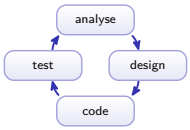
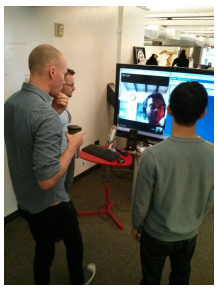
Software Development

AS Computer Science ▪ Topic 12

A-Level Computer Science

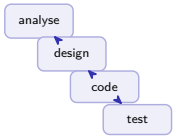


What we will cover

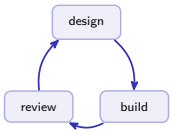


1 Life cycle

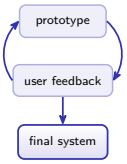
Development life-cycle models



waterfall: linear



iterative: repeated passes



RAD: quick prototypes

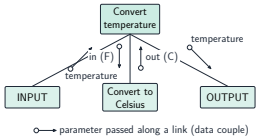
Waterfall 瀑布模型: stable needs. **Iterative** 迭代模型/**RAD** 快速应用开发/**Agile** 敏捷: needs discovered or changing.

The standard stages

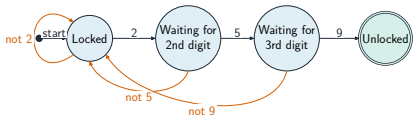
> analysis = what; design = how; then code, test and maintain.

2 Design tools

Design tools



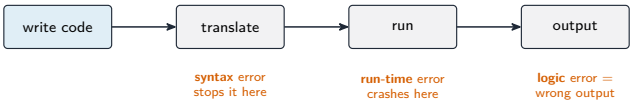
A **structure chart** 结构图 splits the system into modules and shows the parameters passed between them.



3 Errors and testing

Three kinds of error

- **syntax** 语法错误 – caught at translation
- **run-time** 运行时错误 – crashes mid-run
- **logic** 逻辑错误 – runs, but wrong output



syntax error stops it here

run-time error crashes here

logic error = wrong output

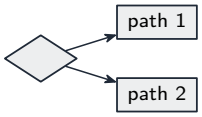
Testing methods

- **black-box** 黑盒测试 – from the spec
- **white-box** 白盒测试 – every code path
- **alpha** α 测试 (in-house), **beta** β 测试 (real users), **acceptance** 验收测试 (customer)

black-box

test from the spec

white-box



test every path in the code

Test strategy vs test plan

test strategy 测试策略

the high-level approach: which kinds of testing, who runs them, and when

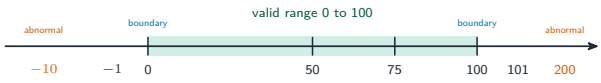
test plan 测试计划

the detailed list of tests: input data, expected output, actual output

The plan's "expected vs actual" columns are exactly how logic errors get caught.

Choosing test data

Four kinds of test data for a 0–100 field:



normal (50, 75) inside; extremes (0, 100) the accepted edges; abnormal (-1, 101, -10, 200) rejected

normal 正常数据
50, 75
well inside

extreme 极端数据
0, 100
edges, still accepted

abnormal 异常数据
-10, 200
must be rejected

boundary 边界数据
0/-1, 100/101
both sides of the line

Worked example: catch the logic error

"Award a pass for marks of 50 or above":

```
INPUT Mark
IF Mark > 50 THEN
  OUTPUT "Pass"
ELSE
  OUTPUT "Fail"
ENDIF
```

the bug: > should be >=

Mark	expected	actual	
75	Pass	Pass	✓
30	Fail	Fail	✓
50	Pass	**Fail**	**X**

Only the boundary value 50 exposes it – the normal values both pass.

> A logic error runs without crashing – compare expected vs actual output, and always test the exact boundary.

4 Maintenance

Maintenance and amending code

- **perfective** 完善性维护 – improve
- **adaptive** 适应性维护 – new environment
- **corrective** 纠正性维护 – fix bugs

Amending a program: read it, make the smallest change, update callers, then

> **regression test** 回归测试: check the new behaviour *and* that you broke nothing old.

5 Recap

Topic 12 – key takeaways

1 Life cycle
waterfall vs iterative/RAD/agile

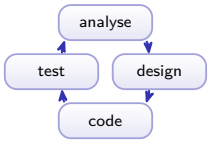
2 Errors
syntax, run-time, logic

3 Testing
black/white box; normal, extreme, abnormal data

4 Maintenance
perfective, adaptive, corrective; regression test

Check yourself

1. Which error gives wrong output but does not crash?
2. Which testing uses only the specification?
3. Test data 0 and 100 for a 0–100 field – which kind?
4. What is regression testing?



> **Answers** **1.** a logic error **2.** black-box **3.** extreme **4.** re-test old features still work