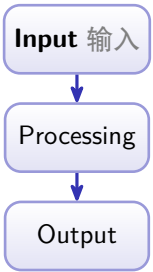
Creative Development

AP Computer Science Principles ▪ Unit 1

AP Computer Science Principles

What we will cover

1. Collaboration
2. Program function & purpose
3. Design & development
4. Finding & fixing errors



Software is a team sport

A large **program** 程序 is designed, written, tested & fixed by a team. **Collaboration** 协作 means working together toward a shared goal.

Driver 驾驶员
types the code

Naviga
watches,
catche

Pair programming 结对编程: two people, one computer, swapping roles. Teams merge work with **version control** 版本控制 and explain it with **documentation** 文档.

Software is designed, written, and tested by people

Purpose, function & the IPO model

Purpose 目的 = **why** a program exists; **function** 功能 = **what** it does.

Every program fits **input** → **processing** → **output** (the IPO model).

Many are **event-driven** 事件驱动: they wait and react to **events** 事件 (a click) via an **event handler** 事件处理程序.

The iterative development cycle

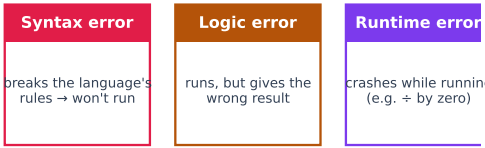
The process is **iterative** 迭代的, not a straight line: investigate, design, implement, test – then repeat.

> Development is incremental: build and test a small piece, then add the next.

Development is iterative and collaborative

Break a large problem into pieces (**decomposition** 分解); plan with a **program requirement** 需求 and **pseudocode** 伪代码; keep it readable with a **comment** 注释.

Four kinds of error



Syntax error 语法错误 – breaks the language rules; won't run

Logic error 逻辑错误 – runs, but wrong answer

Runtime error 运行时错误 – crashes mid-run (divide by zero)

Overflow error 溢出错误 – value too large for its storage

Finding & fixing bugs

A **bug** 缺陷 is a mistake; **debugging** 调试 is finding & fixing it.

test many inputs, incl. **edge cases** 边界情况

compare with the **expected output** 预期输出

divide & check; re-test after each fix

A logic error runs with no crash – "it ran" is not "it's correct". Only comparing output to what you expected catches it.

Hand-tracing with a trace table

A **trace table** 追踪表 records each variable's value as the program runs – line by line, by hand.

> It is how you find a logic error that no crash will ever reveal.

count	total	output
1	5	
2	12	
3	20	20

each variable, at each step

Worked example – a logic error hiding in plain sight

A program should print the average of two numbers, but runs `avg = a + b / 2`

Order of operations: `/` runs before `+`, so it computes $a + \frac{b}{2}$ – not the average. Test with $a = 4,\ b = 6$: the bug gives $4 + 3 = 7$; the fix `avg = (a + b) / 2` gives $\frac{10}{2} = 5$.

Testing with known inputs is exactly how you find and confirm a logic error – the program never crashed.

Key points

Collaboration + version control build better software

Every program is **input** → **processing** → **output**

Development is **iterative**: plan, prototype, test, refine

Syntax, logic, run-time & overflow **errors**

Check yourself

1. `avg = a + b / 2` runs and prints a number. Which error is it?
2. Which error stops the program from running at all?
3. Name the three parts of the IPO model.
4. What does the navigator do in pair programming?

Answers **1.** a logic error **2.** a syntax error **3.** input, processing, output **4.** watches, thinks ahead, catches mistakes