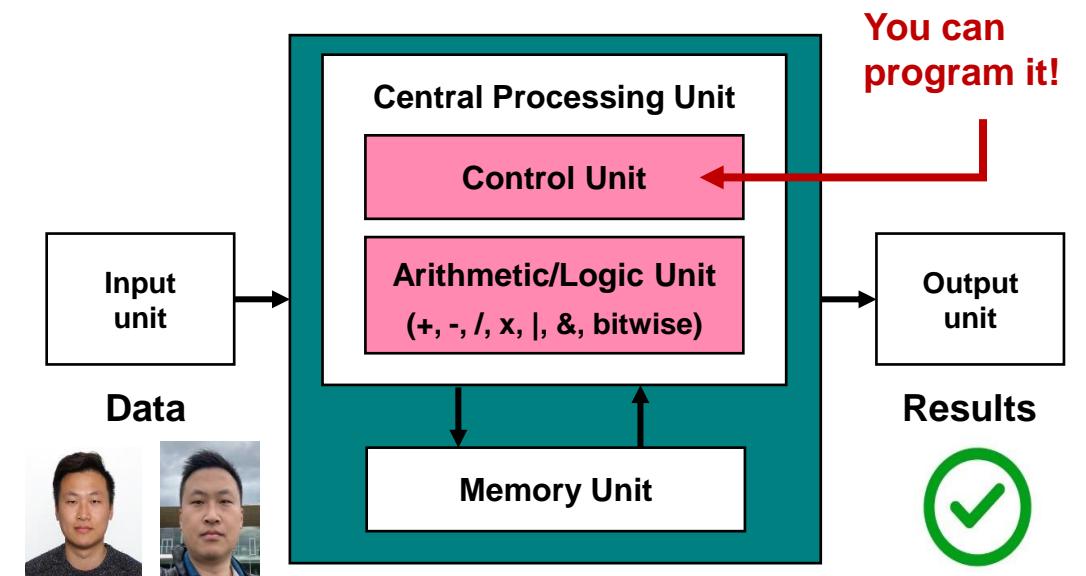


Von Neumann architecture



John von Neumann (1903-1957)
Hungarian-American mathematician physicist
Founder of modern computer architecture

Machine is programmable
Von Neumann architecture (1946)
冯·诺依曼架构



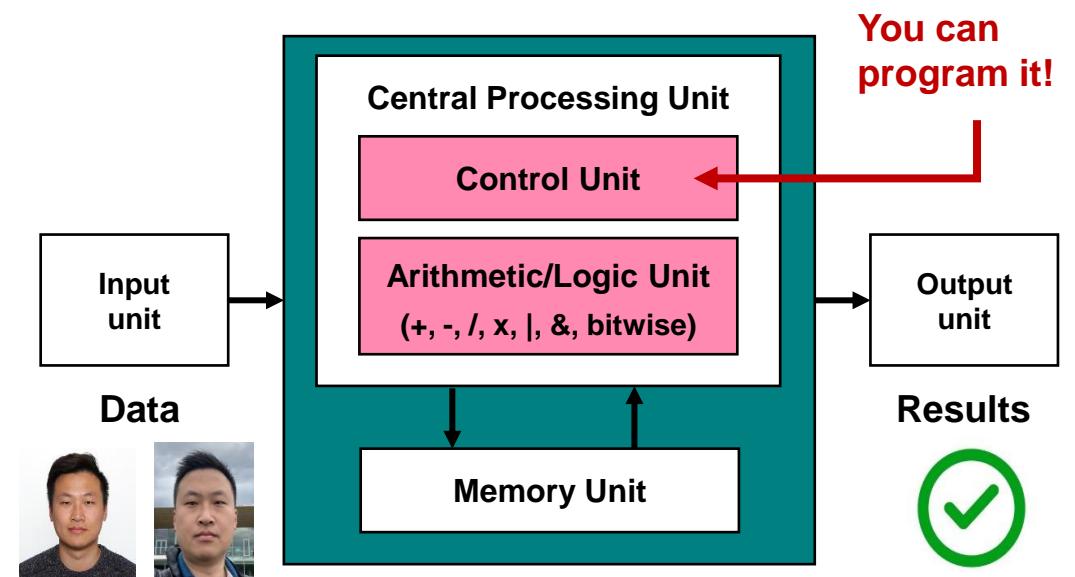
Von Neumann architecture

Input unit

- Obtains data/information from physical world
- Interacts with human



Machine is programmable
Von Neumann architecture (1946)
冯·诺依曼架构



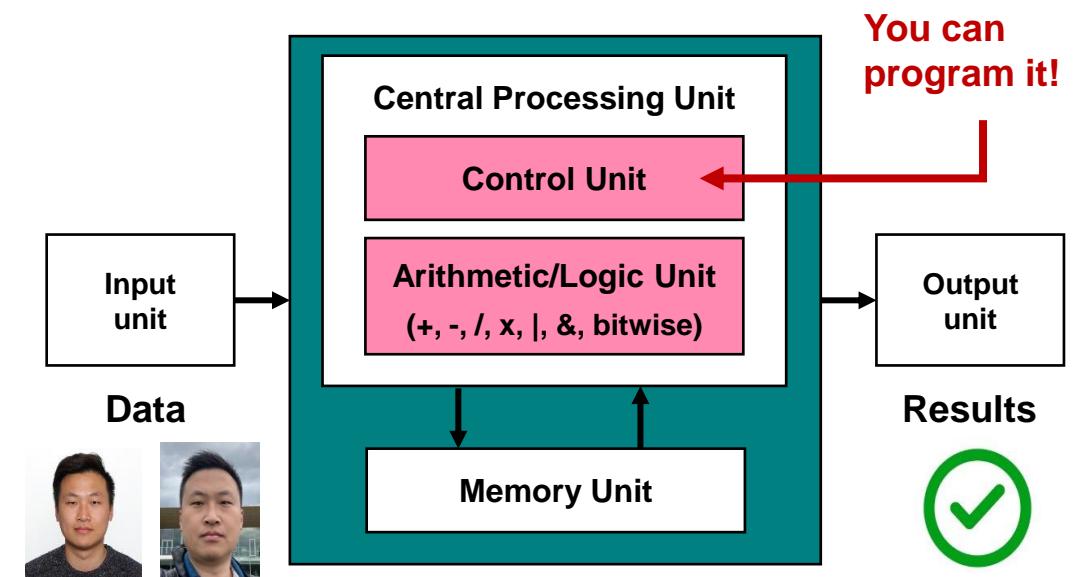
Von Neumann architecture

Output unit

- Output data/information to physical world
- Interacts with human



Machine is programmable
Von Neumann architecture (1946)
冯·诺依曼架构



Von Neumann architecture

Memory unit

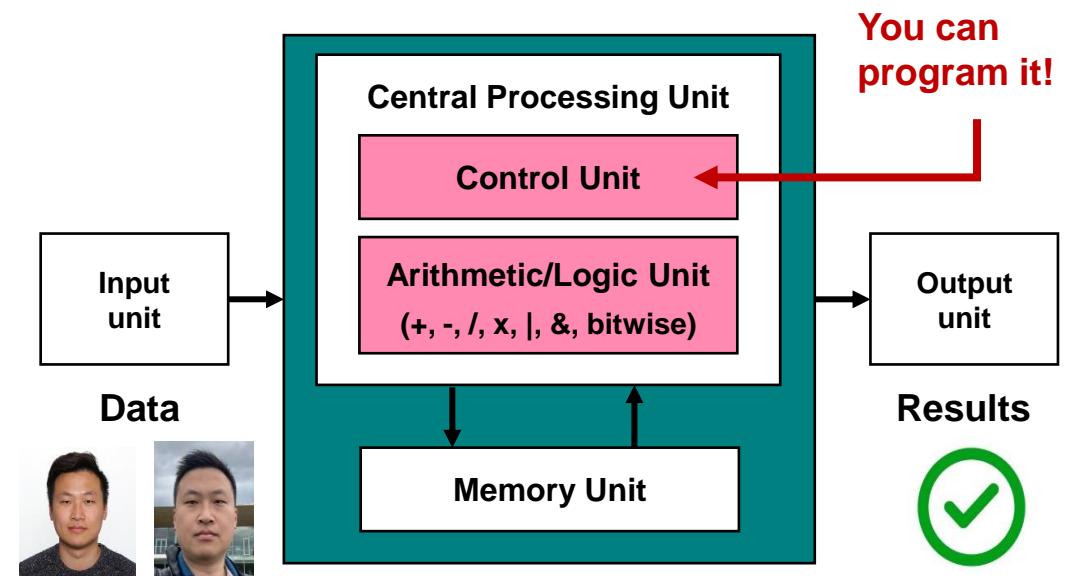
- Stores data/information in the machine, rapid-access
- Known as memory, primary memory, RAM



Machine is programmable

Von Neumann architecture (1946)

冯·诺依曼架构



Von Neumann architecture

Arithmetic & logic unit (ALU)

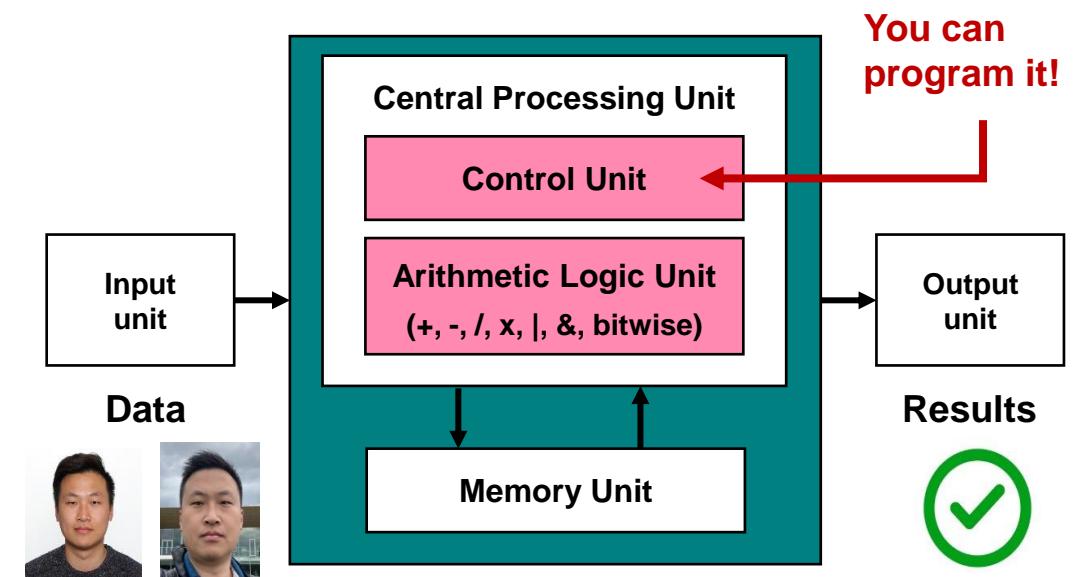
- Defines standard calculations and mechanisms for processing
- ALU is implemented on CPU



Machine is programmable

Von Neumann architecture (1946)

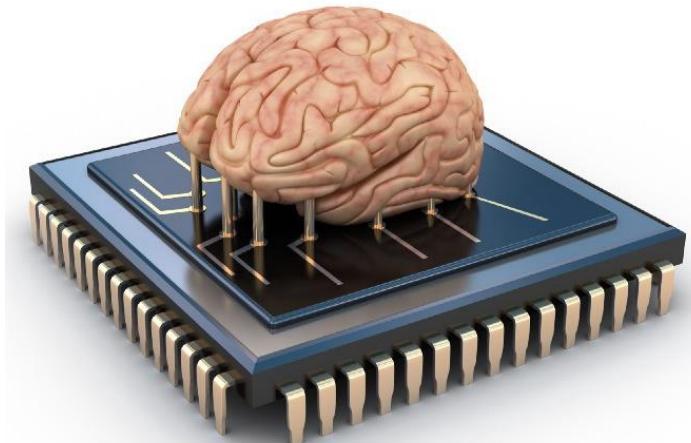
冯·诺依曼架构



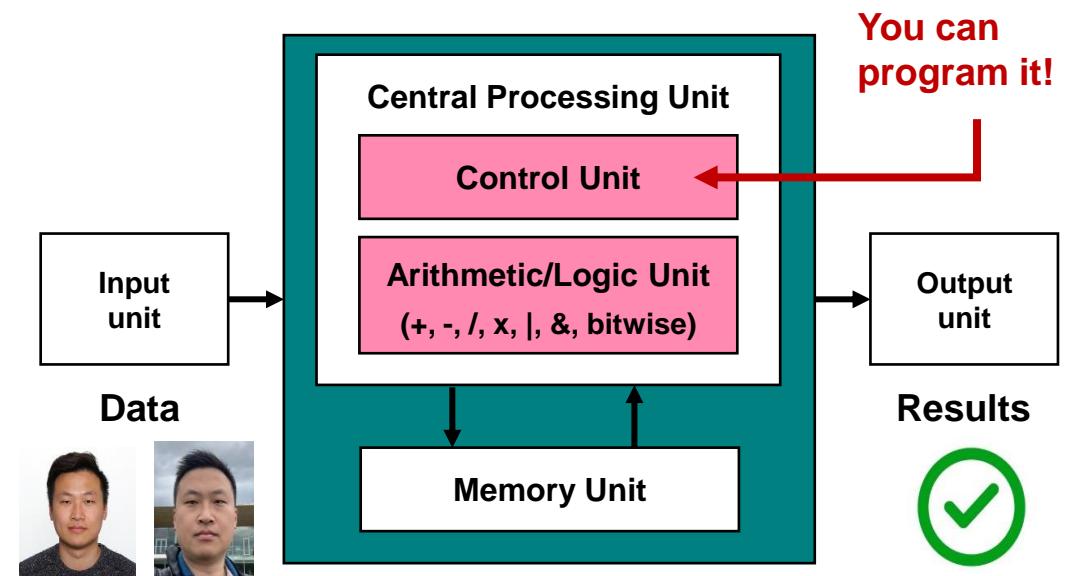
Von Neumann architecture

Control unit

- Defines logics and workflows to process data/information
- **You can control this part!**

