

Selection & Iteration

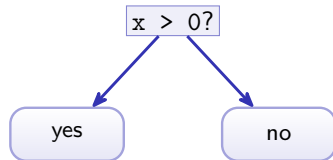
AP Computer Science A ■ Unit 2

AP Computer Science A

if?

What we will cover

- 1 Boolean expressions
- 2 The if statement
- 3 Compound & nested conditions
- 4 while & for loops
- 5 Nested iteration & run-time



Boolean expressions & the if statement

A **Boolean expression** 布尔表达式 evaluates to true or false using **relational operators** 关系运算符 ($>$, $<$, $==$, $!=$).

if (cond)
run a block

if / else
pick one of two

three

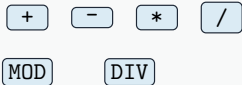
This ability to choose a path is **selection** 选择.
Trace which **branch** 分支 runs for a given input.



assembly loop

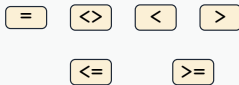
Boolean expressions & the if statement

arithmetic



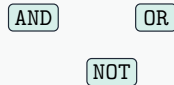
give a
number

relational



compare →
true or false

logical



join conditions →
true or false

Compound & nested conditions

`&&` (AND)
both true

`||` (OR)
at least one

Short-circuit 短路 evaluation stops early: `a && b` skips `b` if `a` is false. Compare **objects** with `.equals()`, not `==` (which compares references).



traffic light if

while & for loops

while loop

repeat while a condition
holds – count of repeats
not known in advance

for loop

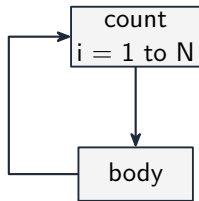
```
for (int i=0; i<n; i++)
```

– a known number of times

Every **loop** 循环 needs progress toward its stop condition, or it becomes an **infinite loop** 无限循环. Trace variables pass by pass.

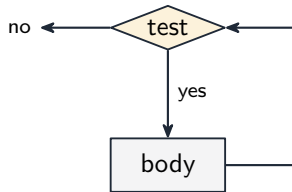
while & for loops

FOR



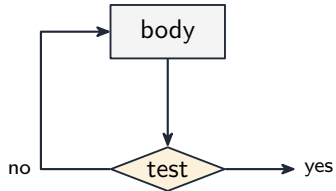
a set number
of passes

WHILE



test **before**
may run 0 times

REPEAT



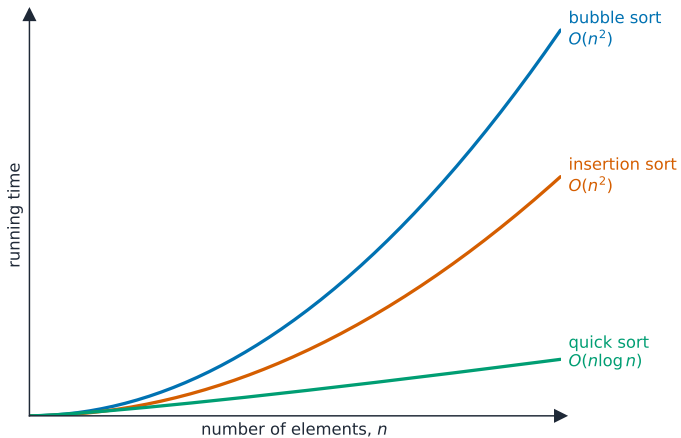
test **after**
runs at least once

Nested iteration & run-time

```
for (int i=0; i<n; i++)  
    for (int j=0; j<n; j++)  
        // runs n x n times
```

A **nested loop** 嵌套循环 puts one loop inside another. **Informal run-time analysis** 运行时分析: count how many times the inner statement runs – here $n \times n = n^2$, so it grows fast.

Nested iteration & run-time



String algorithms

Loop over a String's indices to process each character.

Traverse a String

```
for (int i = 0; i < s.length(); i++)  
    char c = s.charAt(i);
```

Count vowels, reverse text, or find a substring – all by visiting each index in turn.

Key points

if / else if / else
choose a **branch** (selection)

&&, ||, ! build compound conditions

while & for loops **iterate**; avoid infinite loops

A **nested loop** runs n^2 times – growth matters

Check yourself

- 1 A loop runs n times inside a loop that runs n times. How many iterations?
- 2 `while` or `for`: which suits a known count?
- 3 What does `&&` do when the left side is false?
- 4 Name the two structures that control program flow.

Answers 1. n^2 2. `for` 3. short-circuits – the right side never runs 4. selection and iteration