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 (stored program concept); 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 coordinates the actions of other components, 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 by events.

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 stores the data just read from (or about to be written to) the memory.

index register (IX) 索引寄存器

a special-purpose register that stores a value that is added to an address to give another address.

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 (e.g. division by zero) 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.