

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

CPI

Answer: **1.52**

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

MIPS

Answer: **26.32MHz**

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

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

execution time

Answer: **3.80 ms**

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

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, $\frac{\text{CISC}}{\text{RISC}} = \frac{3}{2}$

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

b

Answer: **VAX CPI = 5, IBM CPI = 1.39**

As evidenced above in *2.10-MIPS*.

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

Other things

\LaTeX code refer to these things and was compiled on texlive2020.

- [UCB-CS70's given homework template.](#)
- [A free website useful to edit \$\text{\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 :).