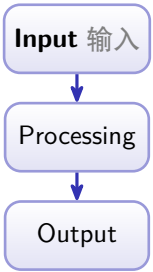
Creative Development

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



1 Collaboration

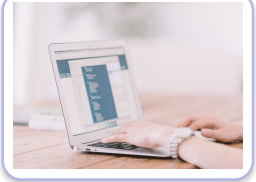
Software is a team sport

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

Navigator 导航员
watches, thinks ahead, catches mistakes

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.



Designed, written and tested by people

Purpose, the IPO model, and why comments matter

every program has a purpose	it solves a problem or pursues an interest – the Create task asks you to state yours
input 输入	what the program takes in – typed, clicked, sensed, or read from a file
processing	what it does with that input
output 输出	what it produces – printed, drawn, stored or sent
comments 注释	ignored by the machine, written for people: they record purpose, assumptions and anything non-obvious

Collaboration 协作 brings more perspectives and catches more errors, which is why the exam treats it as a skill, not a courtesy.

2 Function & purpose

Purpose, function & the IPO model

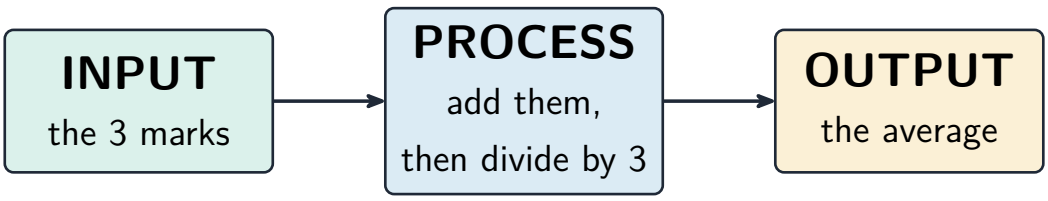
Purpose 目的 = **why** a program exists; **function** 功能 = **what** it does.

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.

computing system model: Input → Process → Output (IPO)

Every program decomposes into input



Every program decomposes into input, processing, and output

3 Design & development

The iterative development cycle

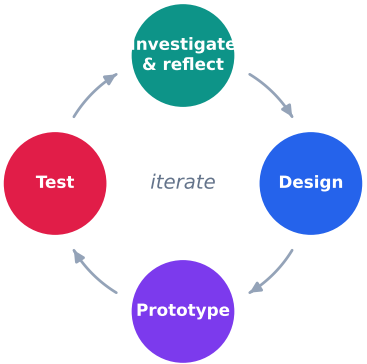
The process is **iterative** 迭代的, not a straight line: investigate, design, implement, test – then repeat.

> 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.

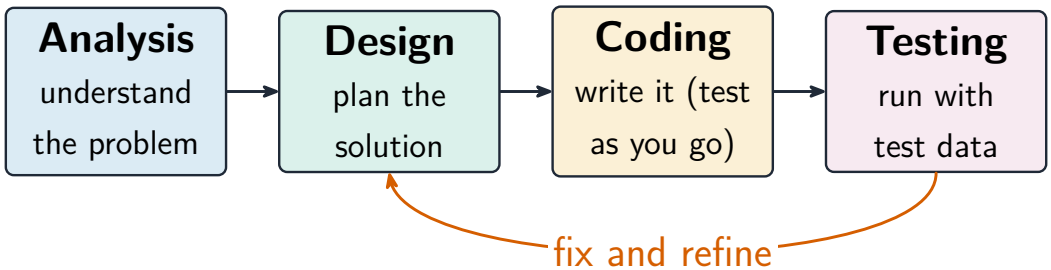
Iterative, incremental development



iterative + incremental: refine after testing; ship working pieces early

> Software is built by an iterative, incremental development process

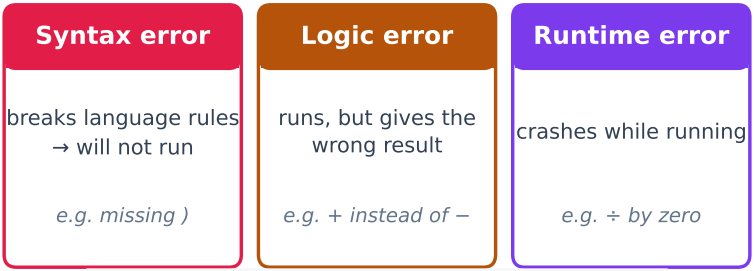
The program development cycle



The stages of program development, with testing feeding back to fix and refine

4 Errors

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

Name the error, then name the test that catches it

syntax error 语法错误	breaks the language's rules – caught by the compiler or interpreter before it runs
run-time error 运行时错误	crashes during execution – dividing by zero, indexing past the end
logic error 逻辑错误	runs and gives the wrong answer – the hardest, because nothing complains
overflow error 溢出错误	a value too large for the bits available
how to catch each	read the message for the first two; hand-trace or test with known values for a logic error

This pairing – error type plus a testing strategy that would find it – is a recurring multiple-choice and Create-task theme.

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**

Exam tips

- Much of CSP is assessed through the **Create** and written performance tasks – explain your reasoning clearly, not just your result.
- Know the benefits of collaboration and how diverse perspectives reduce bias in a program.
- Use precise vocabulary (iterative development, program requirements) when you describe a design process.
- Give and take feedback constructively; credit collaborators and sources.
- Break a large problem into smaller modules that a team can build in parallel.

5 Recap

Unit 1 – key takeaways

1 Create task

explain reasoning, not just the result

2 Collaboration

diverse perspectives reduce bias

3 Vocabulary

iterative development, program requirements

4 Modules

break a large problem so a team can build in parallel

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