IGCSE Computer Science

Syllabus Checklist · 大纲自查表

Tick one box per statement: ☐ not yet ☐ nearly ☐ confident. 每条打一个勾：尚未掌握 / 快会了 / 有把握。

1. Data representation 数据表示

1.1 Number systems 数制

☐☐☐ Understand how and why computers use **binary** to represent all forms of data

☐☐☐ (a) Understand the **denary**, **binary** and **hexadecimal** number systems (b) Convert between (i) positive denary and positive binary (ii) positive denary and positive hexadecimal (iii) positive hexadecimal and positive binary

☐☐☐ Understand how and why hexadecimal is used as a beneficial method of data representation

☐☐☐ (a) Add two positive 8-bit binary integers (b) Understand the concept of **overflow** and why it occurs in binary addition

☐☐☐ Perform a **logical binary shift** on a positive 8-bit binary integer and understand the effect this has on the positive binary integer

☐☐☐ Use the **two's complement** number system to represent positive and negative 8-bit binary integers

1.2 Text, sound and images 文本、声音与图像

☐☐☐ Understand how and why a computer represents text and the use of **character sets**, including American standard code for information interchange (**ASCII**) and **Unicode**

☐☐☐ Understand how and why a computer represents sound, including the effects of the **sample rate** and **sample resolution**

☐☐☐ Understand how and why a computer represents an image, including the effects of the **resolution** and **colour depth**

1.3 Data storage and compression 数据存储与压缩

☐☐☐ Understand how data storage is measured

☐☐☐ Calculate the file size of an image file and a sound file, using information given

☐☐☐ Understand the purpose of and need for **data compression**

☐☐☐ Understand how files are compressed using **lossy** and **lossless compression** methods

2. Data transmission 数据传输

2.1 Types and methods of data transmission 数据传输的类型与方法

☐☐☐ (a) Understand that data is broken down into **packets** to be transmitted

☐☐☐ (b) Describe the structure of a packet

☐☐☐ (c) Describe the process of **packet switching**

☐☐☐ (a) Describe how data is transmitted from one device to another using different methods of data transmission

☐☐☐ (b) Explain the suitability of each method of data transmission, for a given scenario

☐☐☐ Understand the **universal serial bus (USB)** interface and explain how it is used to transmit data

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2.2 Methods of error detection 差错检测方法

☐☐☐ Understand the need to check for errors after data transmission and how these errors can occur

☐☐☐ Describe the processes involved in each of the following error detection methods for detecting errors in data after transmission: **parity check** (odd and even), **checksum** and **echo check**

☐☐☐ Describe how a **check digit** is used to detect errors in data entry and identify examples of when a check digit is used, including international standard book numbers (ISBN) and bar codes

☐☐☐ Describe how an **automatic repeat query (ARQ)** can be used to establish that data is received without error

2.3 Encryption 加密

☐☐☐ Understand the need for and purpose of **encryption** when transmitting data

☐☐☐ Understand how data is encrypted using **symmetric** and **asymmetric encryption**

3. Hardware 硬件

3.1 Computer architecture 计算机体系结构

☐☐☐ (a) Understand the role of the **central processing unit (CPU)** in a computer

☐☐☐ (b) Understand what is meant by a **microprocessor**

☐☐☐ (a) Understand the purpose of the components in a CPU, in a computer that has a **Von Neumann architecture**

☐☐☐ (b) Describe the process of the **fetch–decode–execute (FDE) cycle**, including the role of each component in the process

☐☐☐ Understand what is meant by a **core**, **cache** and **clock** in a CPU and explain how they can affect the performance of a CPU

☐☐☐ Understand the purpose and use of an **instruction set** for a CPU

☐☐☐ Describe the purpose and characteristics of an **embedded system** and identify devices in which they are commonly used

3.2 Input and output devices 输入与输出设备

☐☐☐ Understand what is meant by an **input device** and why it is required

☐☐☐ Understand what is meant by an **output device** and why it is required

☐☐☐ (a) Understand what is meant by a **sensor** and the purposes of sensors

☐☐☐ (b) Identify the type of data captured by each sensor and understand when each sensor would be used, including selecting the most suitable sensor for a given context

3.3 Data storage 数据存储

☐☐☐ Understand what is meant by **primary storage**

☐☐☐ Understand what is meant by **secondary storage**

☐☐☐ Describe the operation of **magnetic**, **optical** and **solid-state (flash memory)** storage and give examples of each

☐☐☐ Describe what is meant by **virtual memory**, how it is created and used and why it is necessary

☐☐☐ Understand what is meant by **cloud storage**

☐☐☐ Explain the advantages and disadvantages of storing data on the cloud in comparison to storing it locally

