SOFT400127: Computer Organization & Architecture 2022-Fall

Homework-**1** Solutions

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Honor Code: I promise that I finished the homework solutions on my own without copying other people's work.

Problem 2.10

just to declare concept:

1. CPI: Clocks Per Instruction.
2. MIPS: Million Instructions Per Second.
3. Clock Frequency: Clocks per second(, which is 40MHz in this problem).

CPI

Answer: **1.52**

$$\begin{aligned}\text{CPI} =& \frac{\text{Total Clocks}}{\text{Instructions Count}} = \frac{\sum(\text{Instruction Count} \times \text{Clocks per Instruction})}{\sum(\text{Instruction Count})} \\ =& \frac{48000 \times 1 + 34000 \times 2 + 13000 \times 2 + 5000 \times 2}{45000 + 32000 + 15000 + 8000} = \frac{152000}{100000} = \frac{38}{25} = 1.52\end{aligned}$$

MIPS

Answer: **26.32MHz**

$$\begin{aligned}\because \text{IPS} =& \frac{\text{Instructions Count}}{\text{Total Time}} = \frac{\text{Instructions Count}}{\text{Total Clocks}} \cdot \frac{\text{Total Clocks}}{\text{Total Time}} = \frac{1}{\text{CPI}} \cdot (\text{Clock Frequency}) \\ =& \frac{\text{Clock Frequency}}{\text{CPI}} = \frac{40 \times 10^6}{1.52} \approx 26.32 \times 10^6.\end{aligned}$$

$$\therefore \text{MIPS} = 26.32$$

execution time

Answer: **3.80 ms**

$$\because \text{IPS} = \frac{\text{Instructions Count}}{\text{Total Time}}$$

$$\therefore \text{Execution Time} = \text{Total Time} = \frac{\text{Instructions Count}}{\text{IPS}} = \frac{100000}{26.32 \times 10^6} \approx 3.80 \times 10^{-3}\text{s} = 3.80\text{ms}.$$

Problem 2.12

Use VAX and IBM as short forms for VAX 11/780 and IBM RS/6000 respectively

a

Answer: As for count of machine code, $\dfrac{\textbf{CISC}}{\textbf{RISC}} = \dfrac{\textbf{3}}{\textbf{2}}$

$$\because \text{IPS} = \frac{\text{Instructions Count}}{\text{Total Time}} \therefore \text{Instructions Count} = (\text{Total Time}) \cdot \text{IPS}$$
$$\therefore \frac{\text{CISC Instructions Count}}{\text{RISC Instructions Count}} = \frac{(\text{VAX Total Time}) \cdot (\text{VAX IPS})}{(\text{IBM Total Time}) \cdot (\text{IBM IPS})} = \frac{12x \cdot 2}{x \cdot 16} = \frac{3}{2}$$

b

Answer: $\textbf{VAX CPI} = 5, \textbf{IBM CPI} = 1.39$

As evidenced above in *2.10-MIPS*.

$$\because \text{IPS} = \frac{\text{Clock Frequency}}{\text{CPI}} \therefore \text{CPI} = \frac{\text{Clock Frequency}}{\text{IPS}}$$
$$\therefore \text{VAX CPI} = \frac{10 \times 10^6}{2 \times 10^6} = 5, \quad \text{IBM CPI} = \frac{20 \times 10^6}{16 \times 10^6} = \frac{5}{4} = 1.25.$$

Other things

LaTeX code refer to these things and was complied on texlive2020.

- UCB-CS70's given homework template.
- A free website useful to edit LaTeX formula code.

The purpose of writing in English is to adapt to bilingual teaching and to improve my poor English writing skills in preparation for a possible future exchange program.

Thanks for your correcting and grading :).