# 4 Processor Fundamentals 处理器基础

## 4.1 CPU Architecture 中央处理器架构

### von Neumann architecture 冯・诺伊曼架构

computer architecture with the following features: has a processor that directly accesses to the memory; the memory stores both programs and data; program consists of instructions that the processor executes sequentially.

### arithmetic and logic unit (ALU) 算术逻辑单元

component in the processor that carries out all arithmetic and logical operations.

### control unit (CU) 控制单元

component in the processor that controls the data flow in the computer system and ensures the instructions are handled correctly.

### system clock 系统时钟

produces timing signal on the control bus to synchronise activities in a computer. Strictly speaking there are two clocks, one (internal clock) synchronise activities inside the processor, and the other (system clock) synchronise activities between the inside and the outside.

### register 寄存器

storage components in the processor that temporarily hold data or instructions and have very short access time. Can be general purpose or special purpose.

**accumulator 累加器**

a general-purpose register that stores a numerical value before and after the execution of an instruction by the ALU.

**status register (SR) 状态寄存器**

a special-purpose register, each bit of which (called a “flag”) can be referenced independently and is set or cleared to mean special status.

**program counter (PC) 程序计数器**

a special-purpose register that stores the memory address of the next instruction.

**current instruction register (CIR) 当前指令寄存器**

a special-purpose register that stores the current instruction while it’s being decoded and executed.

**memory address register (MAR) 内存地址寄存器**

a special-purpose register that stores the address (in the memory or in an I/O device) about to be accessed.

**memory data register (MDR) 内存数据寄存器**

a special-purpose register that the data just read from (or about to be written to) the memory.

**index register (IX) 索引寄存器**

a register used for index addressing.

**address bus 地址总线**

a component that carries an address to the memory controller to access the memory location or to the I/O system to identify the source or destination of the data.

**data bus 数据总线**

a component that carries data from the processor to the memory or to an output device or can carry data from the memory or from an input device.

**control bus 控制总线**

a component that carries signal from the CU to all other computer components.

**word 字**

a group of bits that can be handled as a single unit by the computer system.

**Basic Input/Output System (BIOS) 基本输入/输出系统**

a bootstrap program that is the first to run when a computer is turned on. It’s usually stored on a ROM chip.

**port 端口**

external connection to a computer which allows it to communicate with various peripheral devices.

**Universal Serial Bus (USB) 通用串行总线**

standard port connecting device to a computer that allows plug-and-play.

**High-definition Multimedia Interface (HDMI) 高清晰度多媒体接口**

type of port connecting devices (usually video output devices such as screen, monitor or projector) to a computer. It transmits both video and audio signals.

**Video Graphics Array (VGA) 视频图形阵列**

type of port that has similar functionality as HDMI but only transmits video signal.

**interrupt 中断**

signal sent from a device or software to a processor, requesting it to suspends the current operations and serve the interrupt first. Causes include fatal error in program or in hardware, need of I/O.

**interrupt service routine (ISR) 中断处理程序**

a program which handles specific type of interrupt requests.

## 4.2 Assembly Language 汇编语言

**opcode 操作码**

defines the action associated with the instruction.

**operand 操作数**

defines any data needed by the instruction.

**machine code 机器码**

the language that the CPU uses directly.

**instruction 指令**

a single operation CPU performs. Each instruction is represented by a binary code with a defined number of bits that comprises an opcode and, most often, one or more operand.

**instruction set 指令集**

the complete set of machine code instructions use by a CPU.

**assembly language 汇编语言**

a low-level language related to machine code where opcodes are written as mnemonics and there is a character representation for an operand.

**source code 源码**

a computer program that is not written in machine code and has to be translated before execution.

**object code 目标码**

the machine code program translated from a source code.

**assembler 汇编器**

a program used to translate an assembly language program into machine code.

**directive 伪指令**

an instruction to the assembler program.

**addressing mode 寻址模式**

method of using the operand to find the value used by the instruction.

**direct addressing 直接寻址**

an addressing mode in which the operand is the memory address of the value used.

**indirect addressing 间接寻址**

an addressing mode in which the operand is the memory address of a "pointer", which in turn holds the memory address of the value used.

**index addressing 索引寻址**

an addressing mode in which the memory address of the value used is "operand + content in IX register".

**immediate addressing 立即数寻址**

an addressing mode in which the operand itself is the value used.

## 4.3 Bit Manipulation 位操纵

**logical shift 逻辑移位**

where bits in the accumulator are shifted to the right or to the left and zero moves into the bit position vacated

**cyclic shift 循环移位**

similar to a logical shift but bits shifted from one end reappear at the other end.

**arithmetic shift 算术移位**

similar to a logical shift but the sign of the number is preserved. Used in multiplication or division of a signed integer stored in the accumulator.