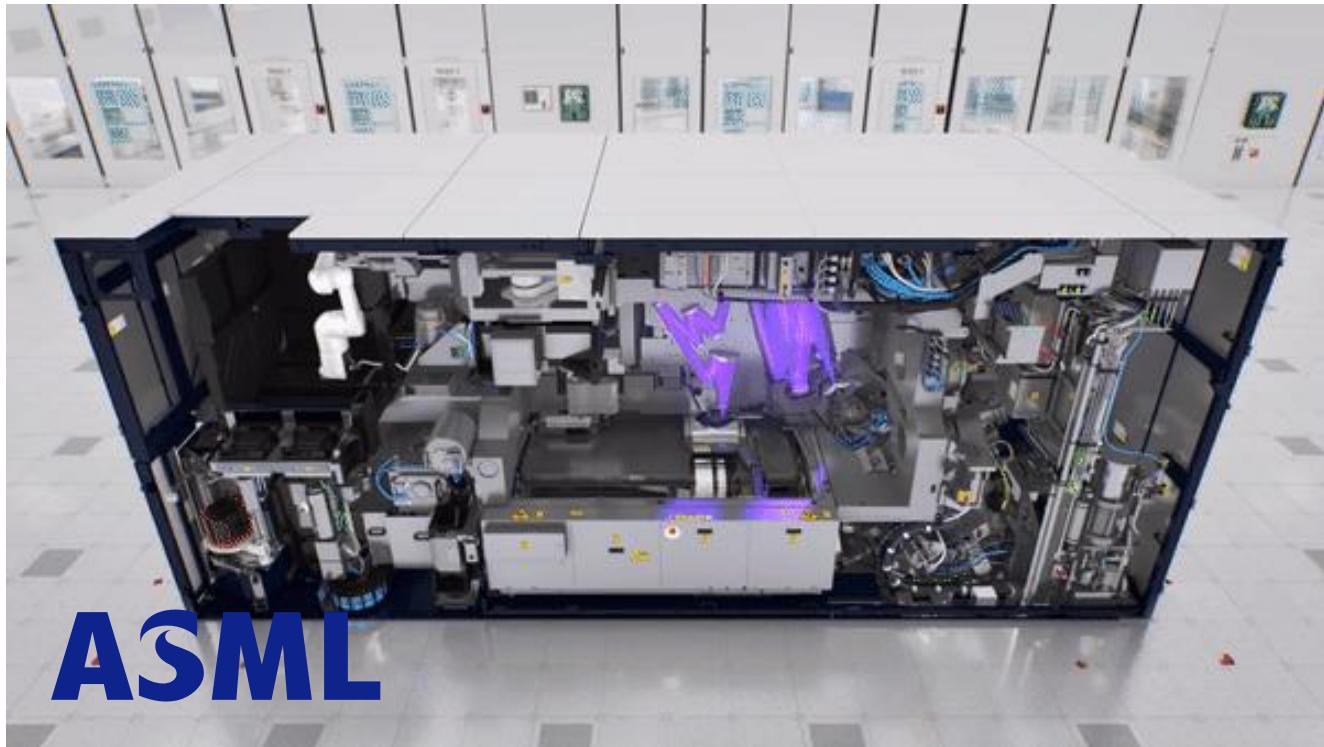


Machine is programmable
Von Neumann architecture (1946)
冯·诺依曼架构



Von Neumann architecture

Lithography卡脖子！



Central Processing Unit

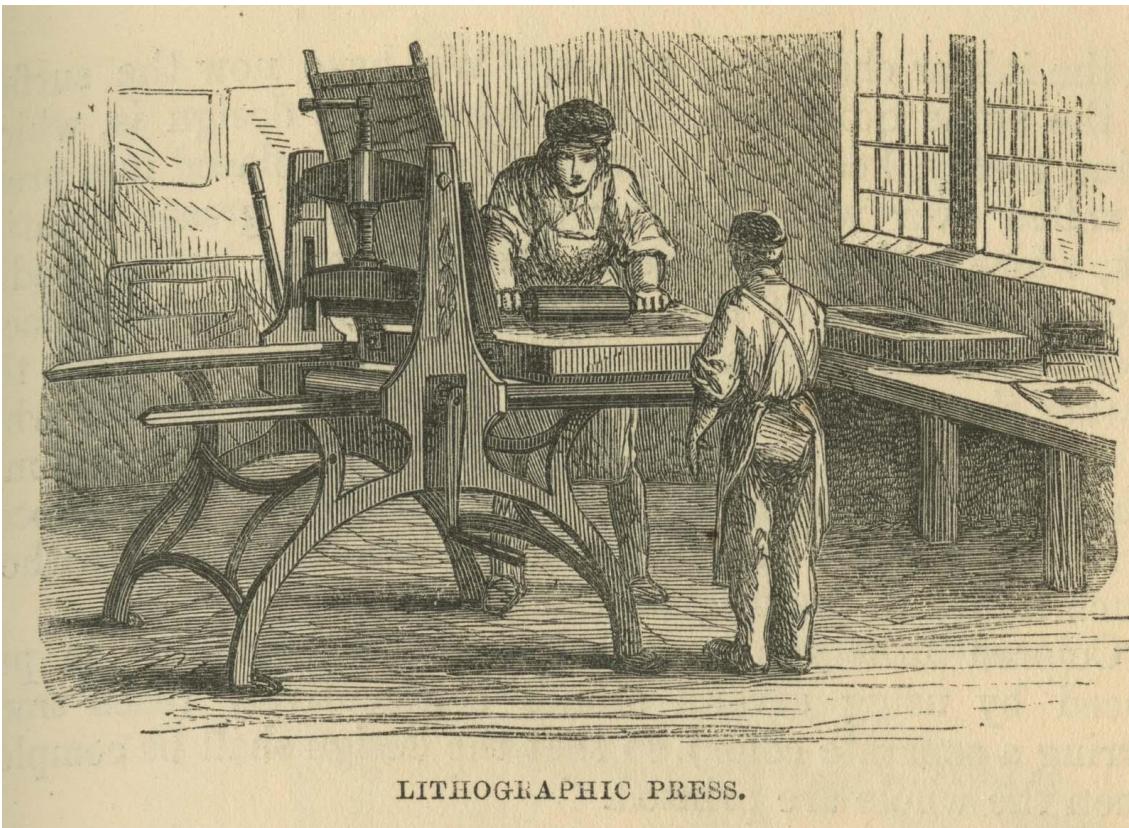
Control Unit

Arithmetic/Logic Unit
 $(+, -, /, \times, |, \&, \text{bitwise})$

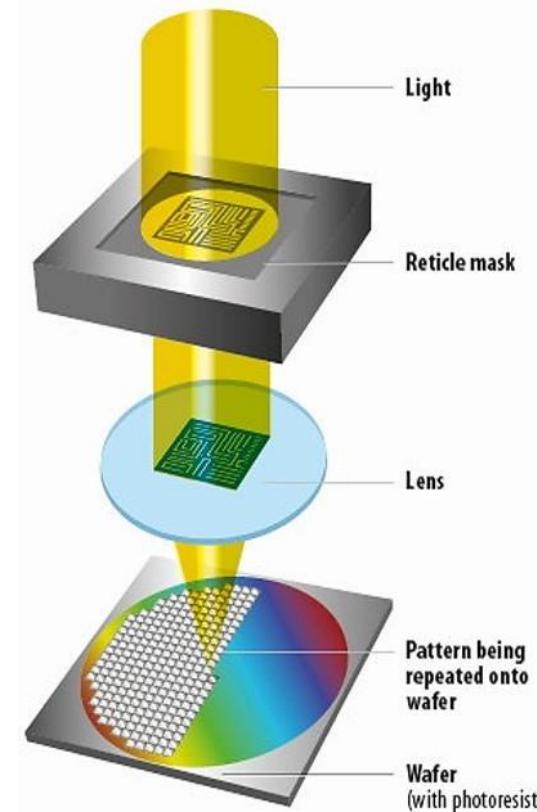


Lithography

Lithography on the stone

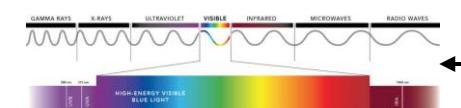


Lithography on the chip



$$CD = k_1 \frac{\lambda}{NA}$$

Wavelength λ
Resolution factor k_1
Numerical aperture NA



UV to DUV to EUV
193 nm to 13.5 nm

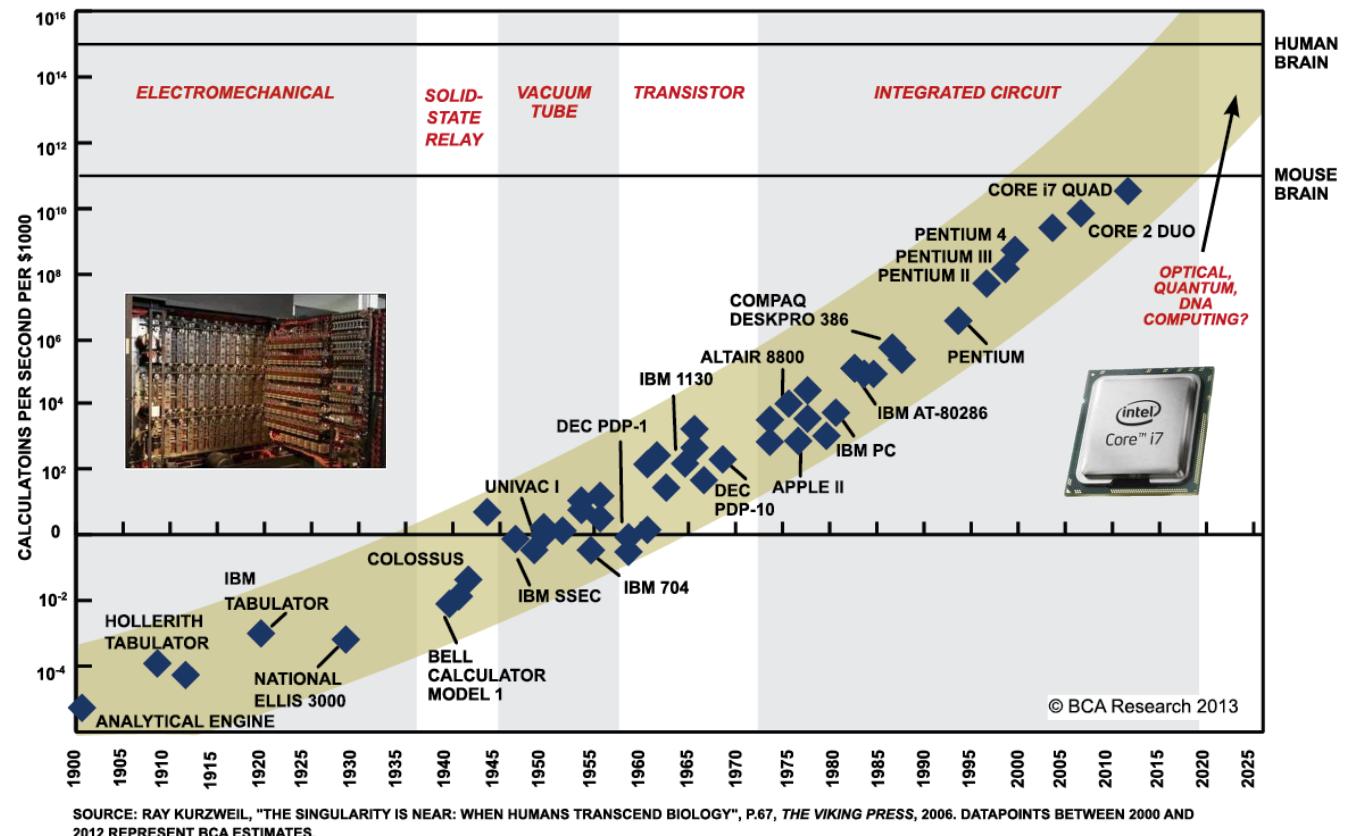
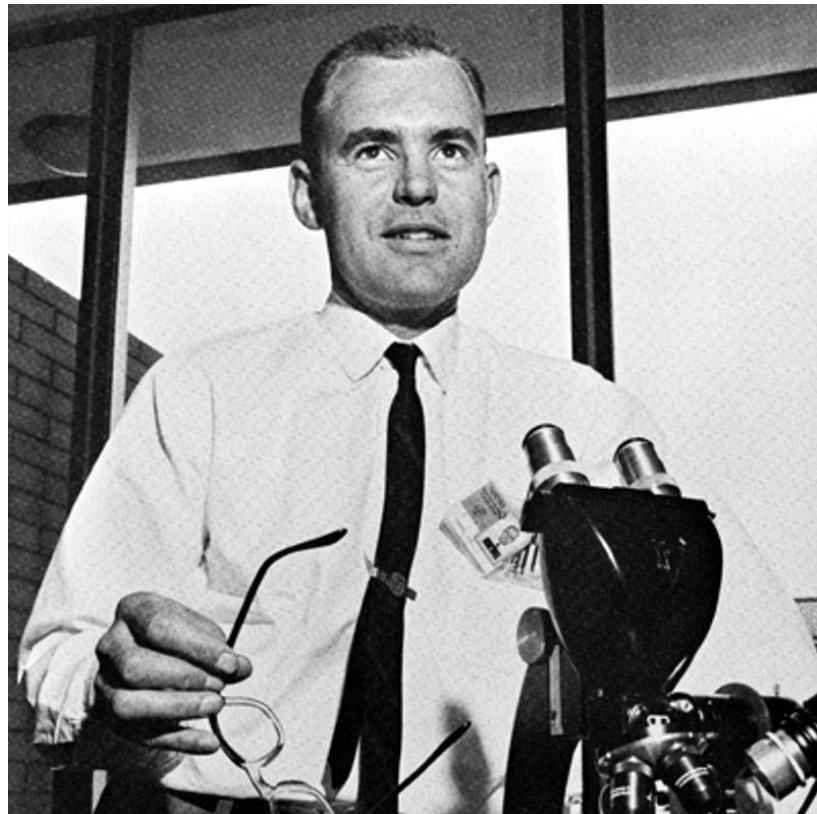


三分钟看懂： 最先进的EUV光刻机

Moore's Law

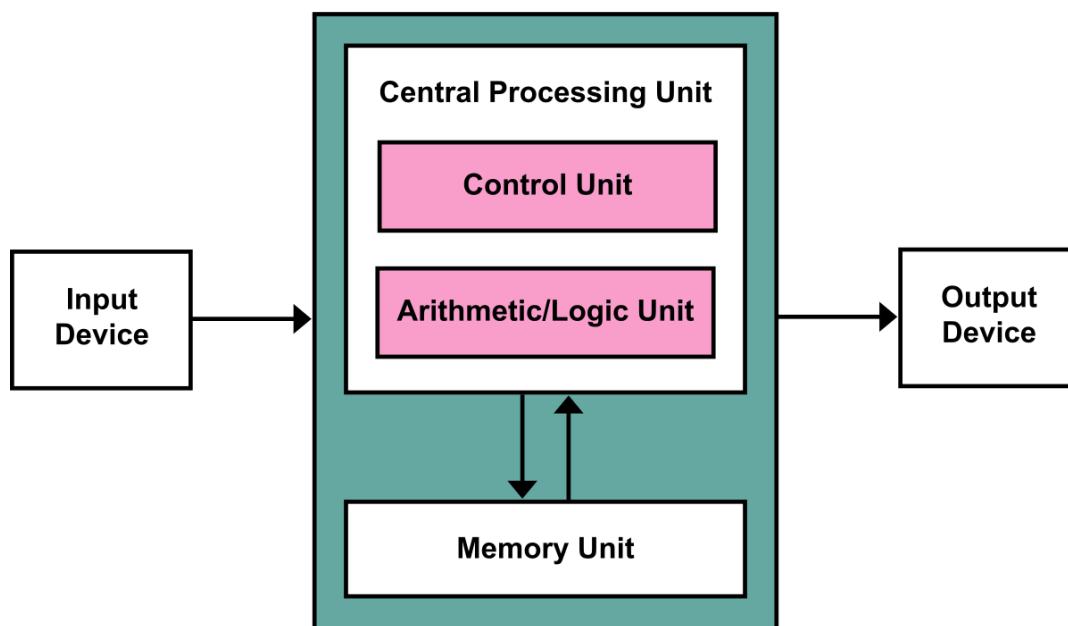
Gordon Moore (chairman of Intel) claimed in 1965:

“The number of transistors in a dense integrated circuit (IC) doubles about every two years.”

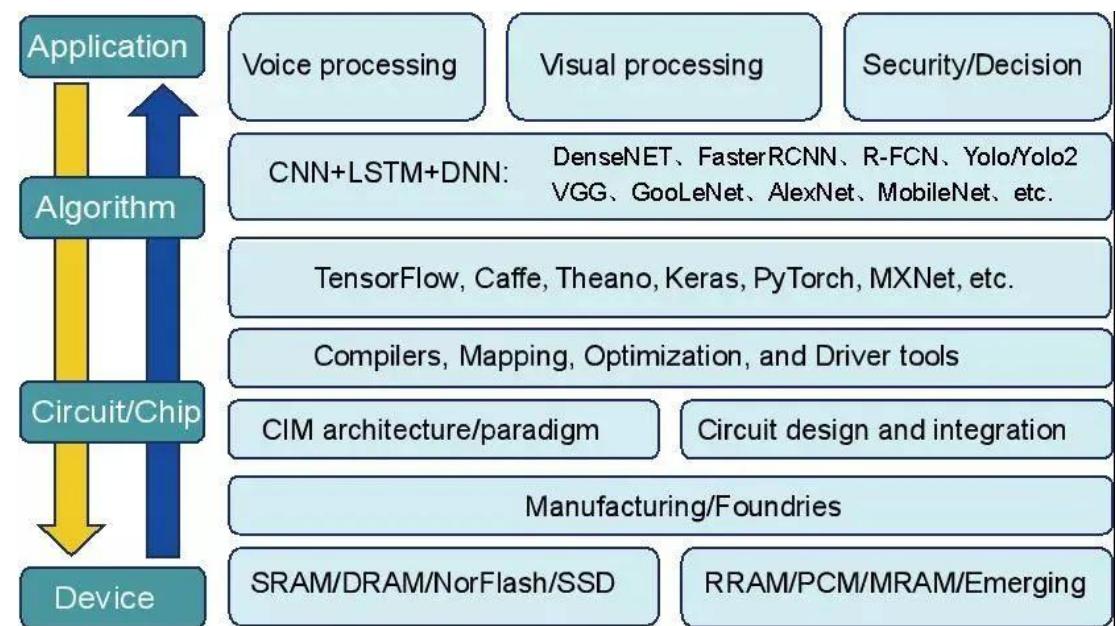


What's next?

Von Neumann Architecture

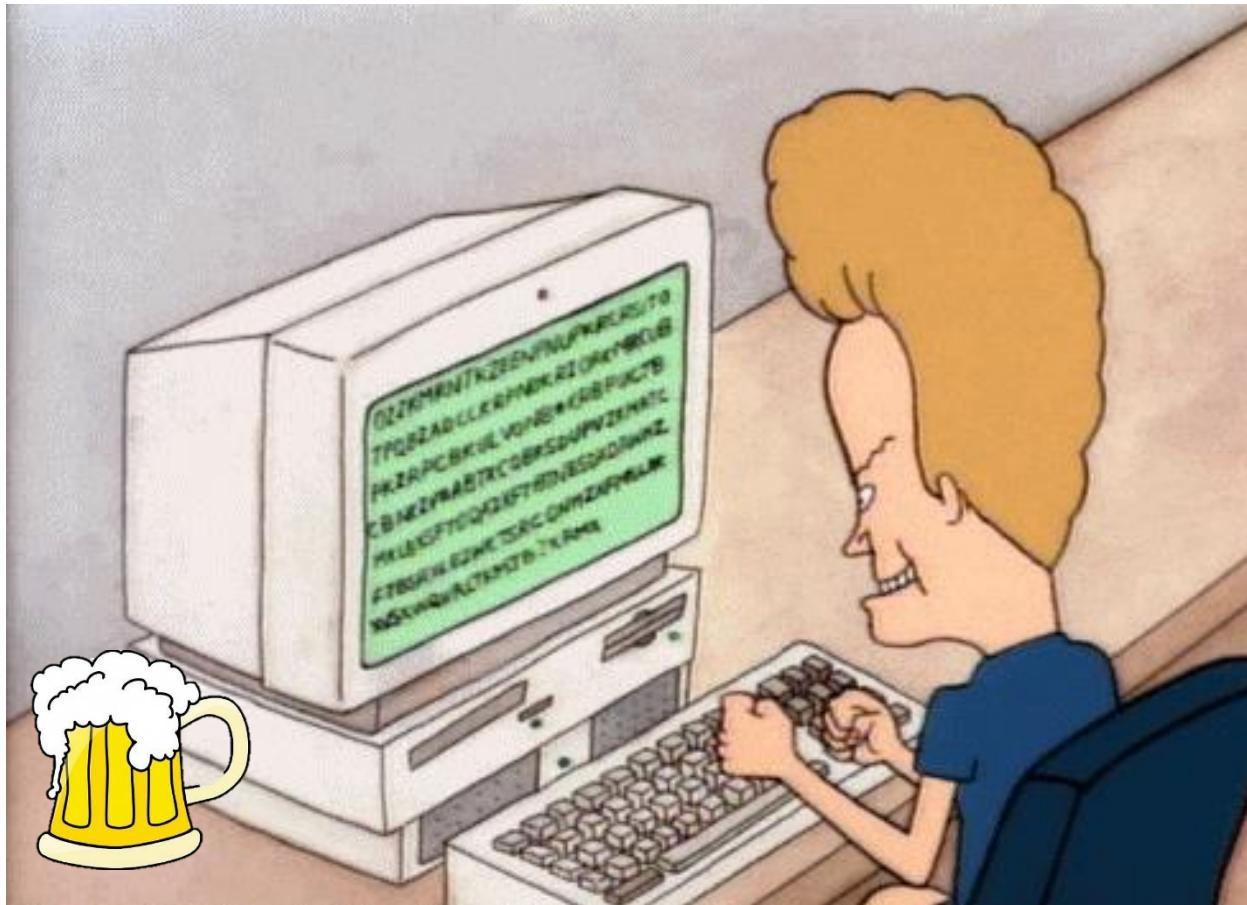


In-memory Computing Architecture



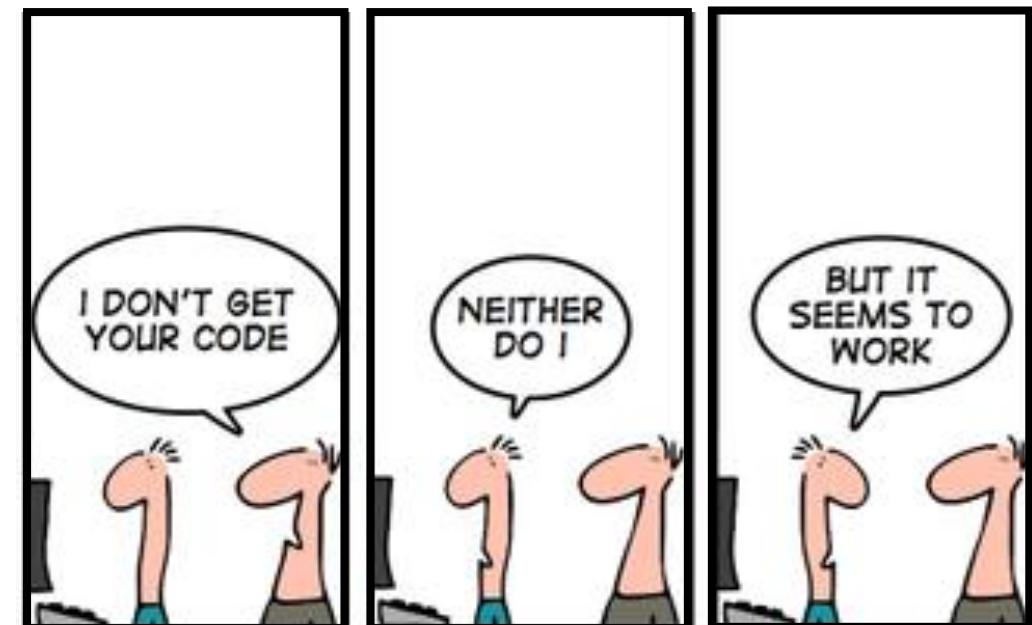
Programming allows you to control machine

Programming is very simple



Only 3 steps to program:

1. You have a PC/laptop
2. You can turn on the PC
3. You can type



Programming language is a “language”

Natural language



If you master English, you can talk to American.

