HW 2   9/14/20

Part 1

a.) Avg CPI for MBASE

$2 * 35\% = 70$ $325/100 = 3.25$

$3 * 20 = 60$ $\boxed{\text{avg CPI} = 3.25}$

$4 * 30 = 120$

$+ \; 5 * 15 = 75$
_____

100%   325

b.) $3 * 40 = 120$ $370/100 = 3.70$

$4 * 30 = 120$ $\boxed{\text{Avg CPI} = 3.7}$

$4 * 20 = 80$

$+ \; 5 * 10 = 50$
_____

370

Part 2

a.) MIPS $= MHz/CPI$ Clock $= 1.5$ GHz $= 1500$ mhz

$= 1500/3.25$

$\boxed{MIPS = 466.54} \times 10^6$ instructions/sec

b.) MIPS $= MHz/CPI$ Clk $= 3.0$ GHz $= 3000$ MHz

$3000/3.7 = 810.81 \times 10^6$ inst/sec

$\boxed{MIPS = 810.81}$

Part 3: ~~810.81~~

faster / slower = speedup

$$\frac{810.81}{461.54} \approx 1.757 \text{ times faster} \rightarrow \text{than MBASE}$$

MOPT is ↗

Part 4:

4x faster   old time = 15 sec

⅓ floating point

$$= \frac{(15\,sec/3)}{4} + \left(\frac{2}{3}\right)(15sec)$$

$$= \frac{5sec}{4} + 10sec \qquad 15/11.25 = \text{speed up}$$

| New time = 11.25 sec | | Speed up = 1.33 times faster |

Part 5:

$\frac{3}{4}$ floating point...

$$\frac{(15sec * 3/4)}{4} + \left(\frac{1}{4}\right)(15\,sec) =$$

$$= \frac{11.25\,sec}{4} + 3.75 = 6.5625\,sec = \text{New time}$$

Speed up = $\frac{15sec}{6.5625\,sec} \approx$ | 2.29 times faster |

Part 6

$\hookrightarrow$ from previous Calculation $\rightarrow$ $\boxed{6.5625 \text{ sec}}$

Part 7:

multiply inst $\rightarrow$ 4x faster   old time = 100 sec

mem access $\rightarrow$ 5x faster

25% — multiply inst

45% — mem access inst

30% — other inst

a.) improve mul.

$$\text{New time} = \frac{100 \text{ sec} * \frac{25}{100}}{4} + 100 \text{ sec} * \left(\frac{100 - 25\%}{100}\right)$$

$$= \frac{25 \text{ sec}}{4} + 75 \text{ sec}$$

$$\text{new time} = 6.25 \text{ sec} + 75 \text{ sec} = 81.25 \text{ sec}$$

$$\text{Speed up} = \frac{100 \text{ sec}}{81.25 \text{ sec}} \approx \boxed{1.231 \text{ times faster}}$$

b. improve mem

$$\text{New time} = \frac{100 \text{ sec} * \left(\frac{45}{100}\%\right)}{3} + 100 \text{ sec} * \left(\frac{100 - 45\%}{100}\right)$$

$$= \frac{45 \text{ sec}}{3} + 55 \text{ sec}$$

$$\text{Speed up} = \frac{100}{70} \approx \boxed{1.429 \text{ times faster}}$$

$$\text{New time} = 15 \text{ sec} + 55 \text{ sec} = 70 \text{ sec}$$

c.) mul & mem

$$\text{new time} = \frac{100\,\text{sec}\left(\frac{25\%}{100}\right)}{4} + \frac{100\,\text{sec}\left(\frac{45\%}{100}\right)}{3} + 100\,\text{sec} * \left(\frac{100-45-25\%}{100}\right)$$

$$= \frac{25\,\text{sec}}{4} + \frac{45\,\text{sec}}{3} + 30\,\text{sec}$$

$$\text{new time} = 6.25\,\text{sec} + 15\,\text{sec} + 30\,\text{sec} = 51.25\,\text{sec}$$

$$\text{Speed up} = \frac{100\,\text{sec}}{51.25\,\text{sec}} = \boxed{1.951 \text{ times faster}}$$