Performance1

March 9, 2023

1 Details

1.1 CPIs:

- $a \Rightarrow 1$
- $b \Rightarrow 2$
- $c \Rightarrow 3$

1.2 Compilers (billion instructions):

- 1
  - $a \Rightarrow 5$
  - $b \Rightarrow 1$
  - $c \Rightarrow 1$
- 2
  - $a \Rightarrow 10$
  - $b \Rightarrow 1$
  - $c \Rightarrow 1$

1.3 Clock Rate: 500 MHz

2 Questions

2.1 Which compiler has bigger MIPS?

$$\text{CPI} = \frac{\Sigma_{i=1}^{n} \text{CPI}_i * \text{IC}_i}{\text{Instruction Count}} \tag{1}$$

$$\text{CPI compiler 1} = \frac{\overbrace{((5*1)+(1*2)+(1*3))}^{=10} * 10^9}{7} = \frac{10^{10}}{7}$$

$$\text{CPI compiler 2} = \frac{\overbrace{((10*1)+(1*2)+(1*3))}^{=15} * 10^9}{12} = \frac{5*10^9}{4}$$

$$\text{MIPS} = \frac{\text{Clock Rate}}{\text{CPI} * 10^6} \tag{2}$$

$$\text{MIPS compiler 1} = \frac{500}{\frac{10^{10}}{7} * 10^6} = \frac{5 * 10^{-14}}{7}$$

$$\text{MIPS compiler 2} = \frac{500}{\frac{5*10^9}{4} * 10^6} = 4 * 10^{-13}$$

It means that the second has bigger MIPS.

2.2 Which compiler executes faster?

This is not a clear question, if compilation time is the desired thing: the first compiler executes faster but if the cpu time is the desired answer:

$$\text{CPU Time} = \frac{\text{clock cycle}}{\text{clock rate}} \tag{3}$$

$$\text{CPU Time compiler 1} = \frac{7 * 10^9 * \frac{10^{10}}{7}}{500} = \frac{1000 * 10^{16}}{500} = 2 * 10^{16}$$

$$\text{CPU Time compiler 2} = \frac{12 * 10^9 * \frac{15*10^9}{12}}{500} = \frac{1500 * 10^{16}}{500} == 3 * 10^{16}$$

It means that the program compiled by compiler 1, executes faster.

2.3 Is MIPS a good measure

No, the second has a bigger MIPS but it executes slower!