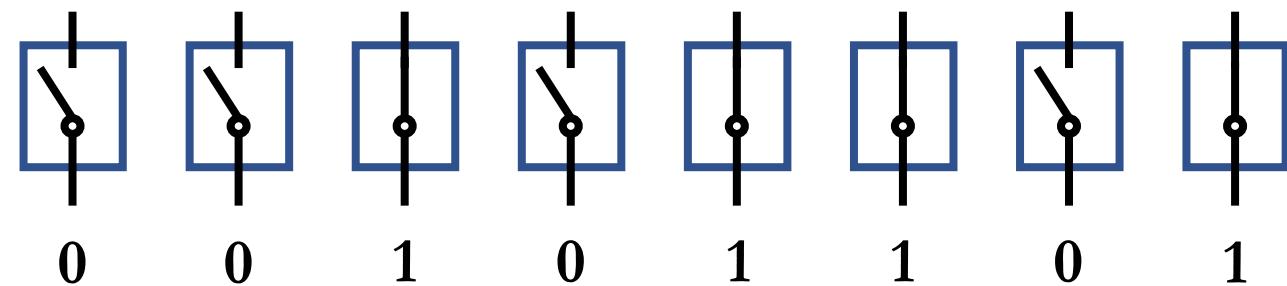
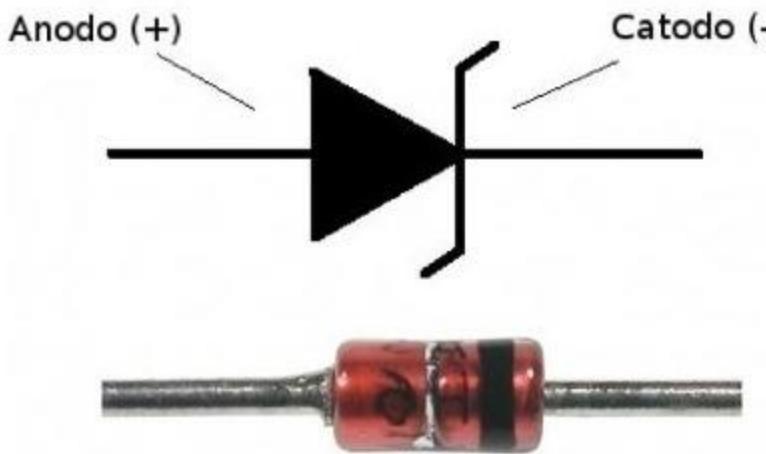
Programming language



If you master programming language, you can talk to machines.

What is machine language?

- English has 26 letters: A - Z
- Machine speaks **binary language**: 0 and 1
- A computer is nothing but a vast collection of **electronic switches** (diode) to store information



What is machine language?

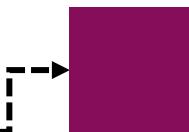
How computer interprets an image?



Our colourful world is quantized in 256 values!

Machine uses 8 bit to quantize colours

$$00000000 = 2^8 = 256 \text{ scales}$$

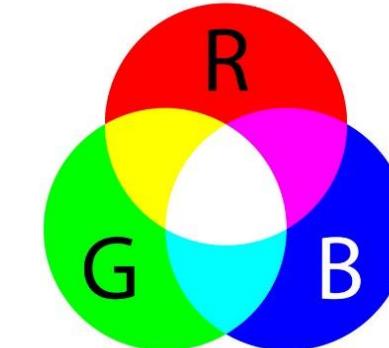


(130, 10, 50)

11011011

00000101

00111010



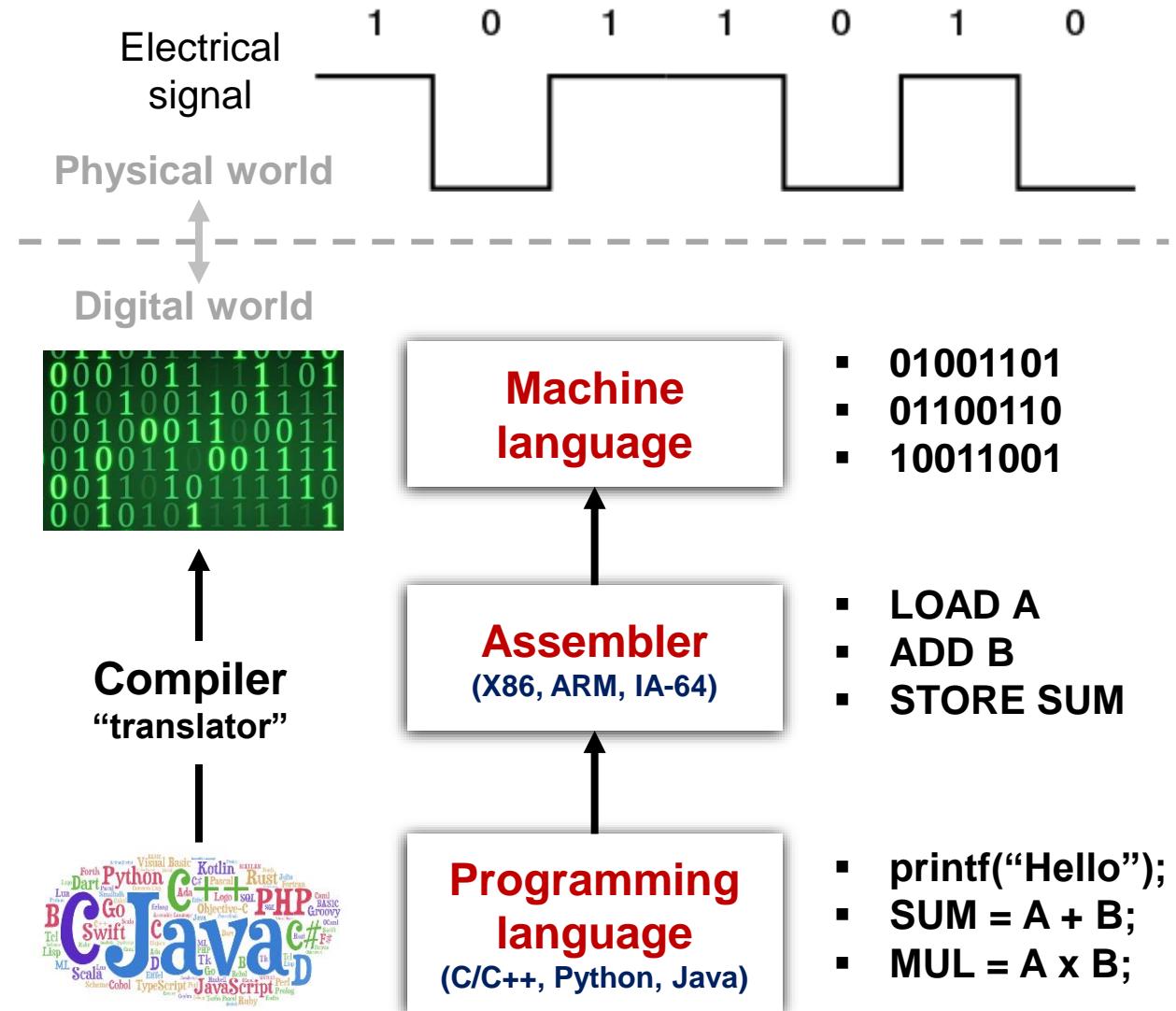
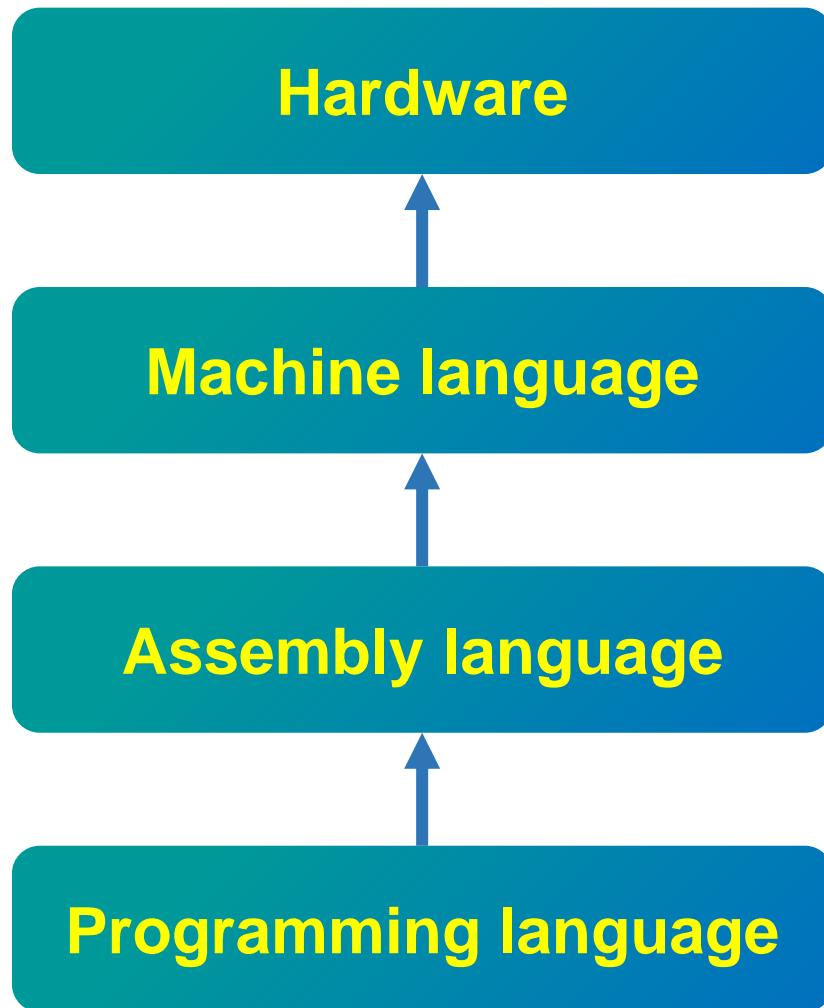
(60, 60, 220)

00010011

00010011

01111010

Programming language is a “language”



Content

1. What is programming?
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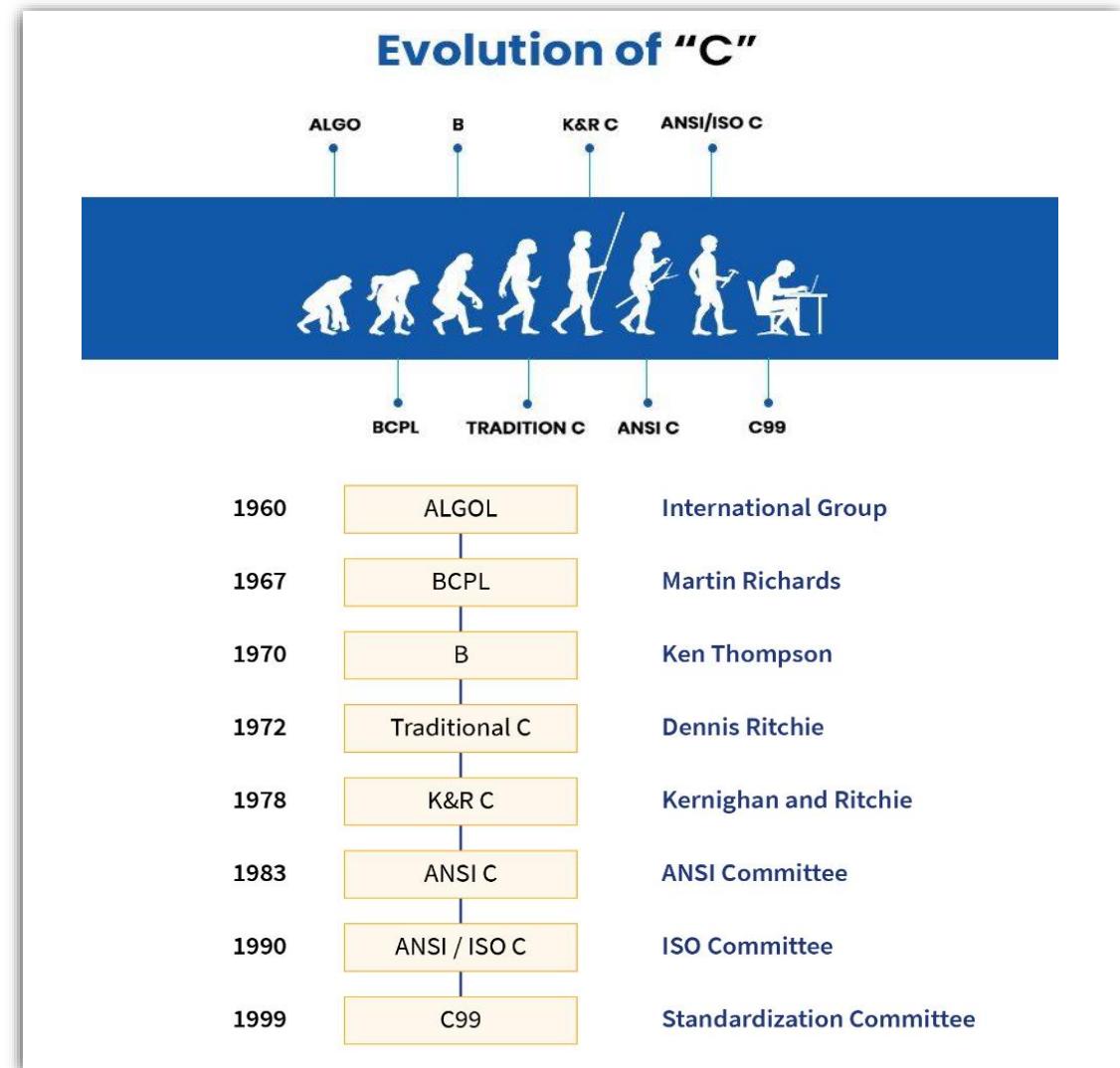
History of C

- 1950s, a first high-level language ALGO (A) was invented by ACM, extended to BCPL (B), but **too close to machines, hard to be used.**
- 1972, C was developed by Bell Labs (Ken Tompson and Dennis Ritchie) for UNIX systems, **close to machine while comfortable to human.**
- 1978, the book “The C programming Language” was published.
- 1990, ISO made the first standard of C, called C90; updated in 1999 and 2011, called C99 and **C11 (the version we use).**



History of C

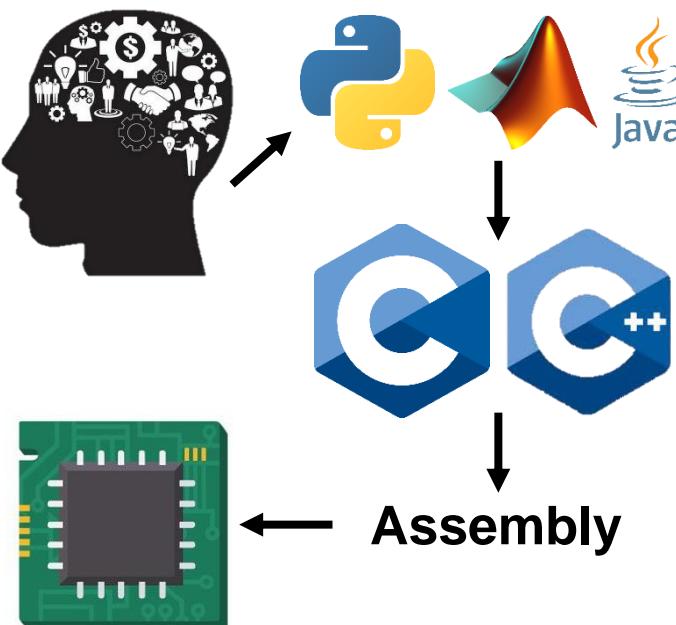
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What are the characteristics of C?

High-level language to human

- High-level syntax, comfortable to be used, e.g. printf("Hello!");
- Easy to be structured and extended.



Efficient language to machine

- Way of accessing machine memory is efficient, e.g. bitwise operations, pointers.
- Grammar is close to machine interpretations.

C is desired for edge devices



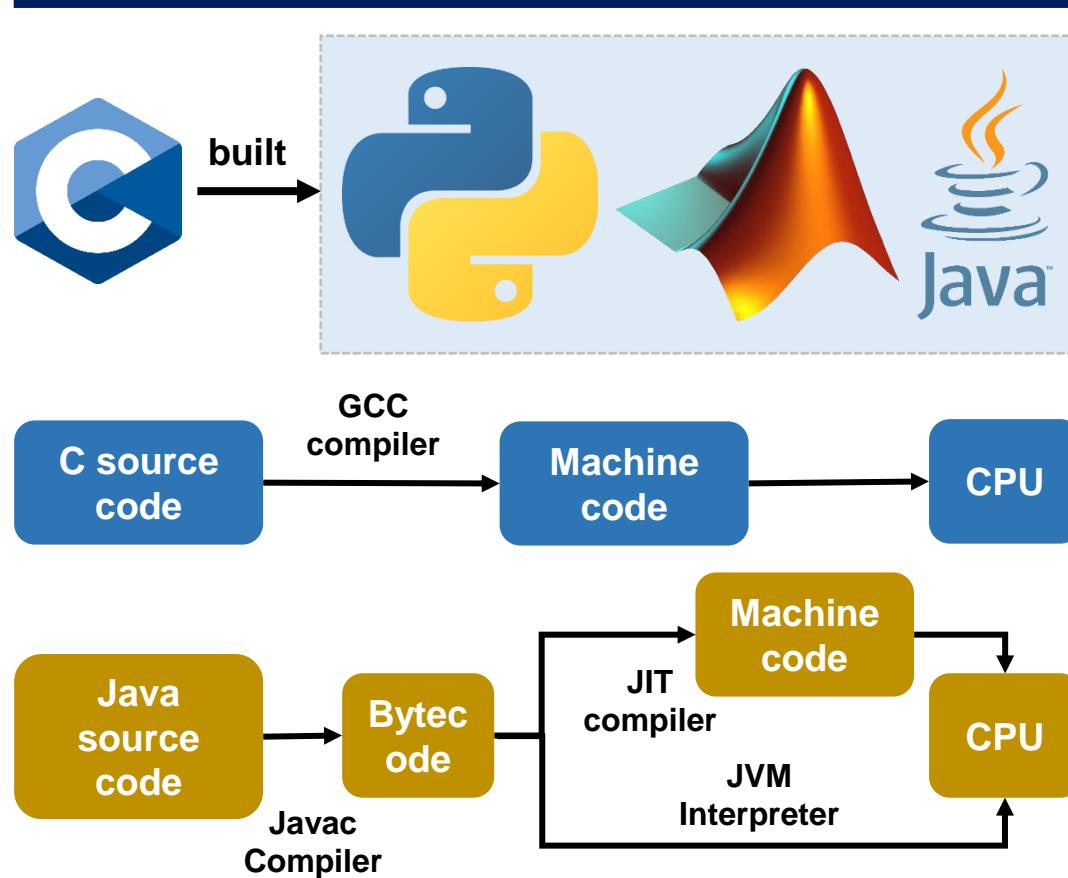
Ubiquitous and scalable for applications

- Can run on Windows/Linux/IOS and various systems.
- Can build programs, compilers and operating systems.

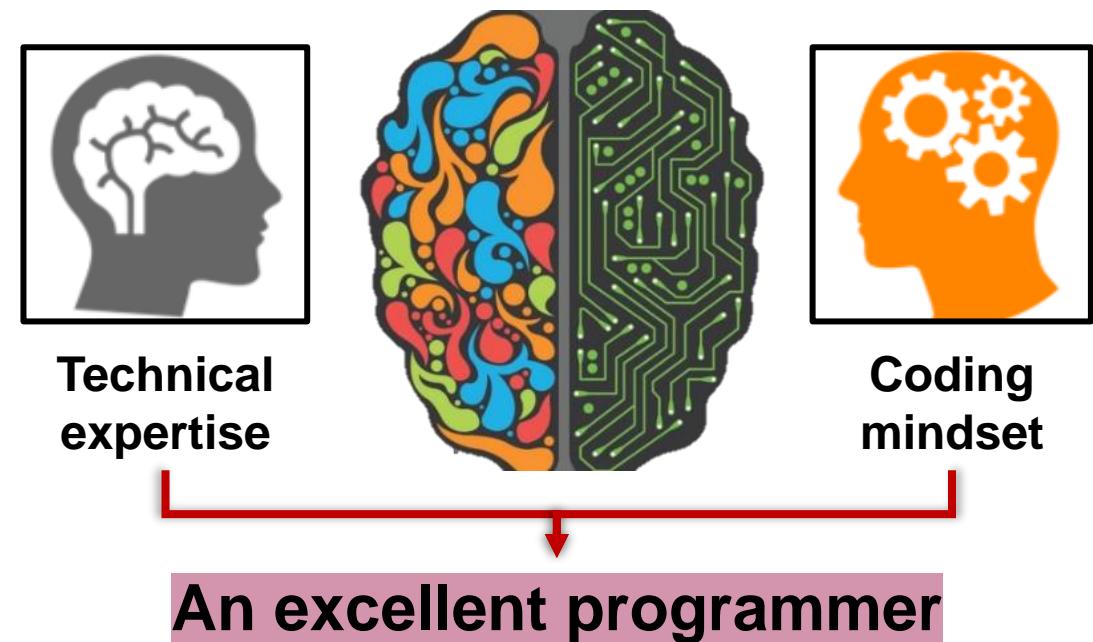


Why learning C?