3.4 Network hardware 网络硬件

- ☐☐☐ Understand that a computer needs a **network interface card (NIC)** to access a network
- ☐☐☐ Understand what is meant by, and the purpose of, a **media access control (MAC) address**, including its structure
- ☐☐☐ (a) Understand what is meant by, and the purpose of, an **internet protocol (IP) address** (b) Understand that there are different types of IP address
- ☐☐☐ Describe the role of a **router** in a network

4. Software 软件

4.1 Types of software and interrupts 软件类型与中断

- ☐☐☐ Describe the difference between **system software** and **application software** and provide examples of each
- ☐☐☐ Describe the role and basic functions of an **operating system**
- ☐☐☐ Understand how hardware, firmware and an operating system are required to run applications software
- ☐☐☐ Describe the role and operation of **interrupts**

4.2 Types of programming language, translators and integrated development environments (IDEs) 编程语言类型、翻译程序与集成开发环境（IDE）

- ☐☐☐ Explain what is meant by a **high-level language** and a **low-level language**, including the advantages and disadvantages of each
- ☐☐☐ Understand that **assembly language** is a form of low-level language that uses mnemonics, and that an **assembler** is needed to translate an assembly language program into **machine code**
- ☐☐☐ Describe the operation of a **compiler** and an **interpreter**, including how high-level language is translated by each and how errors are reported
- ☐☐☐ Explain the advantages and disadvantages of a compiler and an interpreter
- ☐☐☐ Explain the role of an **IDE** in writing program code and the common functions IDEs provide

5. The internet and its uses 互联网及其应用

5.1 The internet and the world wide web 互联网与万维网

- ☐☐☐ Understand the difference between the **internet** and the **world wide web**
- ☐☐☐ Understand what is meant by a **uniform resource locator (URL)**
- ☐☐☐ Describe the purpose and operation of **hypertext transfer protocol (HTTP)** and **hypertext transfer protocol secure (HTTPS)**
- ☐☐☐ Explain the purpose and functions of a **web browser**
- ☐☐☐ Describe how web pages are located, retrieved and displayed on a device when a user enters a URL
- ☐☐☐ Explain what is meant by **cookies** and how they are used, including **session cookies** and **persistent cookies**

5.2 Digital currency 数字货币

- ☐☐☐ Understand the concept of a **digital currency** and how digital currencies are used
- ☐☐☐ Understand the process of **blockchain** and how it is used to track digital currency transactions

5.3 Cyber security 网络安全

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- ☐☐☐ Describe the processes involved in, and the aim of carrying out, a range of **cyber security threats**
- ☐☐☐ Explain how a range of solutions are used to help keep data safe from **security threats**

6. Automated and emerging technologies 自动化与新兴技术

6.1 Automated systems 自动化系统

- ☐☐☐ Describe how **sensors**, **microprocessors** and **actuators** can be used in collaboration to create **automated systems**
- ☐☐☐ Describe the advantages and disadvantages of an automated system used for a given scenario

6.2 Robotics 机器人技术

- ☐☐☐ Understand what is meant by **robotics**
- ☐☐☐ Describe the characteristics of a **robot**
- ☐☐☐ Understand the roles that robots can perform and describe the advantages and disadvantages of their use

6.3 Artificial intelligence 人工智能

- ☐☐☐ Understand what is meant by **artificial intelligence (AI)**
- ☐☐☐ Describe the main characteristics of AI as the collection of data and the rules for using that data, the ability to reason, and it can include the ability to learn and adapt
- ☐☐☐ Explain the basic operation and components of AI systems to simulate intelligent behaviour

8. Programming 程序设计

8.1 Programming concepts 编程概念

- ☐☐☐ Declare and use **variables** and **constants**
- ☐☐☐ Understand and use basic **data types**
- ☐☐☐ Understand and use **input** and **output**
- ☐☐☐ (a) Understand and use the concept of **sequence**
- ☐☐☐ (b) Understand and use the concept of **selection**
- ☐☐☐ (c) Understand and use the concept of **iteration**
- ☐☐☐ (d) Understand and use the concepts of **totalling** and **counting**
- ☐☐☐ (e) Understand and use the concept of **string handling**
- ☐☐☐ (f) Understand and use **arithmetic**, **relational** and **logical operators**
- ☐☐☐ Understand and use **nested statements**
- ☐☐☐ (a) Understand what is meant by **procedures**, **functions** and **parameters** (b) Define and use procedures and functions, with or without parameters (c) Understand and use local and global variables
- ☐☐☐ Understand and use **library routines**
- ☐☐☐ Understand how to create a **maintainable program**

8.2 Arrays 数组

- ☐☐☐ Declare and use **one-dimensional (1D)** and **two-dimensional (2D) arrays**
- ☐☐☐ Understand the use of arrays

☐☐☐ Write values into, and read values from, an array using iteration

8.3 File handling 文件处理

☐☐☐ Understand the purpose of storing data in a **file** to be used by a program

☐☐☐ Open, close and use a file for reading and writing