HW3_20161595

Problem1.

(a) $CPI = 5\times0.4 + 4\times0.15 + 3\times0.3 + 5\times0.1 + 3\times0.05 = 4.15$

$$\text{Execution Time} = \frac{\text{Instruction Count} \times \text{CPI}}{\text{Clock rate}} = \frac{2\times10^6 \times 10^3 \times 4.15}{8\times10^8} = 10.375\text{s}$$

∴ 4.15, 10.375s

(b) $\frac{3}{4}$ of ALU instruction → 20% of total

					new Percentage	CPI
Load	40	40-20	Load	20	25%	5
Store	15		Store	15	18.75%	4
ALU Operation	30	30-20 →	ALU Op.	10	12.5%	3
Branch	10		Branch	10	12.5%	5
Jumps	5		Jumps	5	6.25%	3
Total	100		New instruction	20	25%	7
Before			Total	80	100%	

After add new instruction

$$CPI_{new} = 5\times0.25 + 4\times0.1875 + 3\times0.125 + 5\times0.125 + 3\times0.0625 + 7\times0.25 = 4.9375$$

$$\text{Execution Time}_{new} = \frac{2\times10^6 \times 0.8\times10^3 \times 4.9375}{6\times10^8} = 13.167\text{s}$$

(cause total is changed(100→80))

It is not good to use this new instruction.

Because it takes more time than part (a)'s execution time 10.375s

(c) $CPI_{new} = 5\times0.4 + 4\times0.15 + 1\times0.3 + 1\times0.1 + 3\times0.05$

$= 3.15$

$$\text{Execution Time}_{new} = \frac{2\times10^6 \times 10^3 \times 3.15}{8\times10^8} = 7.875\text{s}$$

$$\therefore \text{speed up} = \frac{10.375}{7.875} \approx 1.317$$

Problem 2.

bias : 7

(a) 0111011111

(c) $(-1)^0 \times (1+0.11111_2) \times 2^{14-7} = 1.11111_2 \times 2^7 = 1.96875 \times 2^7$

(d) A = 1101000100

$= (-1)^1 \times (1+0.0001_2) \times 2^{10-7} = -1.0001_2 \times 2^3 = -0.01001_2 \times 2^5$

B = 0110000010

$= (-1)^0 \times (1+0.0101_2) \times 2^{12-7} = 1.0101_2 \times 2^5$

$\therefore -0.01001_2 \times 2^5 + 1.0101_2 \times 2^5 = 1.00001_2 \times 2^5$

$\Rightarrow$ 0111000001

(e) $(-1)^0 \times (0+0.11111_2) \times 2^{-7} = 0.96875 \times 2^{-7}$

$(-1)^0 \times (0+0.00001_2) \times 2^{-7} = 0.03125 \times 2^{-7}$

$(0.03125 \times 2^{-7}) \sim (0.96875 \times 2^{-7})$