C is fundamental of various programming languages



C is good for practicing skills and mindset of programming (as beginners)



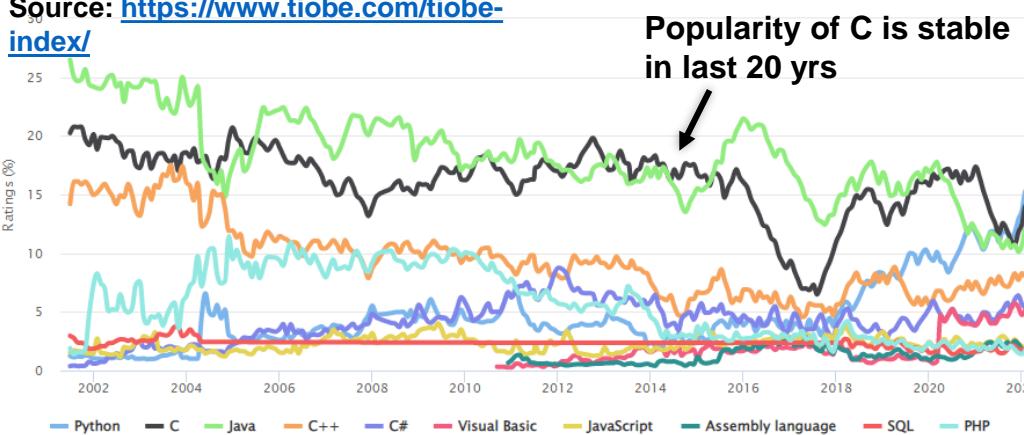
- ✓ Creative in solutions, solid in implementation
- ✓ Code is easy-to-read, neat and elegant
- ✓ Code is maintainable and extendable

Why learning C?

C is a long-live popular language in the industry (越老越吃香)

May 2022	May 2021	Change	Programming Language	Ratings	Change
1	2	▲	Python	12.74%	+0.86%
2	1	▼	C	11.59%	-1.80%
3	3		Java	10.99%	-0.74%
4	4		C++	8.83%	+1.01%
5	5		C#	6.39%	+1.98%
6	6		Visual Basic	5.86%	+1.85%

Source: <https://www.tiobe.com/tiobe-index/>



C is a must-learned language for “考研” if choosing Computer Science 😊

2013 年中国传媒大学计算机学院 827 程序设计[专业硕士]考研真题

中国传媒大学

2013 年全国硕士研究生入学统一考试

程序设计 试题

答题说明：答案一律写在答题纸上，不需抄题，标明题号即可，答在试题上无效。

一、单项选择题（每小题 2 分，共 40 分）

- 若用数组名作为函数调用时的实参，则实际上传递给形参的是（ ）。
A. 数组的首地址 B. 数组的第一个元素值
C. 数组中全部元素的值 D. 数组元素的个数
- C 语言中函数返回值的类型由（ ）决定的。
A. return 语句中的表达式类型 B. 调用该函数的主调函数的类型
C. 调用函数时临时决定 D. 定义函数时所指定的函数类型
- 对一个已排序的具有 100 万个数的数组采用折半查找法，最多进行（ ）次比较。
A. 10 B. 20
C. 30 D. 999,999
- 假设已有定义 int a[4][8]；下面哪条语句是正确的？（ ）
A. int *p= a; B. int *p[8] = a;
C. int (*p)[8] = a; D. int *p[4] = a;
- 已知赋值语句 wang.year = 2005; 则 wang 是（ ）类型的变量。
A. 字符或文件 B. 整型和枚举
C. 共用体或结构体 D. 实型或指针
- Fibonacci 数列的递归计算方法如下：F(0)=0, F(1)=1, F(n) = F(n-1) + F(n-2)，该递归函数的时间复杂度是（ ）。
A. O(n) B. O(n²)
C. O(2ⁿ) D. O(nlogn)

浙江 大学

2018年攻读硕士学位研究生入学考试试题

考试科目_____ 软件工程 编号 878

注意：答案必须写在答题纸上，写在试卷或草稿纸上均无效。

2018真题详细版!

一、C 语言部分：

C 语言分析题：

(6 分) 第一题：插入排序)

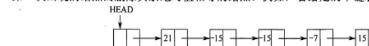
```
void F(int i,int A[],int n){  
    int tmp=A[i];  
    for(int j = i+1; j > 0 && A[j-1] > tmp ; j--) A[j] = A[j-1];  
    A[j] = tmp;  
}
```

2015 年全国硕士研究生入学统一考试

计算机科学与技术学科联考计算机学科专业基础综合试题

二、综合应用题（第 41~47 小题，共 70 分）

41. (15 分) 用单链表保存 m 个整数，结点的结构为 [data][link]，且 $data \leq n$ (n 为正整数)。现要求设计一个时间复杂度尽可能低的算法，对于链表中 data 的绝对值相等的结点，仅保留第一次出现的结点而删除其余绝对值相等的结点。例如，若给定的单链表 HEAD 如下：



则删除结点后的 HEAD 为

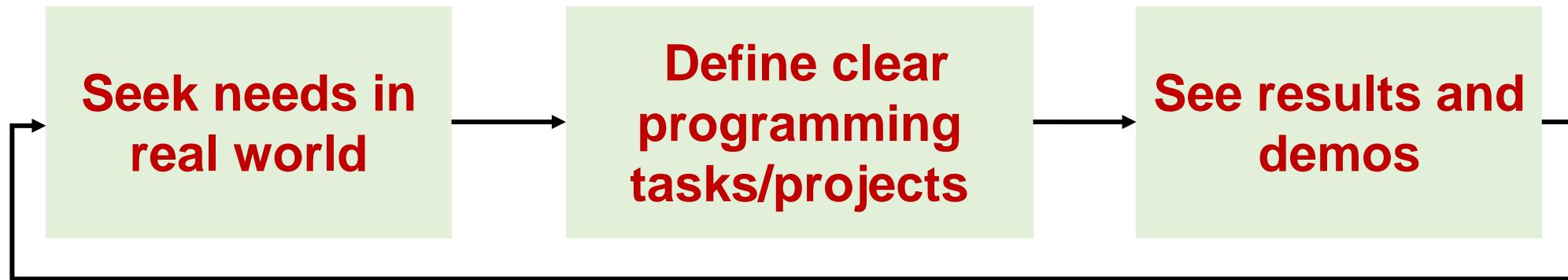


要求：

- 给出算法的基本设计思想。
- 使用 C 或 C++ 语言，给出单链表结点的数据类型定义。
- 根据设计思想，采用 C 或 C++ 语言描述算法，关键之处给出注释。
- 说明你所设计算法的时间复杂度和空间复杂度。

How to learn C?

It's a language, practice!



**Understand
what to solve**

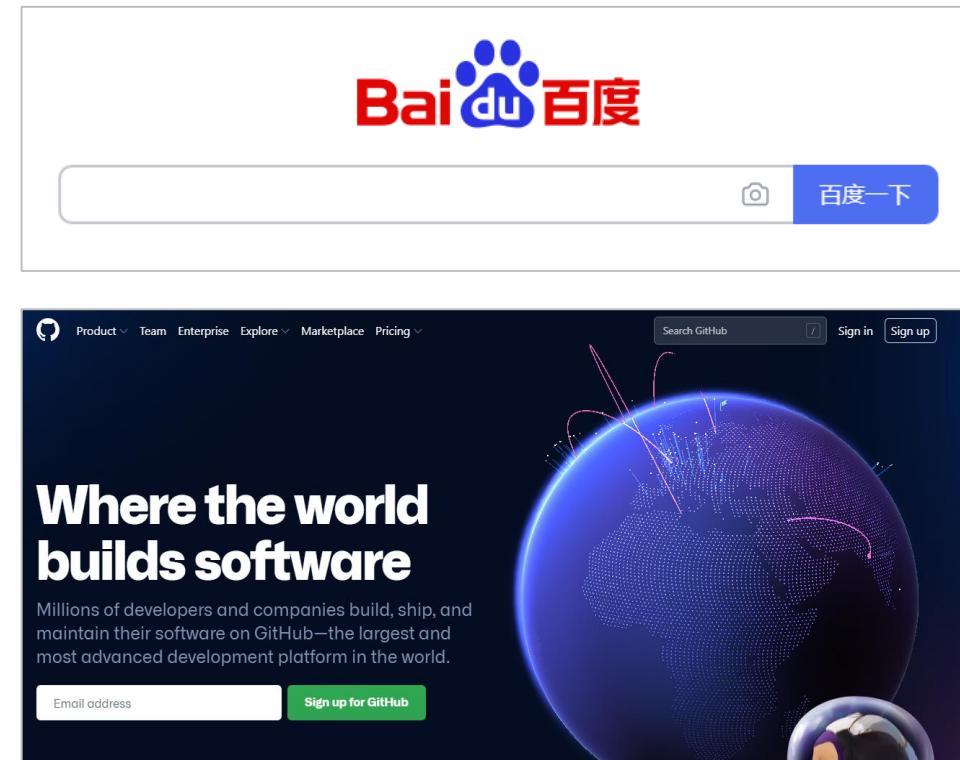
Practicex3

**Be proud of
achievements**

Project/content oriented, turn it into a hobby!

How to learn C?

Do not memorize, Google is your friend!



How to learn C?

What makes you different from others?

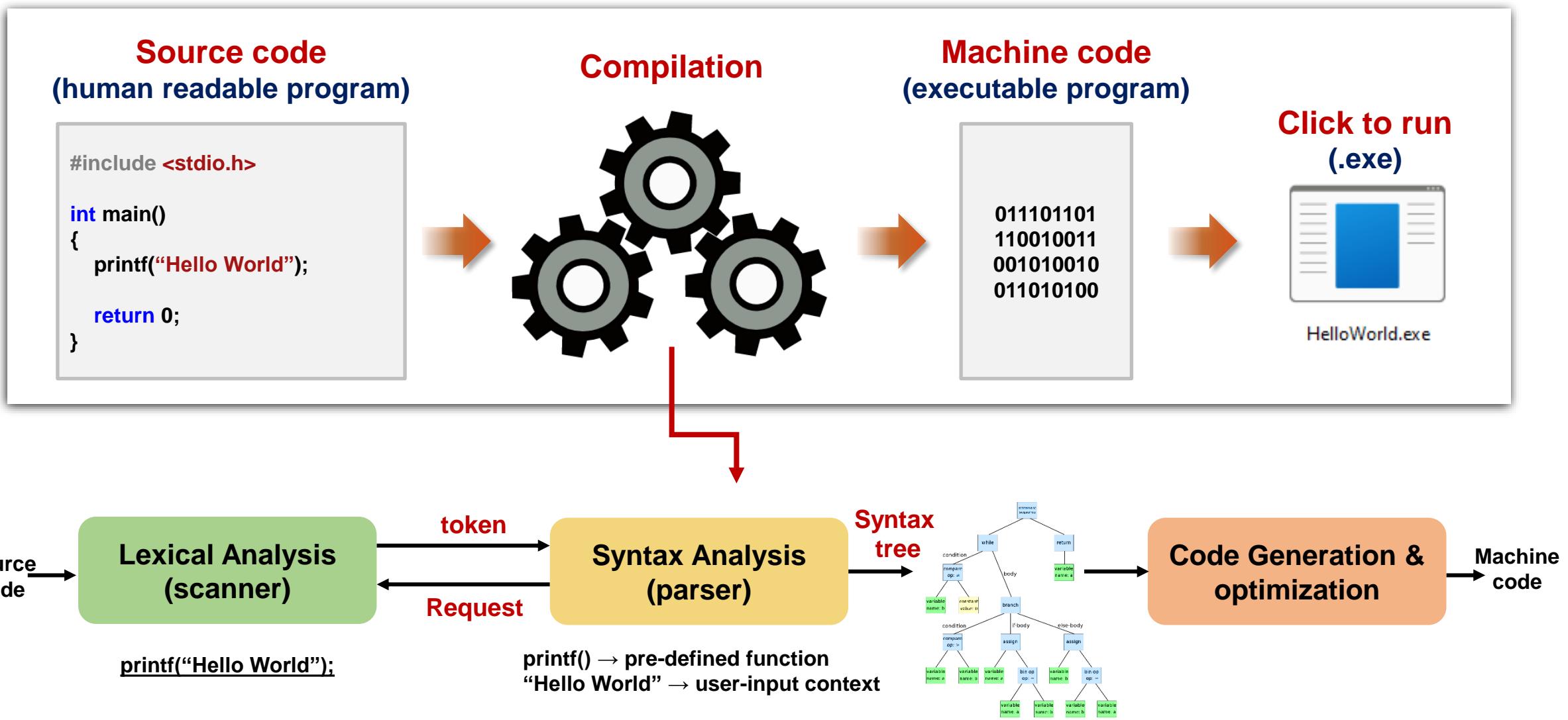


C + AI to build the core competence!

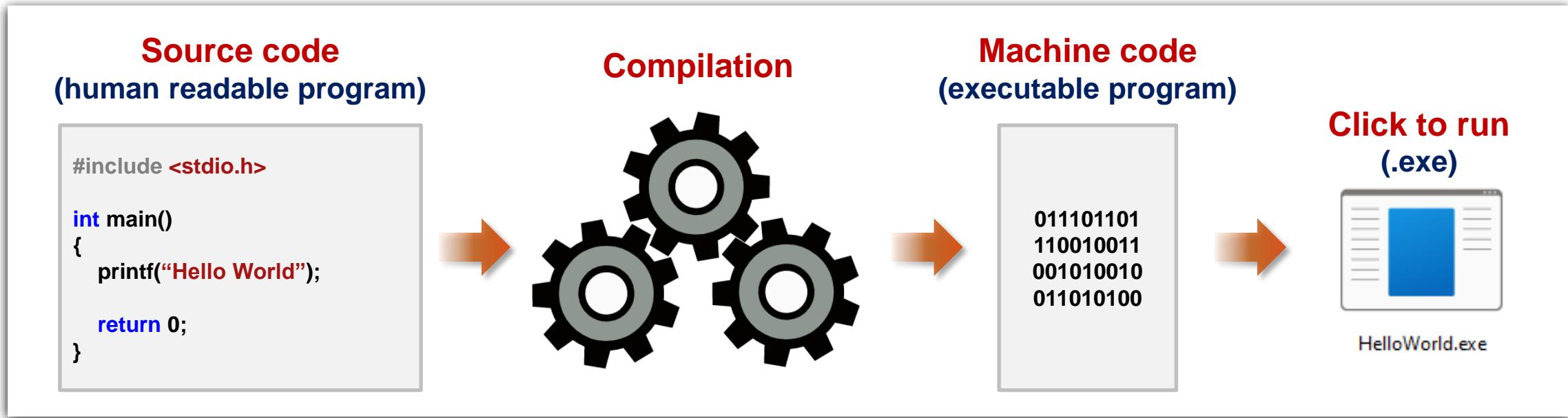
Content

1. What is programming?
2. What is C language?
- 3. A first example in C**
4. Summary

How a C program is executed?



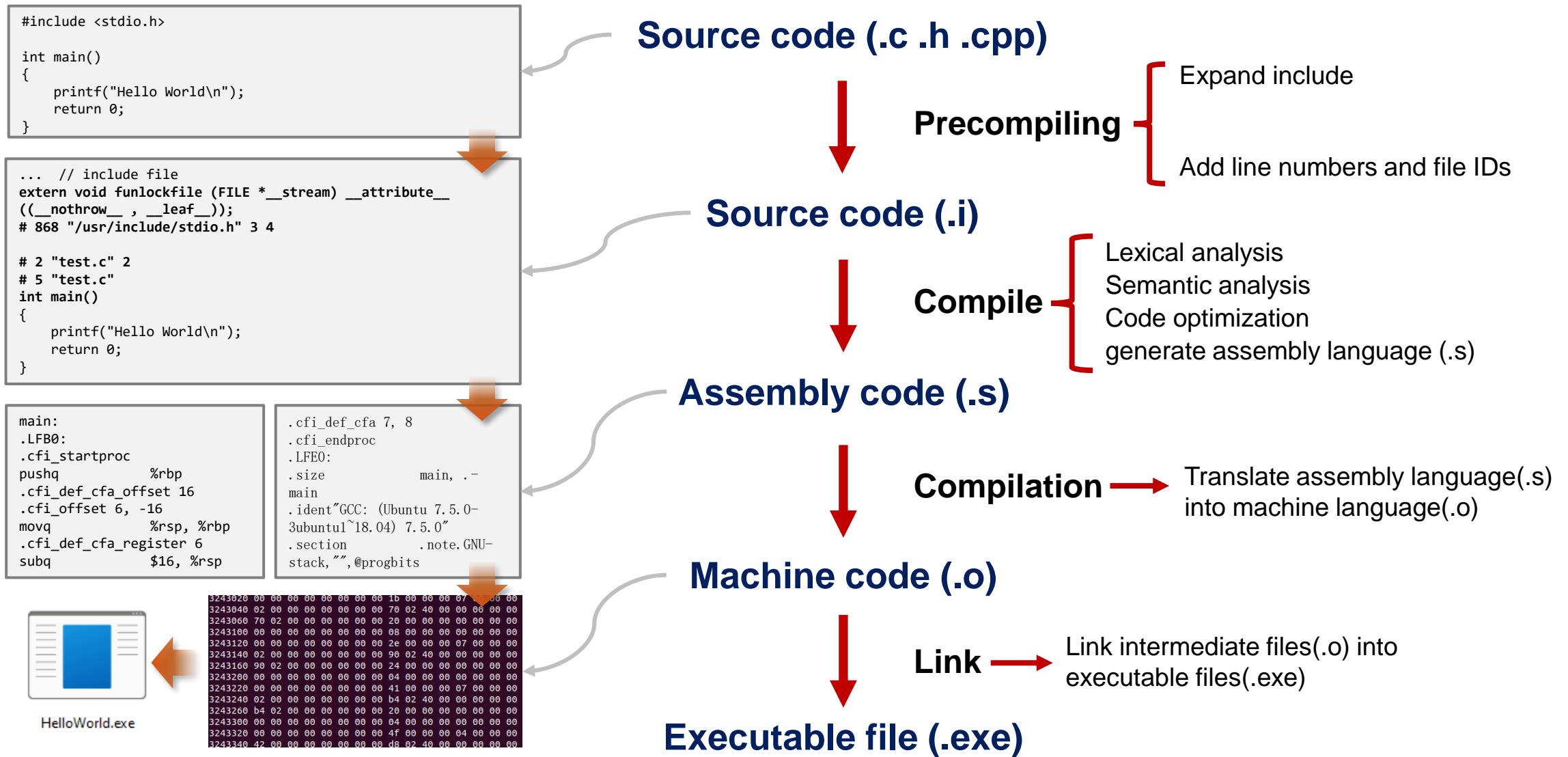
How a C program is executed?



Write source code
(hmm...) 🤔

Compile source code
(easy, click a button)

How a C program is executed?



How tools used for C programming?

Highly-skilled (Notepad + CMD)

Notepad window showing the code:

```
#include <stdio.h>

int main()
{
    printf("Hello World");

    return 0;
}
```

Windows Command Prompt window showing the error:

```
Select Command Prompt
Microsoft Windows [Version 10.0.22000.613]
(c) Microsoft Corporation. All rights reserved.

C:\Users\wenji>gcc
'gcc' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\wenji>gcc HelloWorld.c -o HelloWorld
```

Old-school (1980s) (IDE: Turbo C)

IDE- Integrated Development Environment

Turbo C Version 1.0 Copyright (c) 1987 by Borland International, Inc.

