## 计算机组成原理与系统结构

## 第二章作业

**2.10**A benchmark program is run on a 40 MHz processor. The executed program consists of 100,000 instruction executions, with the following instruction mix and clock cycle count:

|  |  |  |
| --- | --- | --- |
| **Instruction Type** | **Instruction Count** | **Cycles per Instruction** |
| Integer arithmetic | 48,000 | 1 |
| Data transfer | 34,000 | 2 |
| Floating point | 13,000 | 2 |
| Control transfer | 5000 | 2 |

Determine the effective CPI, MIPS rate, and execution time for this program.

CPI = (48,000\*1+34,000\*2+13,000\*2+5,000\*2)/100,000 = 1.52

T = CPI\*IC/f = 1.52\*100,000/40,000,000 = 0.0038 s

MIPS rate = IC/(T\*1,000,000) = 100,000/3,800 = 26.32

**2.12** Early examples of CISC and RISC design are the VAX 11/780 and the IBM RS/6000, respectively. Using a typical benchmark program, the following machine characteristics result:

|  |  |  |  |
| --- | --- | --- | --- |
| **Processor** | **Clock Frequency**  **(MHz)** | **Performance**  **(MIPS)** | **CPU Time**  **(seconds)** |
| VAX 11/780 | 10 | 2 | 12x |
| IBM RS/6000 | 20 | 16 | x |

The final column shows that the VAX required 12 times longer than the IBM measured in CPU time.

1. What is the relative size of the instruction count of the machine code for this benchmark program running on the two machines?
2. What are the CPI values for the two machines?
3. as IC = MIPS rate\*T\*1,000,000

and TVAX = 12\*TIBM

and MIPSVAX = 2 = 16/8 = MIPSIBM/8

so IC VAX = MIPSVAX\*TVAX\*1,000,000 = (MIPSIBM/8)\*12\*TIBM\*1,000,000

= IC IBM\*(3/2)

The relative size IC VAX/IC IBM is 3/2.

1. CPIVAX = fVAX/(MIPSVAX\*1,000,000) = 10,000,000/2,000,000 = 5

CPIIBM = fIBM/(MIPSIBM\*1,000,000) = 20,000,000/16,000,000 = 1.25