HW2.

1.

1) P1: CPU时间 = 时钟周期数 / 频率

$\Rightarrow \quad 10 = x / 3 \cdot 10^9 \Rightarrow x = 3 \cdot 10^{10}$ 个时钟周期

又 CPU时间 = 指令数 × CPI × 周期时间

$\Rightarrow \quad 10 = y \cdot 1.5 / 3 \cdot 10^9 \Rightarrow y = 2 \cdot 10^{10}$ 个指令

P2: $x = 10 \cdot 2.5 \cdot 10^9 = 2.5 \cdot 10^{10}$ 个

$\quad y = 10 \cdot 2.5 \cdot 10^9 / 1.0 = 2.5 \cdot 10^{10}$ 个

P3: $x = 10 \cdot 4 \cdot 10^9 = 4 \cdot 10^{10}$ 个

$\quad y = 10 \cdot 4 \cdot 10^9 / 2.2 = 1.82 \cdot 10^{10}$ 个

2) 执行时间 = 指令数 × 时钟周期数 / 频率

即 $(1 + 20\%) / x = 7\% \Rightarrow x = \dfrac{12}{7}$

即 频率应变为原来的 12/7.

P1 = 3 GHz → 5.14 GHz

P2 = 2.5 GHz → 4.29 GHz

P3 = 4 GHz → 6.86 GHz

2.

1) 1核: $T_1 = \dfrac{2.56 \times 10^9 \times 1 + 1.28 \times 10^9 \times 12 + 2.56 \times 10^8 \times 5}{2 \cdot 10^9}$

$\quad = 9.6 s$

2核:

$$T_2 = \frac{(2.56\times1 + 1.28\times12)/1.4 + 2.56\times5/10}{2}$$

$$= 7.04S \qquad\qquad S = \frac{9.6}{7.04} = 1.36$$

4核:

$$T_4 = \frac{(2.56\times1 + 1.28\times12)/2.8 + 2.56\times5/10}{2}$$

$$= 3.84S \qquad\qquad S = \frac{9.6}{3.84} = 2.5$$

8核:

$$T_8 = \frac{(2.56\times1 + 1.28\times12)/5.6 + 2.56\times5/10}{2}$$

$$= 2.24S \qquad\qquad S = \frac{9.6}{2.24} = 4.29$$

2)  $\quad T_1' = T_1 + 2.56/2 = 10.88S$

$\quad T_2' = T_2 + 2.56/1.4\times2 = 7.95S$

$\quad T_4' = T_4 + 2.56/2.8\times2 = 4.30S$

$\quad T_8' = T_8 + 2.56/5.6\times2 = 2.47S$

3) 即 $2.56 + 1.28x + 1.28 = 2T_4$

$\Rightarrow x = 3$

3.

1) $T_1 = 5 \cdot 10^9 \cdot 0.9 / 4 \cdot 10^9 = 1.125 \, S$

$T_2 = 1 \cdot 10^9 \cdot 0.75 / 3 \cdot 10^9 = 0.25 \, S < 1.125 \, S$

P1频率更高，但执行时间更长，显然P2更优

2) $T_1' = 1 \cdot 10^9 \cdot 0.9 / 4 \cdot 10^9 = 0.225 \, S$

$N_2 = \dfrac{T_1' \cdot 3 \cdot 10^9}{0.75} = 0.9 \cdot 10^9 < 1 \cdot 10^9$

3) $P1 = MIPS = \dfrac{5 \times 10^9}{1.125 S \times 10^6} = 4.44 \times 10^3$

$P2 = MIPS = \dfrac{1 \cdot 10^9}{0.25 \times 10^6} = 4 \times 10^3 < 4.44 \times 10^3$

显然错误

4)

$P1: MFLOPS = MIPS \cdot 0.4 = 1.78 \times 10^3$

$P2: MFLOPS = MIPS \cdot 0.4 = 1.6 \times 10^3$

4.

1) $\Delta T_1 = 70 \cdot 20\% = 14 \, S$

2) $\Delta T_2 = 250 \cdot 20\% = 50 \, S$

3) $\Delta T_2 > 40 \, S$. 不能.