F1-Help F5-Zoom F6-Edit F9-Make F10-Main Menu

```
#include <stdio.h>
#include <conio.h>

int i, j, inpt;
ar[20];

main()
{
    clrscr();
    printf("Enter number (1 to 20) ? ");
    scanf("%d",& inpt);

    ar[0] = ar[1] = 1;
    printf("\n 1 1");
    for (i = 2; i <= inpt; i++)
    {
        ar[i] = ar[i-1] + ar[i-2];
        printf(" %d",ar[i]);
    }
}
```

Recommended (IDE: Visual Studio)

TestC (Running) - Microsoft Visual Studio

```
#include <stdio.h>
void main() {
    printf("Hello World, From C! \n");
    system("pause");
}
```

Output window showing the result:

```
Hello World, From C!
Press any key to continue . . .
```

Source.cpp Project1

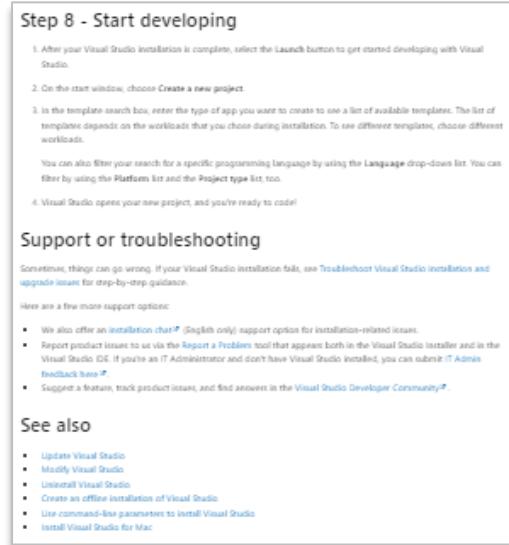
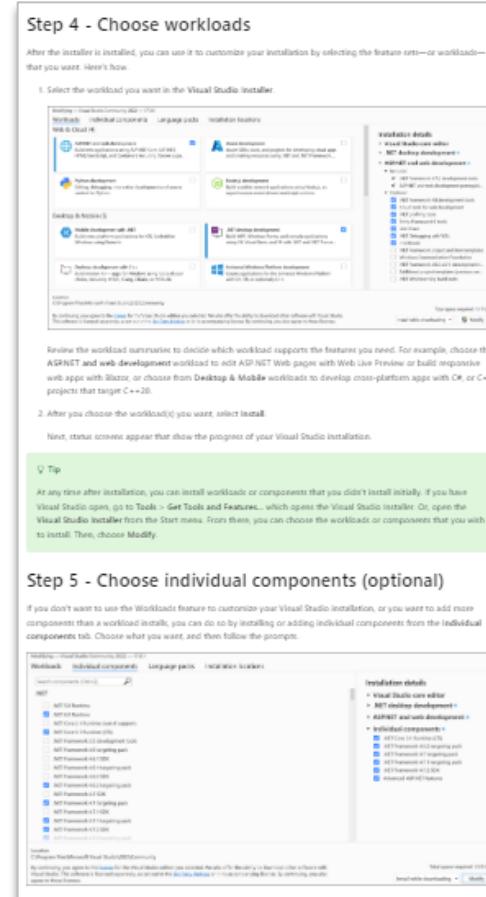
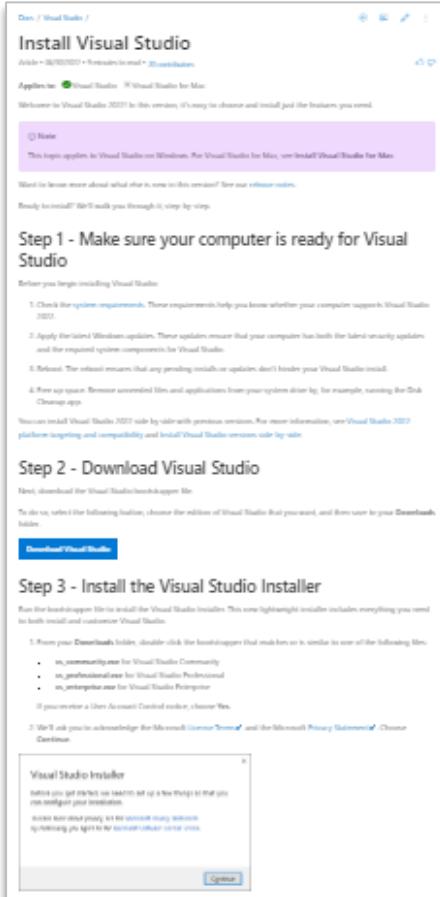
```
#include <iostream>
using namespace std;

int main()
{
    cout << "Hello, World!";
    return 0;
}
```

Identifier "retur" is undefined

How tools used for C programming?

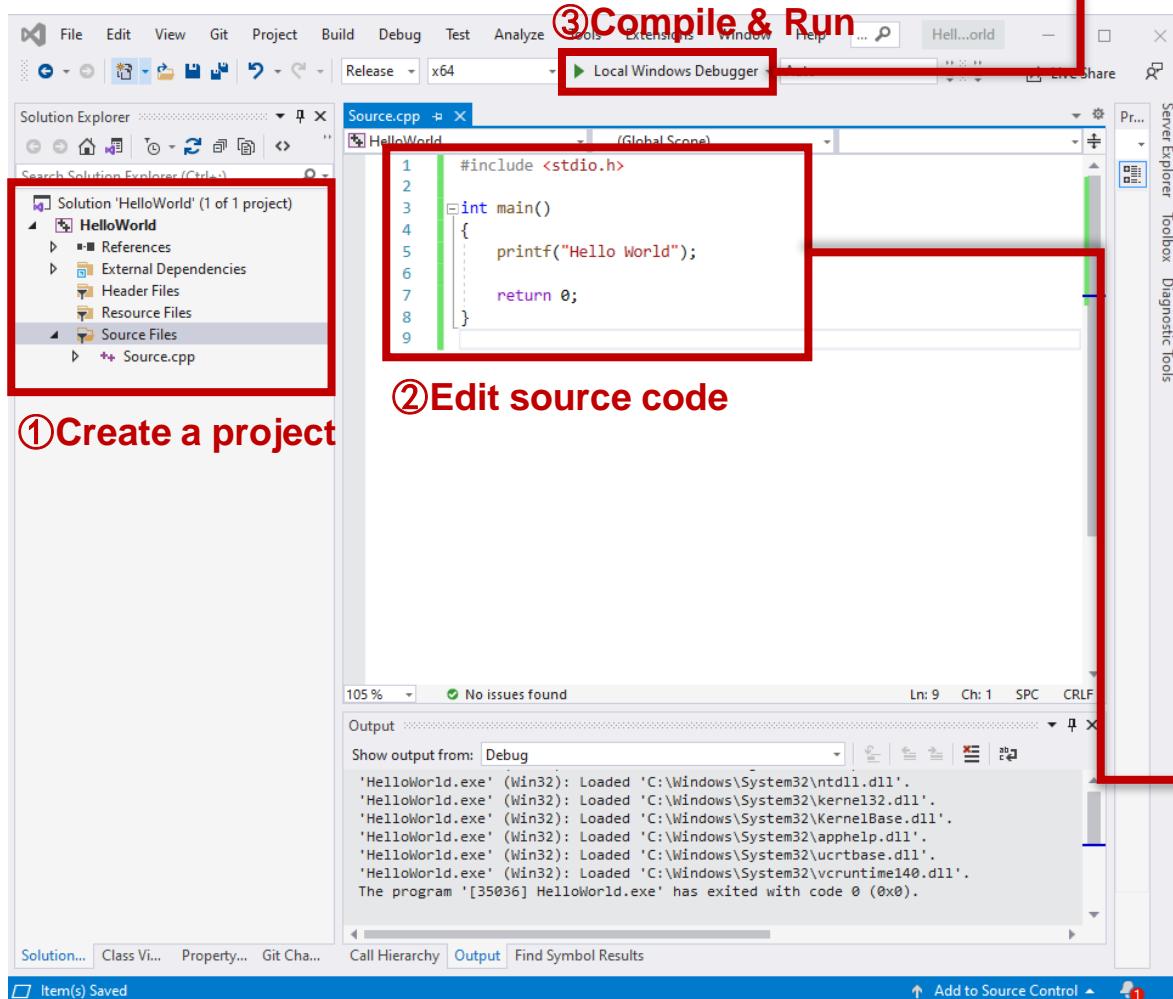
Very simple to install Visual Studio, like you install PC games



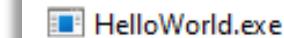
Few steps to start!

Our first C program: Hello world

Visual Studio IDE

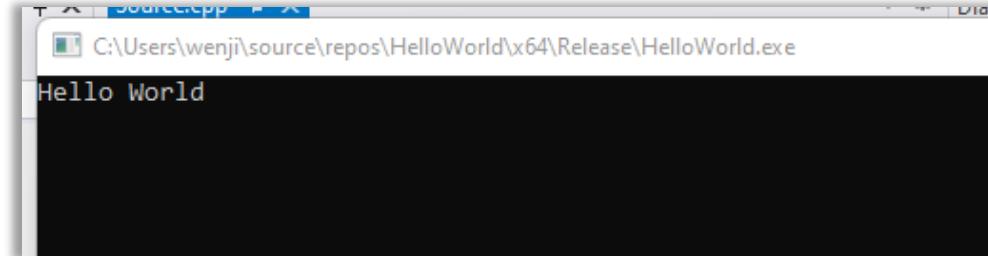


Generate executable file



10/05/2022 16:02

Run the executable file



#include <stdio.h>

```
int main()
{
    printf("Hello World");
    return 0;
}
```

Our first C program: Hello world

The simplest example

```
#include <stdio.h>

int main()
{
    printf("Hello World");

    return 0;
}
```

Main body of program:

```
int main()
{
    return 0;
}
```

Action:

```
printf("Hello World");
```

Pre-compiled head file:

```
#include <stdio.h>
```

Our first C program: Hello world

Commenting is a good habit

```
#include <stdio.h>

int main()
{
    printf("Hello World"); // This
    is to print "Hello World"

    return 0;
}
```

// You can add comment to improve
the code readability

Main body of program:

```
int main()
{
    return 0;
}
```

Action:

```
printf("Hello World");
```

Pre-compiled head file:

```
#include <stdio.h>
```

Our first C program: Hello world

```
*****  
* Name:      HelloWorld.c  
* Author:    Wenjin Wang  
* Date:     5-10-2022  
* Abstract: show HelloWorld printing example  
* Version:   1.0  
* Copyright: SUSTech  
*****
```

```
#include <stdio.h>

int main()
{
    printf("Hello World"); // This is to
print "Hello World"

    return 0;
}
```

Main body of program:

```
int main()
{
    return 0;
}
```

Action:

```
printf("Hello World");
```

Pre-compiled head file:

```
#include <stdio.h>
```

Our first C program: Hello world

```
*****  
* Name:      HelloWorld  
* Author:    Wenjin Wang  
* Date:     5-10-2022  
* Abstract: show HelloWorld printing example  
* Version:   1.0  
* Copyright:SUSTech  
*****  
  
#include <stdio.h>  
  
int main()  
{  
    printf("Hello World"); // This is to  
    print "Hello World"  
  
    return 0;  
}
```

Have a clear motivation

Starts with attributes

Write main body function

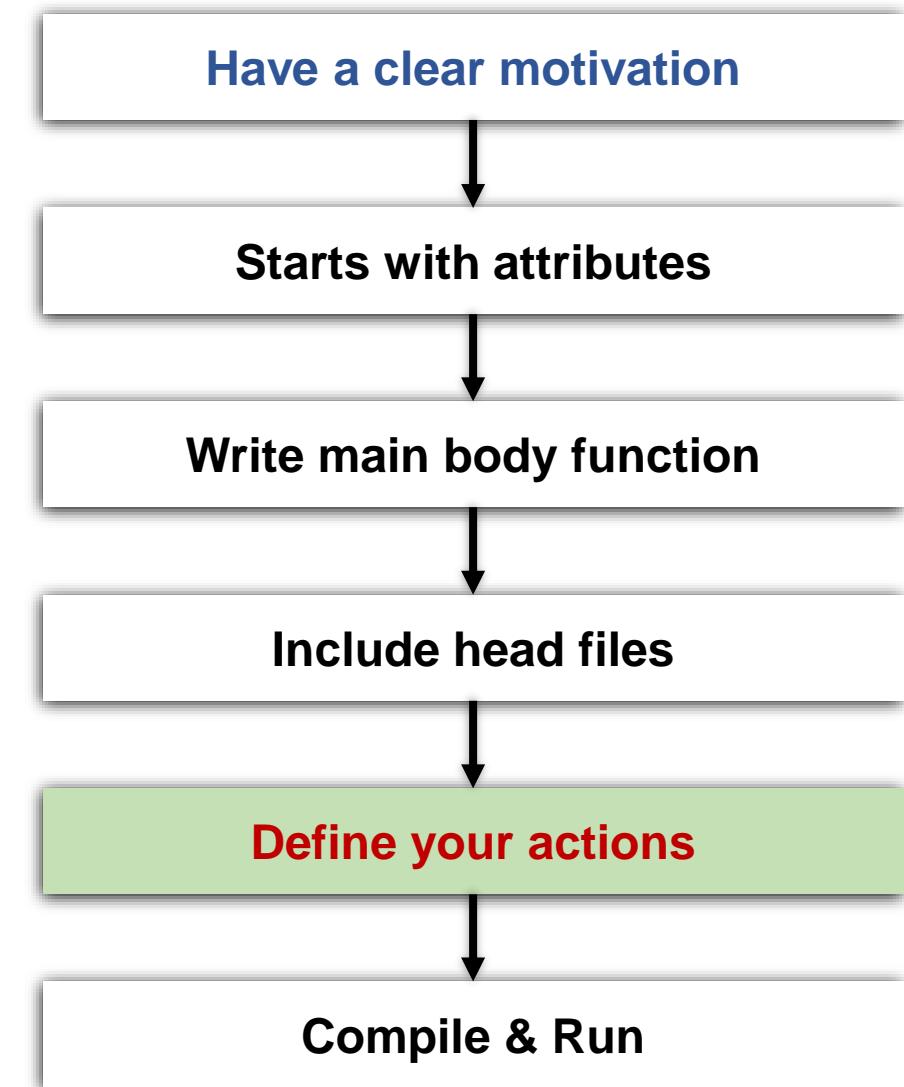
Include head files

Define your actions

Compile & Run

Our first C program: Hello world

```
*****  
* Name:      HelloWorld  
* Author:    Wenjin Wang  
* Date:     5-10-2022  
* Abstract: show HelloWorld printing example  
* Version:   1.0  
* Copyright:SUSTech  
*****  
  
#include <stdio.h>  
  
int main()  
{  
    printf("Hello World"); // This is to  
    print "Hello World"  
  
    return 0;  
}
```



More examples: draw a triangle

```
#include<stdio.h>

int main()
{
printf(" * * *\n");
printf(" * * *\n");
printf(" * *\n");
printf(" *\n");
return 0;
}
```



More examples: draw “love” with “*”

```
#include <stdio.h>

void main()
{
printf("***** *          * *****\n\n");
printf(" *   *   *          * *\n\n");
printf(" *   *   *          * ****\n\n");
printf(" *   *   *   *      * \n\n");
printf("***** *          * *****\n\n");
}
```



More examples: draw a Pikachu

```
#include <stdio.h>

void main()
{
    printf("`;-._\n");
    printf(`.\`\\_..../_.-`^`\n");
    printf("\\\\ / ,`\n");
    printf("/() ()\\\" .`-._\n");
    printf(") . ()\\\" / _.'\n");
    printf("\\\" -' - ,; ' . <\n");
    printf(`; .__ ,; | > \n");
    printf(`/ , / , | .-'.-\n");
    printf(`/_/ (_/ ,; | .<`\n");
    printf(`\\ , ;`-` \n");
    printf(`> `\\ / \n");
    printf(`_, -` > .' \n");
    printf(`_, ' \n");
}
```

Microsoft Visual Studio 调试控制台



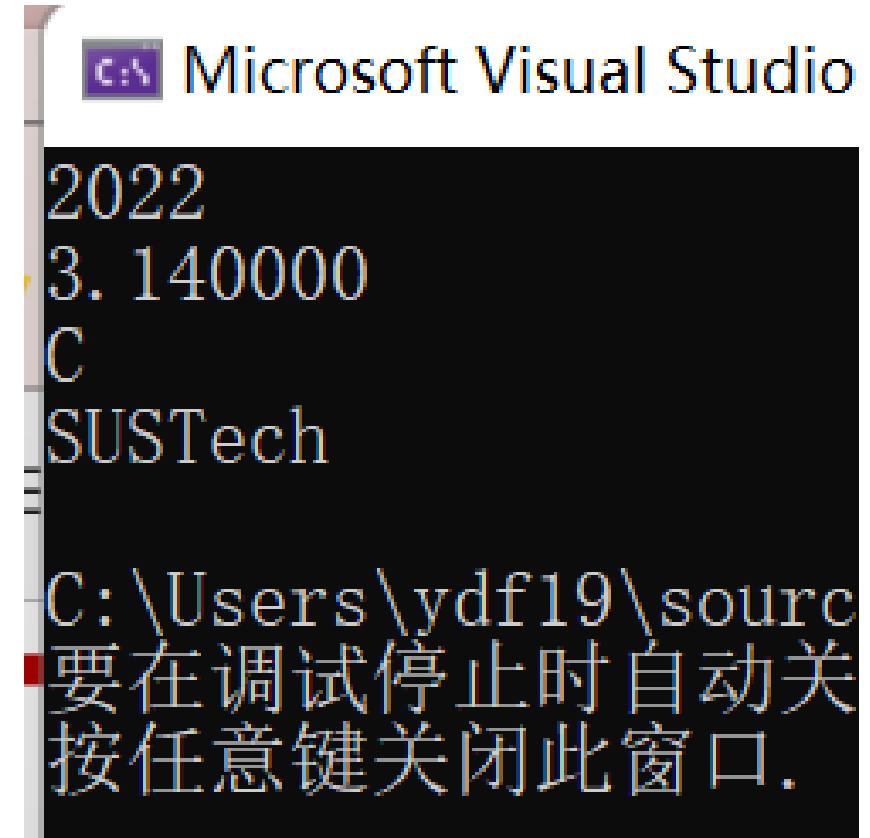
More examples: print numbers, chars, strings

```
#include <stdio.h>

void main()
{
printf("%d\n", 2022);
printf("%f\n", 3.14);
printf("%c\n", 'C');
printf("%s\n", "SUSTech");
}
```

Specifier:

- **%d** – decimal integer
- **%f** – floating point
- **%c** – a single character
- **%s** – a string



More examples: print equations

```
#include<stdio.h>

int main()
{
printf("%d + %d = %d\n",1,1,1 + 1);
printf("%f + %f = %f\n",3.14,3.14,3.14 + 3.14);

return 0;
}
```

Microsoft Visual Studio 调试控制台

```
1 + 1 = 2
3.140000 + 3.140000 = 6.280000
C:\Users\udf10\source\repos\Hello
```

Content

1. What is programming?
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Summary

- Machine and machine intelligence are everywhere. The way to control machine is by **programming**.
- **C + AI (or domain knowledge)** makes you different.
- Programming language allows communication between human and machine. **A good language should be friendly to users while still efficient to machines**, like C.
- C is a high-level language that is **popular and ubiquitous in industry**, especially for edge devices.
- Good ways to learn C is **practicing with projects**, understand the essence instead of memorizing.
- A first “HelloWorld” example was shown, time to write **your first C program**.

