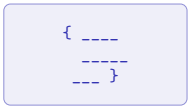
Programming Fundamentals

IGCSE Computer Science ▪ Topic 8

IGCSE Computer Science



What we will cover

1. Variables, constants, data types
2. The three structures
3. Operators & strings
4. Procedures & functions
5. Arrays
6. File handling

a variable is a named box that holds a value

1 Data

Variables, constants, data types

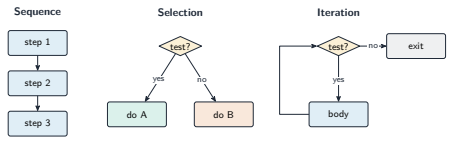
- **variable** 变量: a named store whose value can change
- **constant** 常量: a named value that is fixed

Five **data types** 数据类型: `INTEGER`, `REAL`, `CHAR`, `STRING`, `BOOLEAN`.

> Pick the smallest precise type: a whole count is `INTEGER`, a price is `REAL`, a yes/no is `BOOLEAN`.

integer	whole number: 7
real	decimal: 3.5
char	one letter: 'A'
string	text: "hello"
boolean	true or false

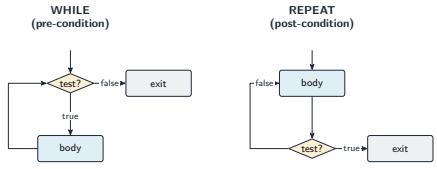
The three basic structures



A **data type** 数据类型 says what kind of value a variable holds.

> Every program is built from three control structures.

Loops and counting



tested first ⇒ may run **zero** times

tested last ⇒ runs **at least once**

- **totalling** 求和 – keep adding values to a running total: 'total ← total + value'.
- **counting** 计数 – add 1 to a counter each time: 'count ← count + 1'.

2 Operators and strings

Operators

arithmetic	**comparison**	**logical**
$+ \ - \ \times \ /$ `DIV` (whole), `MOD` (remainder)	$= \neq < > \leq \geq$	`AND`, `OR`, `NOT`

> 17 `DIV` $5 = 3$ (whole part), 17 `MOD` $5 = 2$ (remainder) – `MOD` is how you test "is it even?"

String handling

- `LENGTH(s)` – number of characters
- `SUBSTRING(s,start,n)` – part of a string
- `UCASE / LCASE` – change case
- `&` – **concatenation** 拼接 (join)

> String positions count from 1, not 0. And a **nested** 嵌套 statement is just one structure inside another – an `IF` within a `FOR`.

3 Subroutines

Procedures and functions

- **procedure** 过程: a named block that does an action, returns nothing
- **function** 函数: a named block that returns a value

Library routines 库例程 are ready-made subroutines (`ROUND`, `RANDOM`).

A function call sits inside an expression (it gives a value back); a procedure call is a statement on its own.

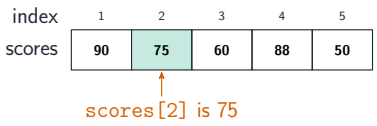
Writing a maintainable program

meaningful names	**comments**	**subroutines**
`score`, not `x`	explain *why*, not the obvious	split the work into named blocks

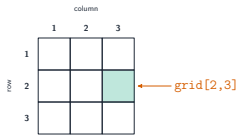
Maintainable code is code the next person (or you, next month) can read and change without fear.

4 Data structures

Arrays



1-D: a list, one index



An **array** 数组 holds many values of the same type under one name, picked out by an **index** 索引.

> A 1-D array is a list (`Marks[3]`); a 2-D array is a grid (`Grid[2,3]`) – perfect for a `FOR` loop over every element.

File handling

Store data on disk so it survives when the program ends:

- `OPENFILE` for `READ` / `WRITE`
- `READFILE` / `WRITEFILE`
- `CLOSEFILE` when done

> Variables live in RAM and vanish at the end; a file keeps the data between runs. Always `CLOSEFILE` – unsaved writes are lost otherwise.

5 Recap

Topic 8 – key takeaways

1 Structures

sequence, selection, iteration

2 Loops

FOR known; WHILE before; REPEAT after

3 Subroutines

procedure acts; function returns a value

4 Arrays & files

array = same type by index; file survives runs

Check yourself

1. Which loop may run zero times?
2. What is 17 `MOD` 5?
3. Procedure or function: which returns a value?
4. From which index do string positions count?

```
{ ____
  ____ }
```

Answers **1.** WHILE **2.** 2 **3.** a function **4.** 1