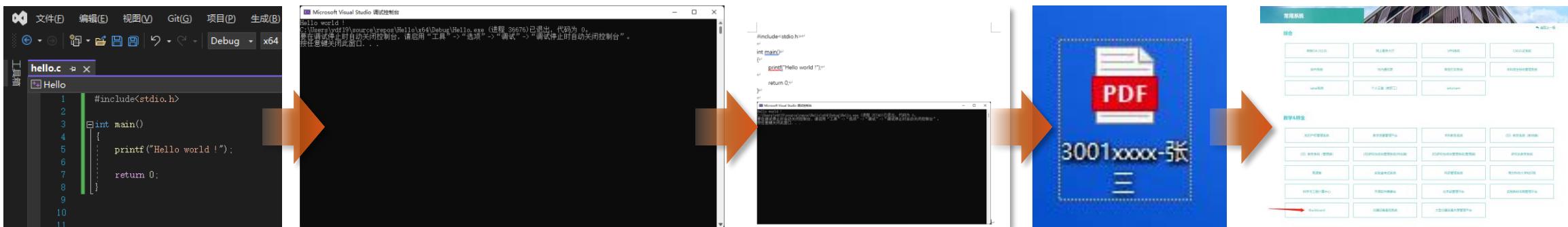
Homework

- (1) Print hello world!
- (2) Print your name and student number with two “printf”
- (3) Print your name and student number with only one “printf”
- (4) Print an equation adding two integer numbers
- (5) Print an equation multiplying two float numbers
- (6) Briefly describe how a C program is executed (in 200 words, bonus)

How to submit homework?

1. Type your code in Visual Studio C++
2. Run your code and screenshot the result
3. Create a word file named by student number + name (in Chinese!)
4. Paste the code and screenshot in the word file
5. Convert into PDF and submit to “Black board”

https://bb.sustech.edu.cn/webapps/portal/execute/tabs/tabAction?tab_tab_group_id=1_1



Instructions for installing Visual Studio

Windows and MacOS

Install Visual Studio 2022 for Windows

Windows下载地址：

<https://visualstudio.microsoft.com/zh-hans/thank-you-downloading-visual-studio/?sku=Community&channel=Release&version=VS2022&source=VSLandingPage&cid=2030&passive=false>

The screenshot shows the Microsoft Visual Studio download page. At the top, there is a navigation bar with links to various Microsoft services like Sci-Hub, Google Scholar, and CSDN. Below the navigation bar, the Microsoft logo and "Visual Studio" are displayed. A red box highlights the "打开网页后会自动下载" (Open the page and it will start downloading automatically) button. To the right, a download progress bar shows "VisualStudioSetup (3).exe" at 0 B/s - 2.0 MB/2.0 MB, with a red border around the entire progress bar area. A dropdown menu is open next to the progress bar, listing several previous download entries for "VisualStudioSetup (2).exe", all of which are marked as "已删除" (Deleted). A "查看更多" (View more) link is also visible in the dropdown. On the left side of the main content area, there is a sidebar with links to "安装 Visual Studio", "入门", "个性化", "启动教程", ".NET", and "C++". The main content area features large text "感谢您下载 Visual Studio" and "安装 Visual Studio IDE 入门". The bottom section contains a paragraph about getting started with Visual Studio.

打开网页后会自动下载

所

VisualStudioSetup (3).exe
0 B/s - 2.0 MB/2.0 MB

VisualStudioSetup (2).exe
打开文件

VisualStudioSetup (2).exe
已删除

VisualStudioSetup (3).exe
已删除

VisualStudioSetup (2).exe
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VisualStudioSetup (2).exe
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查看更多

感谢您下载 Visual Studio

安装 Visual Studio

入门

个性化

启动教程

.NET

C++

不熟悉 Visual Studio? 学习新的开发工具可能非常困难。按照自己的节奏进行此分步学习之旅，以使用你选择的编程语言成功创建简单的应用。让我们开始吧!

安装 Visual Studio

首先，请确保打开 Visual Studio 下载并安装。可以通过 [仅选择所需的组件](#) 来节省安装时间和磁盘空间。你始终可以根据需要随时以增量方式添加更多组件。

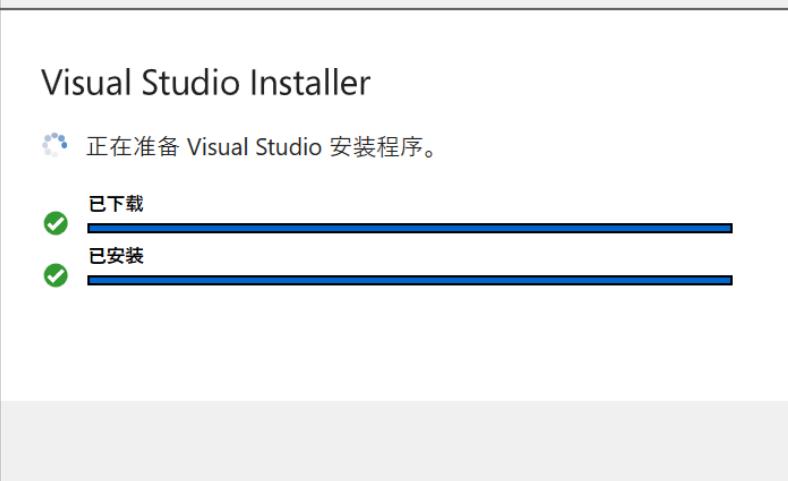
Visual Studio IDE 入门

若要开发任何类型的应用或学习某种语言，你将在 Visual Studio 集成开发环境(IDE)中工作。除了代码编辑，Visual Studio IDE 还将图形设计器、编译器、代码完成工具、源代码管理、扩展以及更多功能集中在一个位置。观看此视频以熟悉 IDE 并了解如何使用它完成基本任务。

Install Visual Studio 2022 for Windows



打开刚才下载的文件



Install Visual Studio 2022 for Windows

正在安装 - Visual Studio Community 2022 - 17.3.2

工作负载 单个组件 语言包 安装位置

1.勾选 使用C++的桌面开发

2.右边默认即可

3.设置路径，可以默认 路径不要有中文

4.点击安装 要求的总空间 6.35 GB

Visual Studio Installer

正在安装 - Visual Studio Community 2022 - 17.3.2

工作负载 单个组件 语言包 安装位置

使用 ASP.NET Core、ASP.NET、HTML/JavaScript 和包括 Docker 支持的容器生成 Web 应用程序。

用于使用 .NET 和 .NET Framework 开发云应用和创建资源的 Azure SDK、工具和项目。还包含用于实现应用程序容...

Python 开发 对 Python 进行编辑、调试、交互式开发和源代码管理。

Node.js 开发 使用 Node.js (一个由异步事件驱动的 JavaScript 运行时)生成可缩放的网络应用程序。

桌面应用和移动应用 (5)

.NET Multi-platform App UI 开发 使用 C# 和 .NET MAUI 从单个基本代码库生成 Android、iOS、Windows 和 Mac 应用。

.NET 桌面开发 将 C#、Visual Basic 和 F# 与 .NET 和 .NET Framework 一起使用，生成 WPF、Windows 窗体和控制台应用程序。

使用 C++ 的桌面开发 使用所选工具(包括 MSVC、Clang、CMake 或 MSBuild)生成适用于 Windows 的现代 C++ 应用。

通用 Windows 平台开发 使用 C#、VB、或 C++ (可选)为通用 Windows 平台创建应用程序。

安装详细信息

使用 C++ 的桌面开发

已包含

- C++ 核心桌面功能

可选

- MSVC v143 - VS 2022 C++ x64/x86 生成工...
- 适用于最新 v143 生成工具的 C++ ATL (x86...)
- Windows 10 SDK (10.0.19041.0)
- 实时调试器
- C++ 分析工具
- 用于 Windows 的 C++ CMake 工具
- Boost.Test 测试适配器
- Google Test 测试适配器
- Live Share
- IntelliCode
- C++ AddressSanitizer
- 适用于最新 v143 生成工具的 C++ MFC (x8...
- Windows 应用 SDK C++ 模板
- Windows 11 SDK (10.0.22621.0)

位置 C:\Program Files\Microsoft Visual Studio\2022\Community 更改...

继续操作即表示你同意所选 Visual Studio 版本的[许可证](#)。我们还提供通过 Visual Studio 下载其他软件的功能。此软件单独进行许可，如[第三方公告](#)或其随附的许可证中所述。继续即表示你同意这些许可证。

下载时安装 安装(I)

Install Visual Studio 2022 for Windows

Visual Studio Installer

已安装 可用

所有安装都是最新的。

 Visual Studio Community 2022
正在下载并验证: 555 MB/1.69 GB (17 MB/秒)
31%
正在安装包: 20/428
3%
Microsoft.Net.6.WindowsDesktop.Runtime
 安装后启动
[发行说明](#)

 Visual Studio Community 2019
16.11.18
功能强大的 IDE, 供学生、开放源代码参与者和个人免费使用
[发行说明](#)

暂停(P)

等待一会儿

修改(M)
启动(L)
更多 ▾

开发人员新闻

[Live Share: Enterprise Policies are here!](#)
Securing your Visual Studio Live Share session ha...
2022年8月17日

[What's New in Visual Studio 2022 17.4 Preview 1](#)
We released Visual Studio 2022 17.4 Preview 1 las...
2022年8月16日

[Git Line-staging Released!](#)
We are excited to announce the release of Line-st...
2022年8月15日

[查看更多 Microsoft 开发者新闻...](#)

需要帮助? 请查看 [Microsoft 开发人员社区](#) 或通过 [Visual Studio 支持](#) 联系我们。

安装程序版本 3.3.2181.41457

Install Visual Studio 2022 for Windows



X

登录

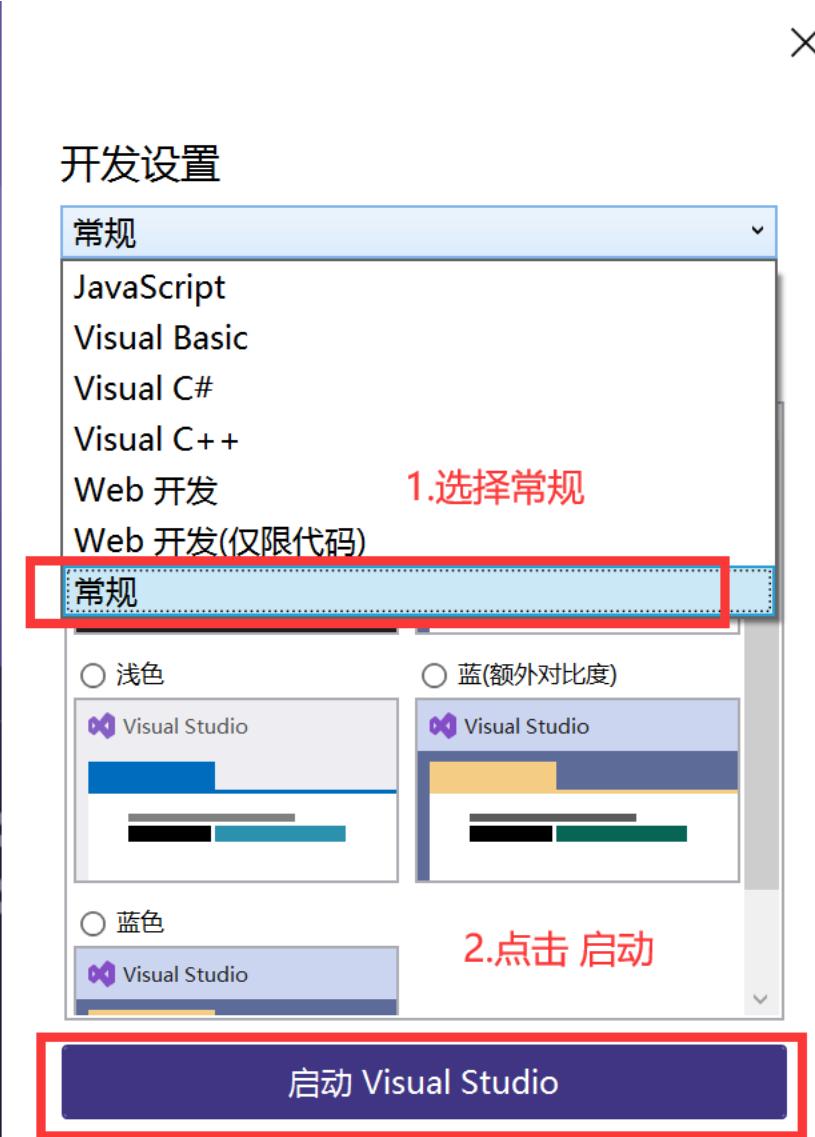
创建帐户

暂时跳过此项。

点击 暂时跳过此项

A screenshot of a login dialog box. It features three buttons: a solid purple "登录" (Log In) button, a white "创建帐户" (Create Account) button with a purple border, and a white "暂时跳过此项。" (Skip This Step) button with a red border. The "Skip This Step" button is highlighted with a red rectangle. To the right of the "Skip This Step" button, there is red text that says "点击 暂时跳过此项" (Click to skip this step).

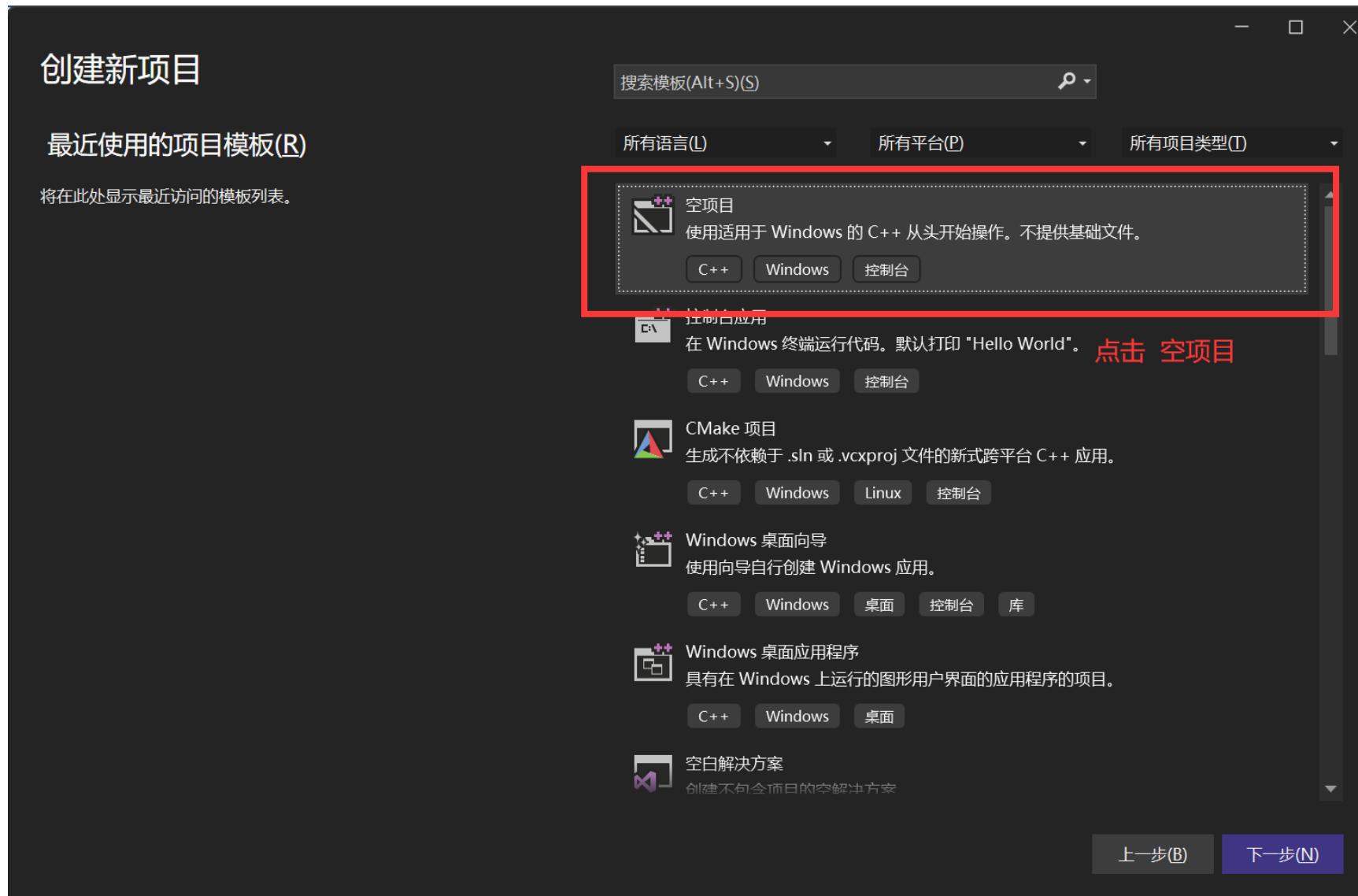
Install Visual Studio 2022 for Windows



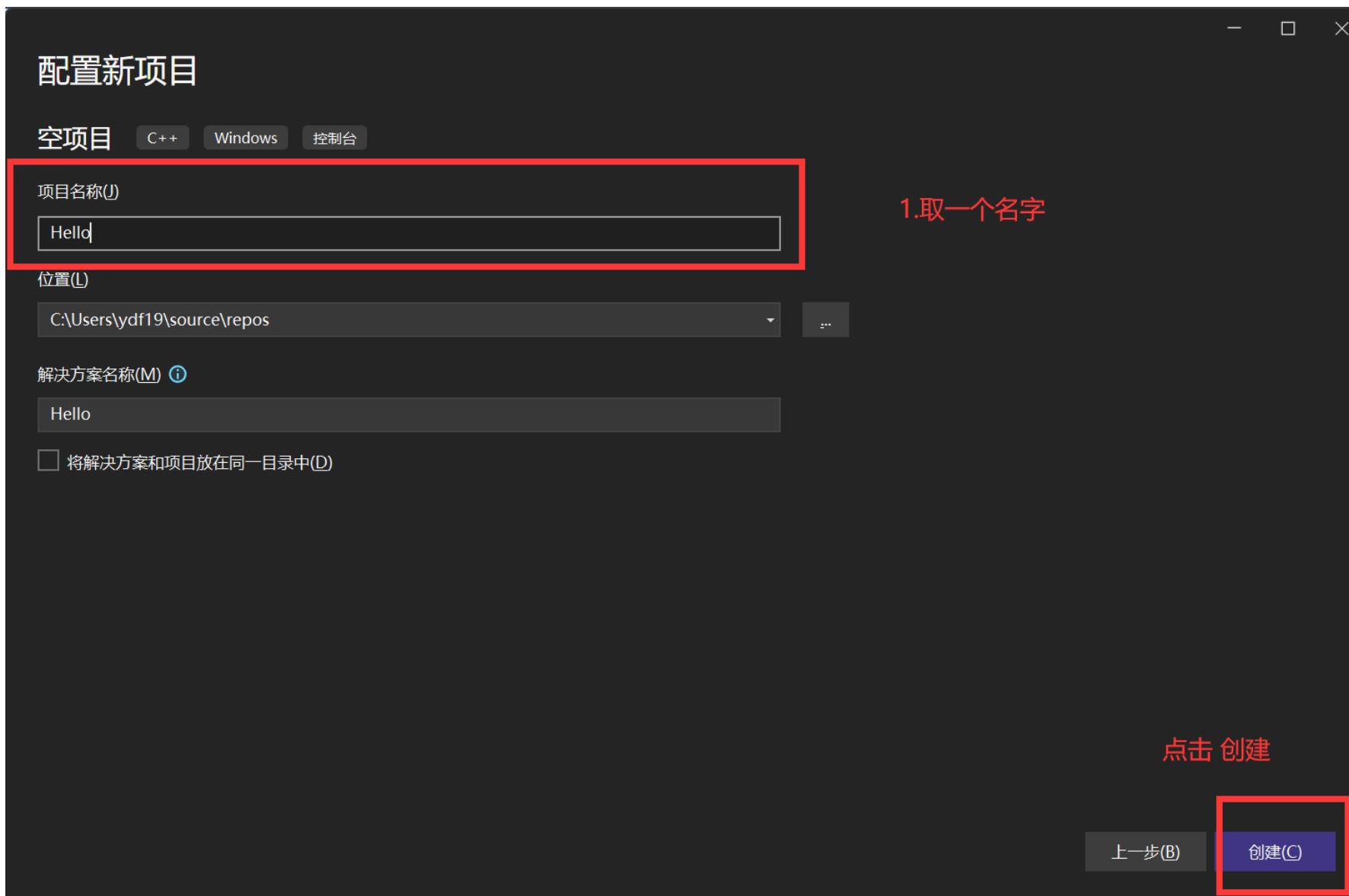
Install Visual Studio 2022 for Windows



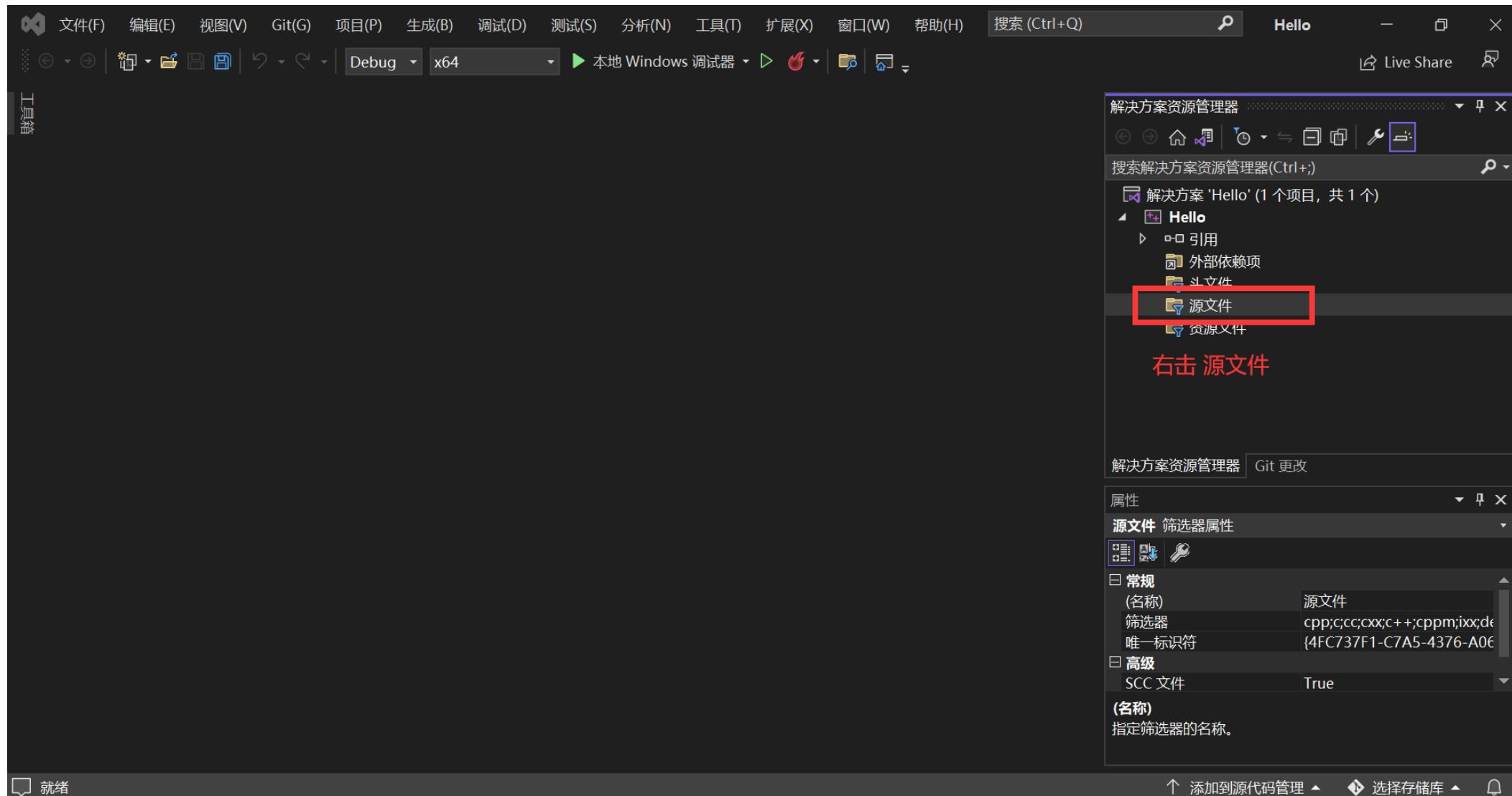
Install Visual Studio 2022 for Windows



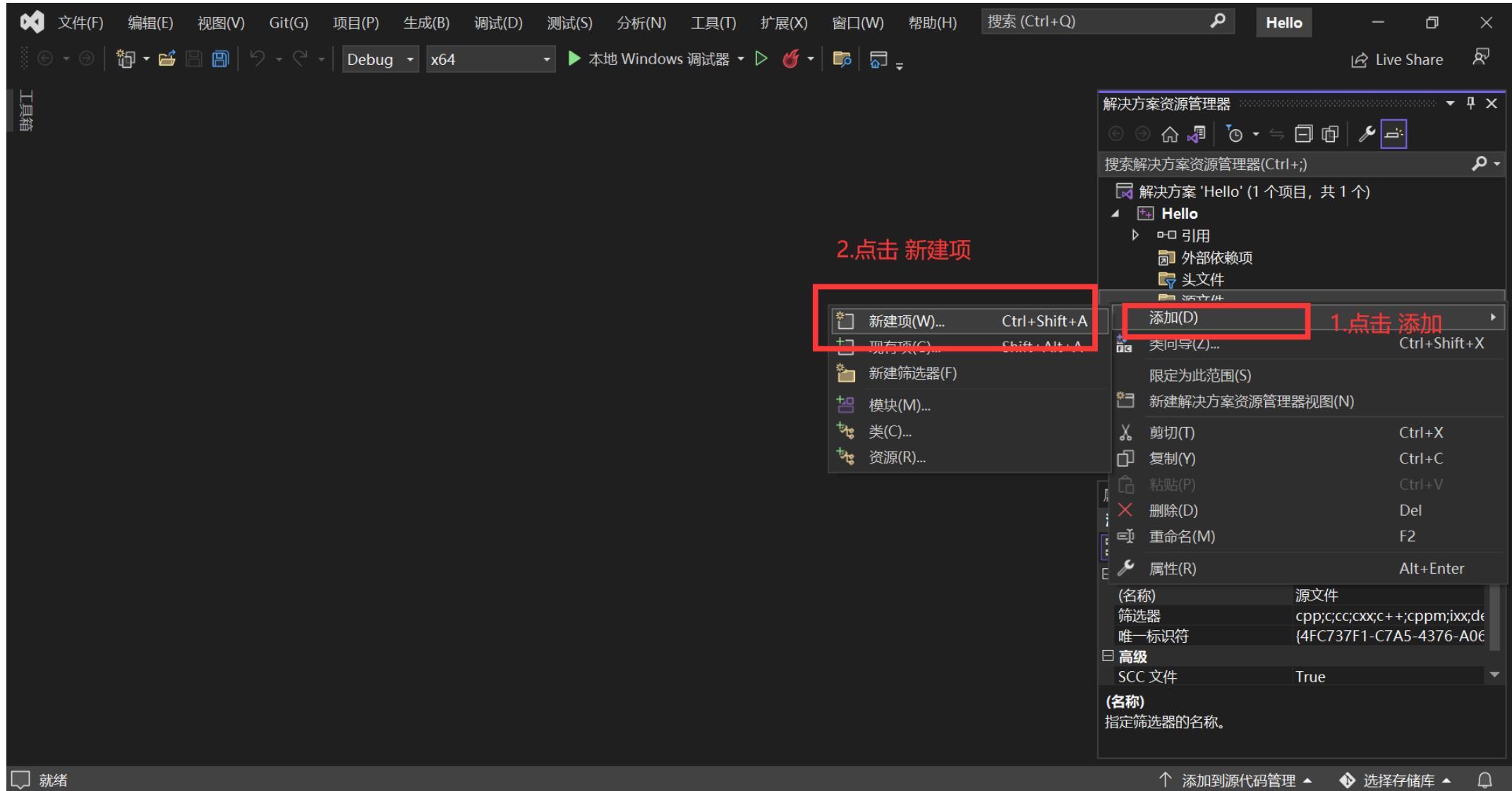
Install Visual Studio 2022 for Windows



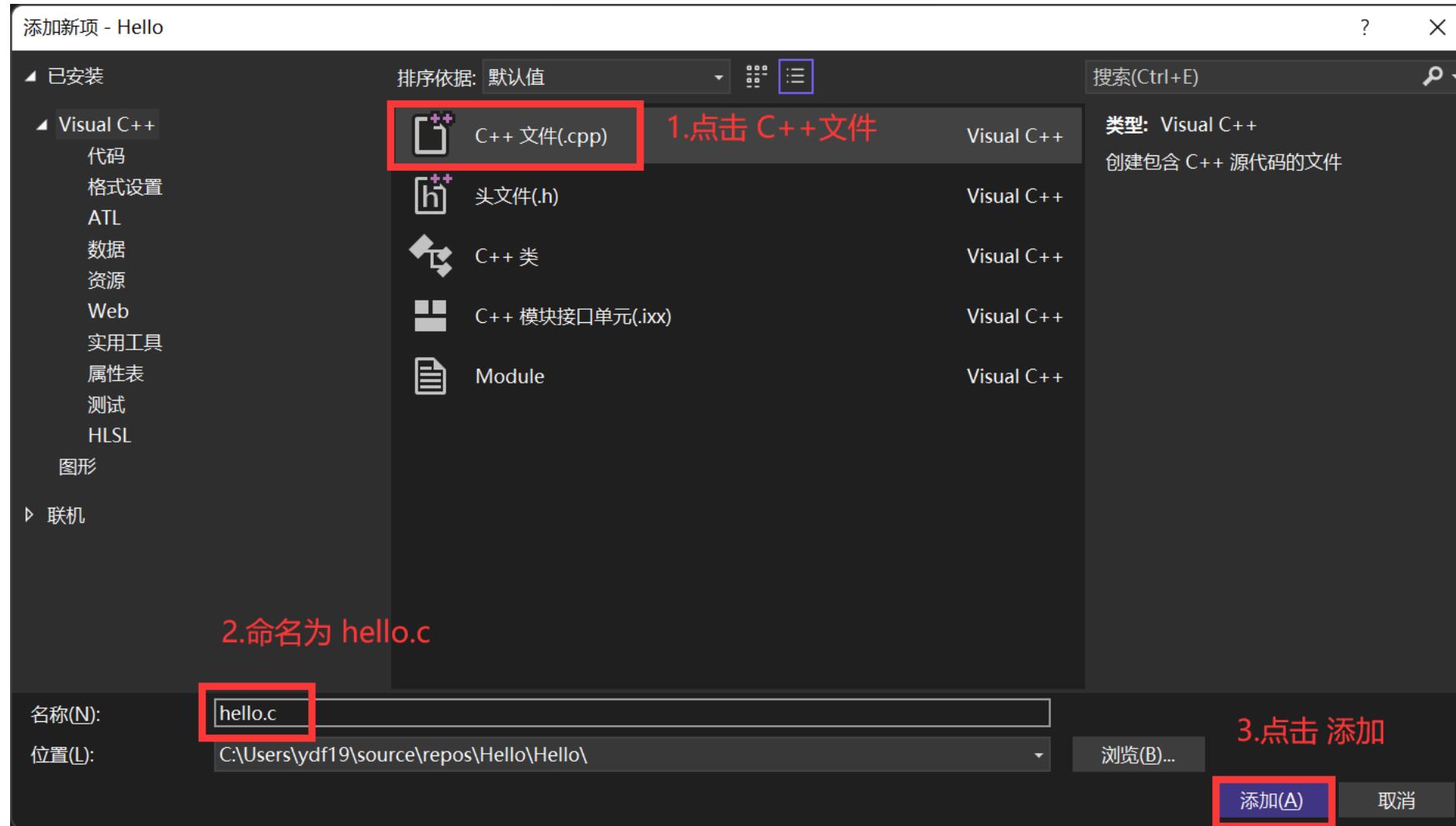
Install Visual Studio 2022 for Windows



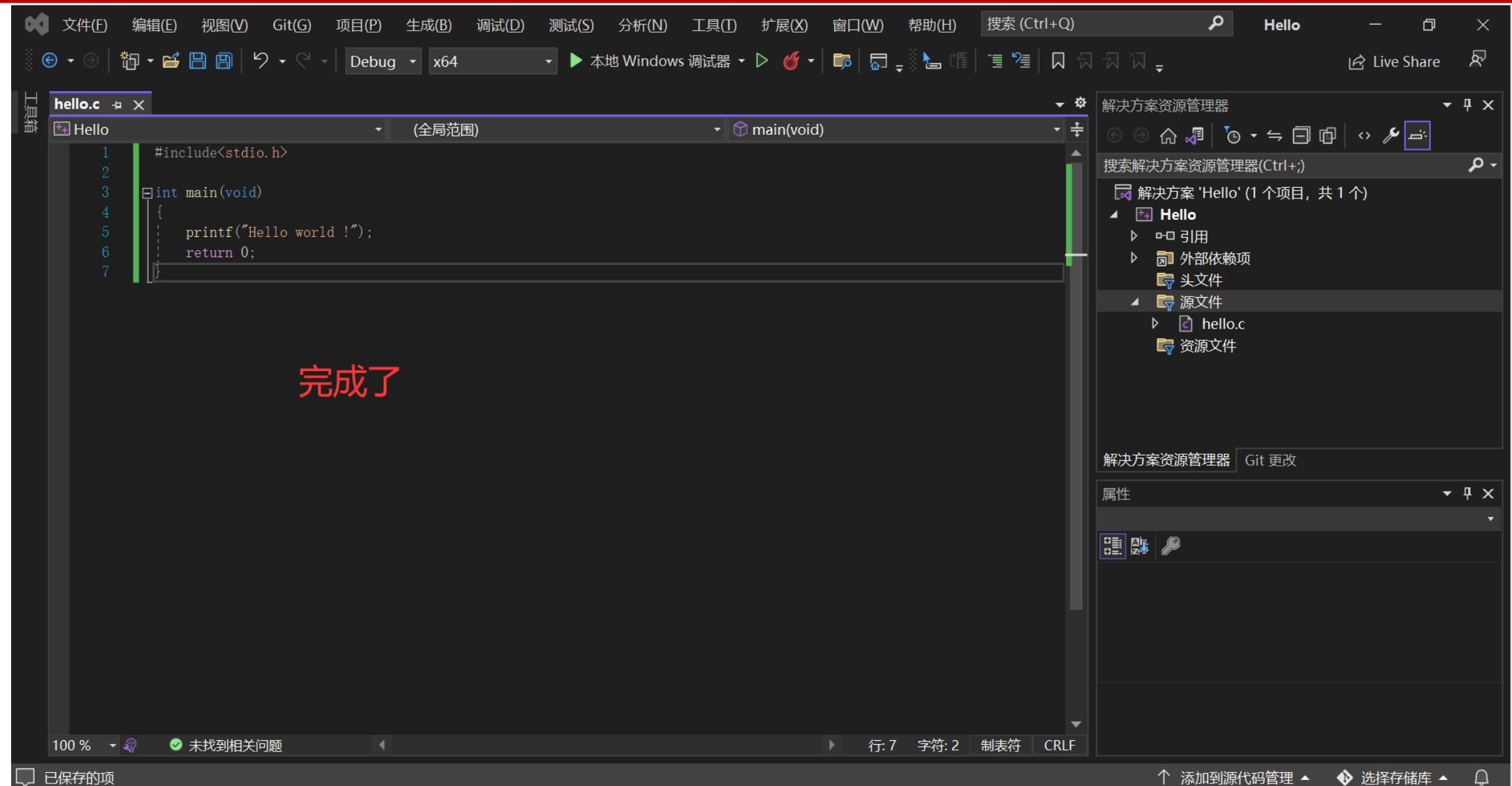
Install Visual Studio 2022 for Windows



Install Visual Studio 2022 for Windows

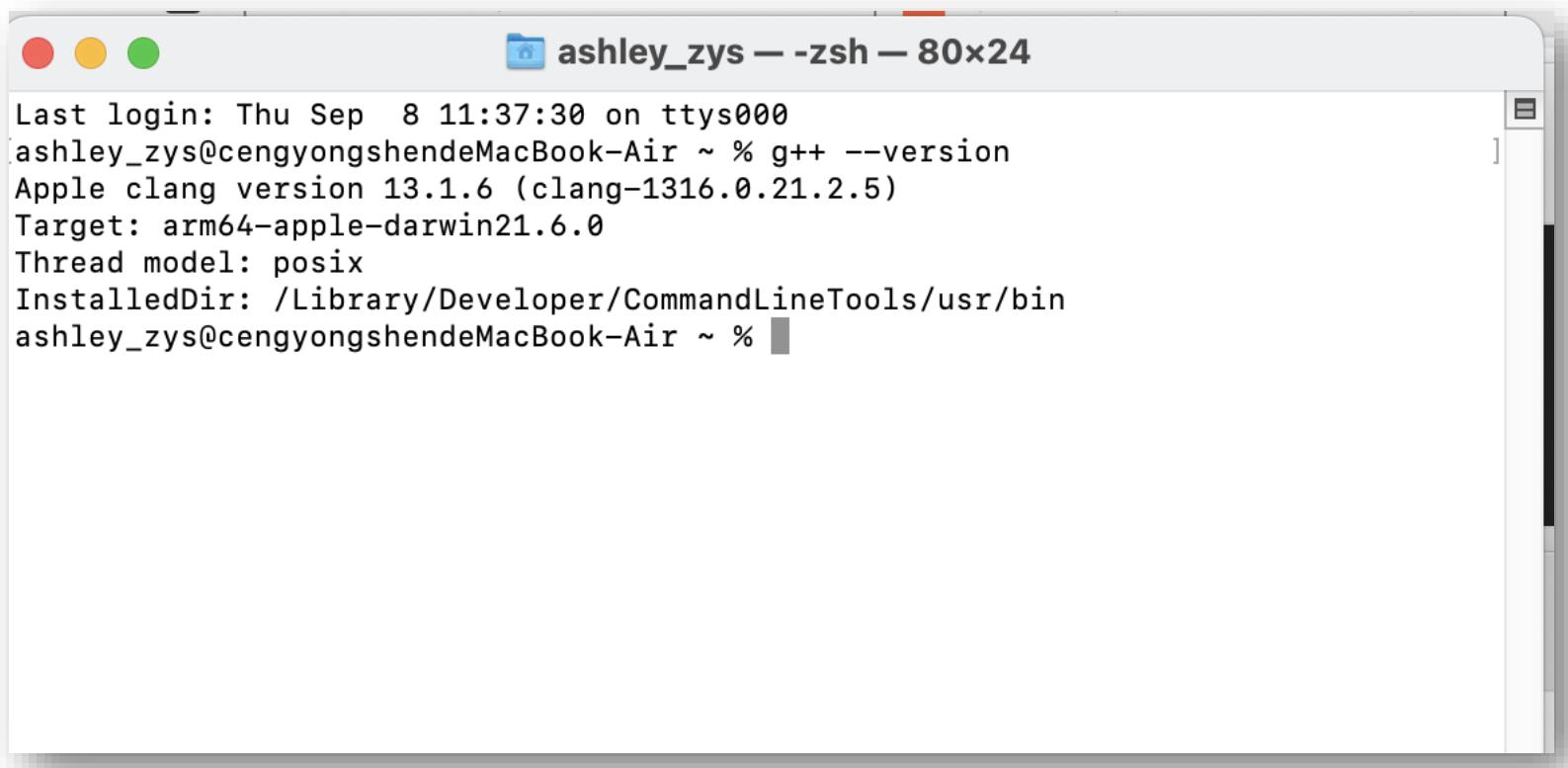


Install Visual Studio 2022 for Windows



Install Visual Studio 2022 for MacOS

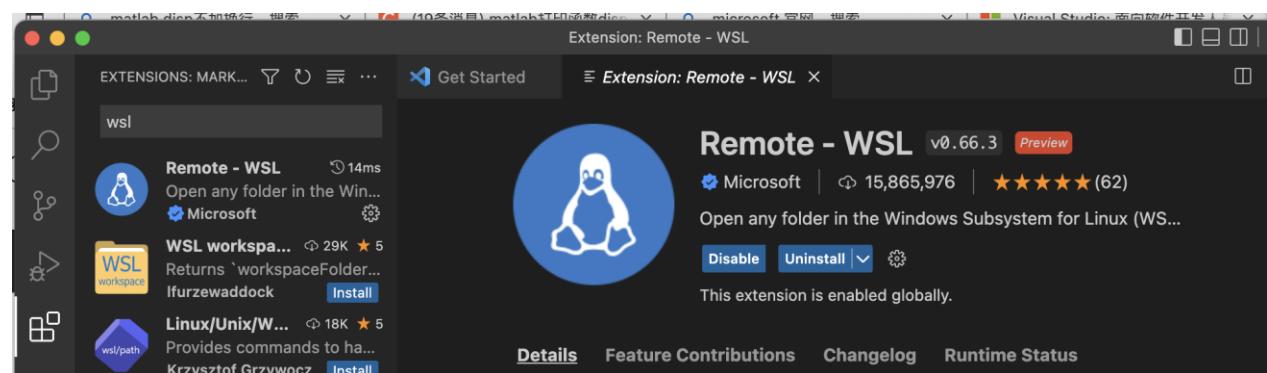
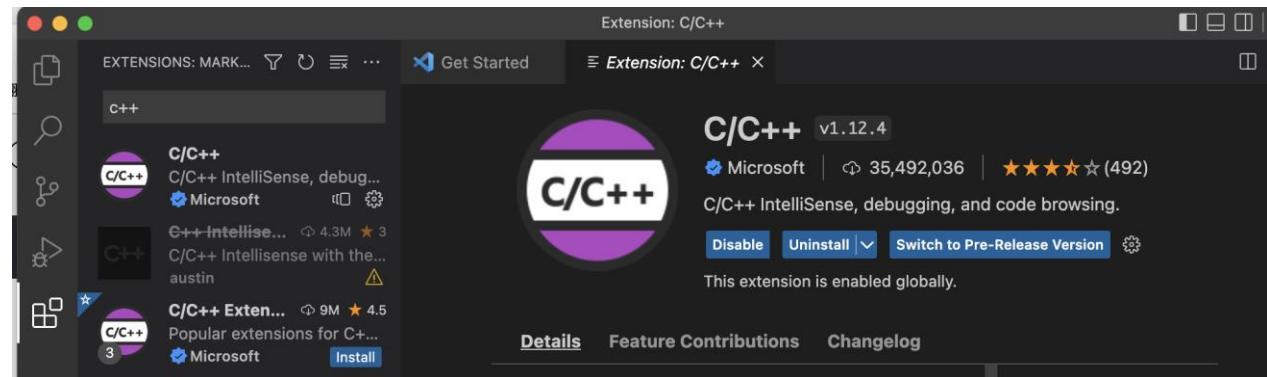
- Open the Terminal on your Mac
- Input `g++` to check whether the CLT or GCC is installed
- If not, the system will guide you to install CLT
- Input `g++ --version` to check whether the installation is successful



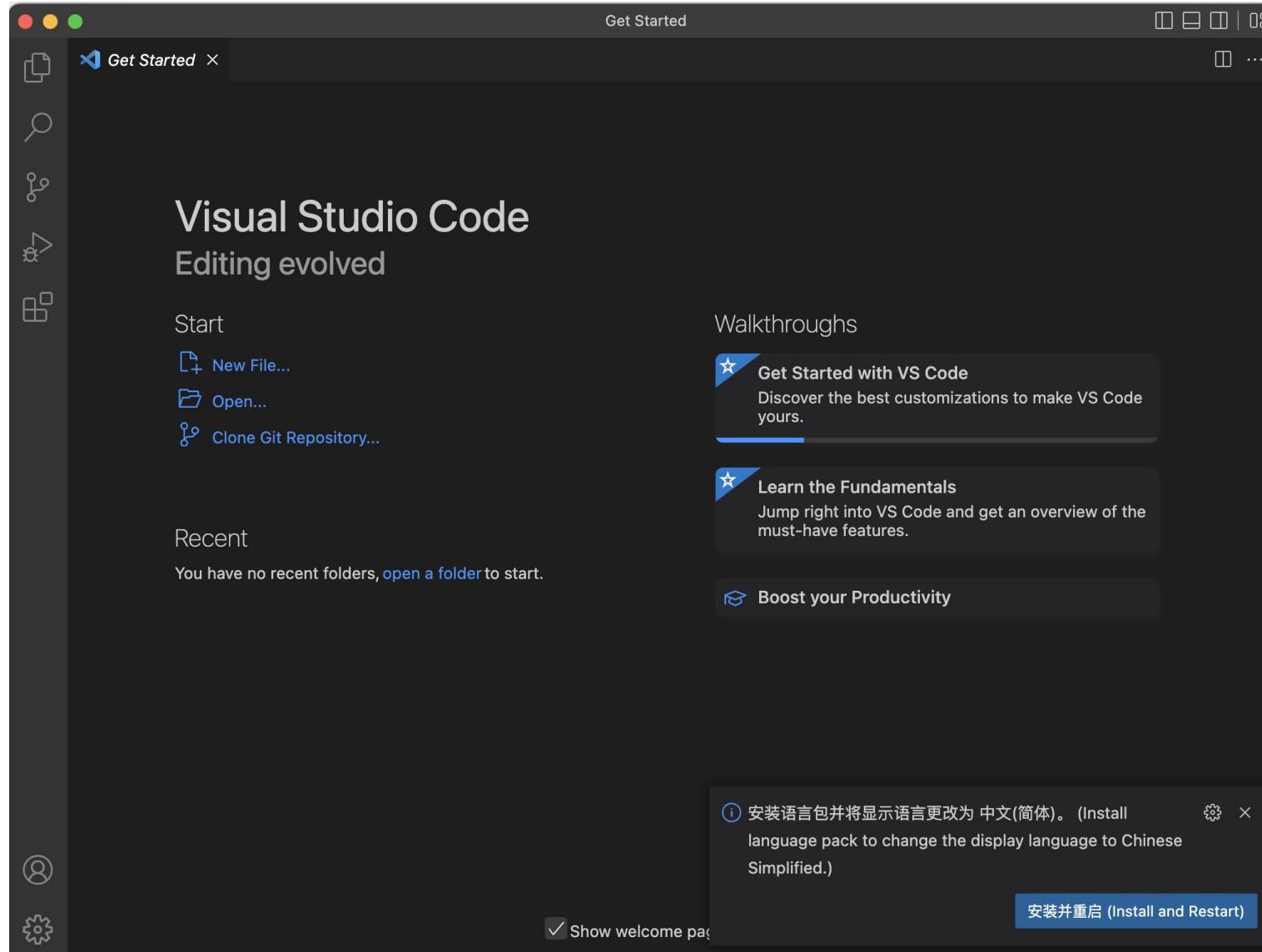
```
Last login: Thu Sep  8 11:37:30 on ttys000
ashley_zys@cengyongshendeMacBook-Air ~ % g++ --version
Apple clang version 13.1.6 (clang-1316.0.21.2.5)
Target: arm64-apple-darwin21.6.0
Thread model: posix
InstalledDir: /Library/Developer/CommandLineTools/usr/bin
ashley_zys@cengyongshendeMacBook-Air ~ %
```

Install Visual Studio 2022 for MacOS

- Install visual studio code on: <https://code.visualstudio.com/docs/?dv=osx>
- After you install VSCode, you need to install two plugins at least to support our development:
 1. C/C++ plugin
 2. Remote - WSL plugin

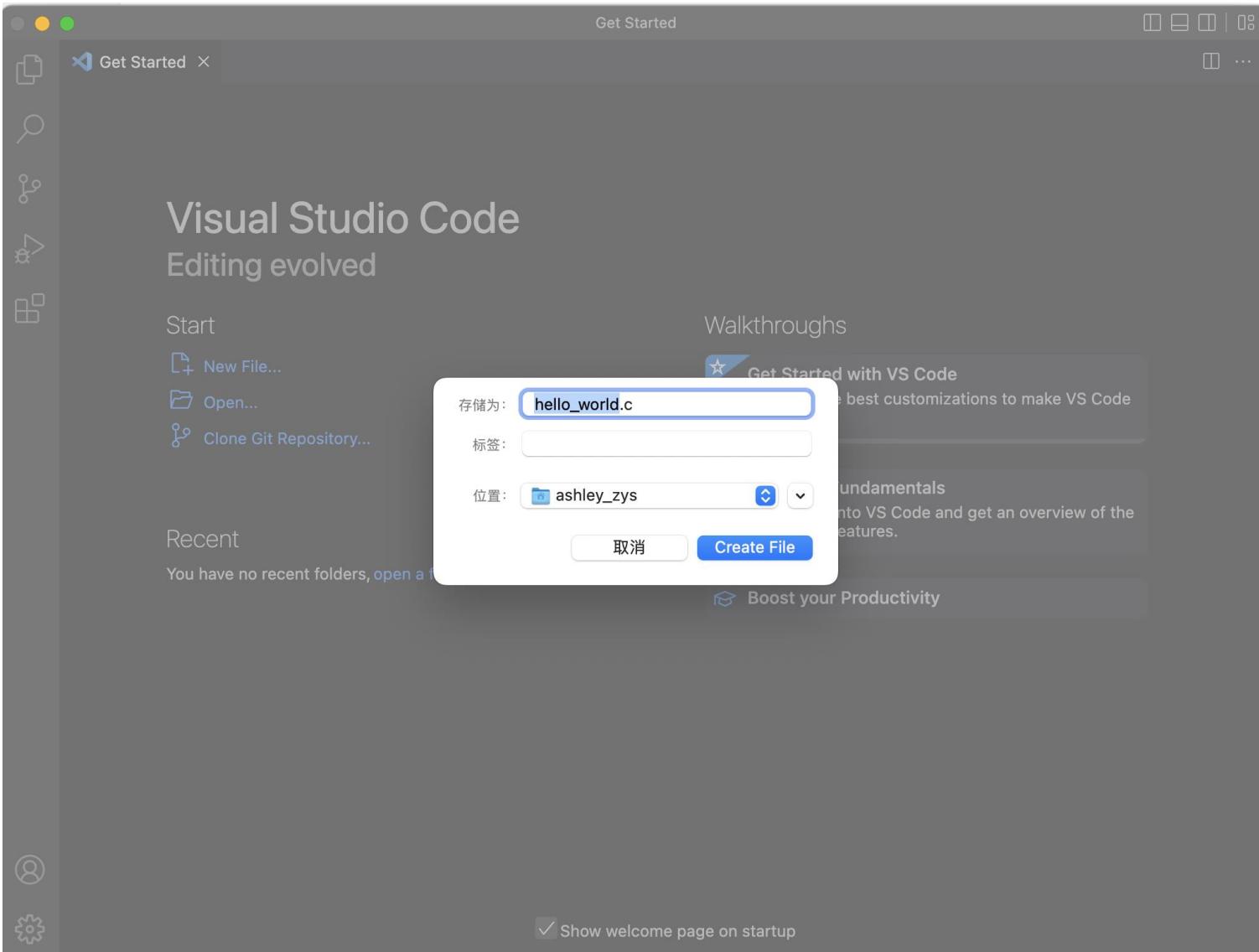


Install Visual Studio 2022 for MacOS



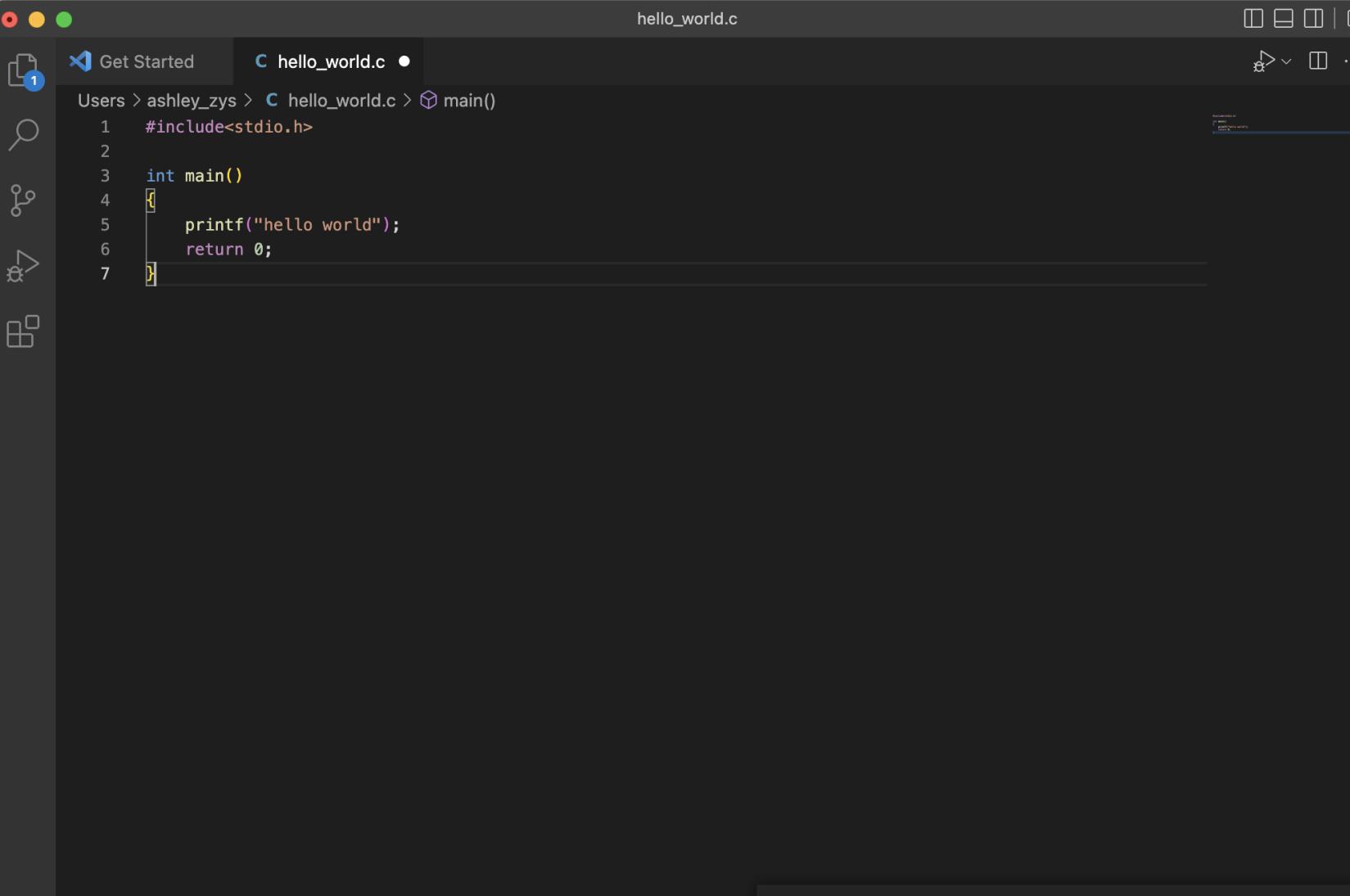
Create a new file named:
`hello_world.c`

Install Visual Studio 2022 for MacOS



Create a new file named:
hello_world.c

Install Visual Studio 2022 for MacOS

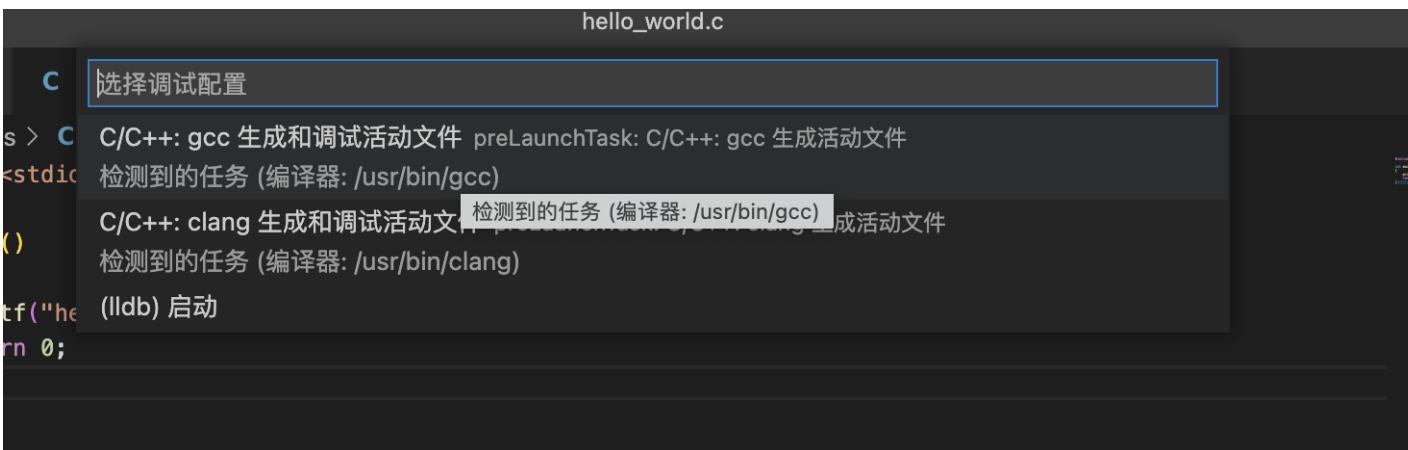
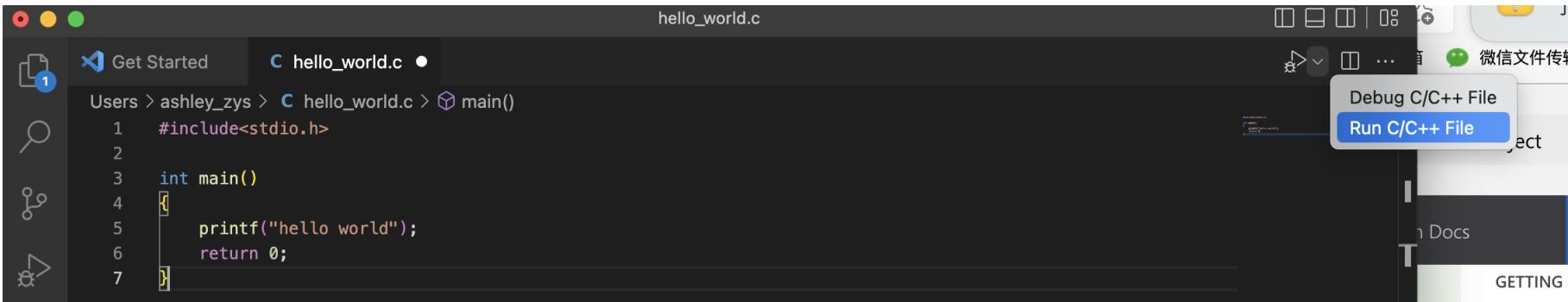


A screenshot of the Visual Studio 2022 for Mac interface. The window title is "hello_world.c". The code editor shows the following C code:

```
1 #include<stdio.h>
2
3 int main()
4 {
5     printf("hello world");
6     return 0;
7 }
```

Type your code

Install Visual Studio 2022 for MacOS



Run your code

