1. $T_A = \frac{1}{8MHz} = 125ns$ $T_B = \frac{1}{3GHz} = 333PS$

2. Sequence1: $1\times3+2\times1+1\times5+3\times1=13$

Sequence2: $1\times2+2\times4+1\times1+3\times3=20$

所以1更快

3. A的时钟周期数 = A的CPU time × 频率 = $100\times5\times10^9=5\times10^{11}$

B的时钟周期数 = $5\times10^{11}\times2=10^{12}$

$CR_B = \frac{B的时钟周期数}{B的CPU\ time} = \frac{10^{12}}{20} = 50GHz$

4. A的CPU时间: $500PS\times4\times IC = 2\times10^{-9}\times IC$

B的CPU时间: $200PS\times5\times IC = 1\times10^{-9}\times IC$

由于A的CPU时间更长，故B更快

$\frac{2\times10^{-9}\times IC}{1\times10^{-9}\times IC} = 2$，故快了2倍

$CR_B = \frac{1}{CC_B} = \frac{1}{200PS} = 5GHz$

5. a. $IPS_{(P1)} = \frac{CR_{(P1)}}{CPI_{(P1)}} = \frac{3\times10^9}{1.5} = 2\times10^9$

$IPS_{(P2)} = \frac{CR_{(P2)}}{CPI_{(P2)}} = \frac{2.5\times10^9}{1.0} = 2.5\times10^9$

$IPS_{(P3)} = \frac{CR_{(P3)}}{CPI_{(P3)}} = \frac{4\times10^9}{2.2} = 1.82\times10^9$

故P2表现最好

b. $CN_{(P1)} = CPU\ time_{(P1)} \times CR_{(P1)} = 10 \times 3\times10^9 = 3\times10^{10}$

$CN_{(P2)} = CPU\ time_{(P2)} \times CR_{(P2)} = 10\times2.5\times10^9 = 2.5\times10^{10}$

$CN_{(P3)} = CPU\ time_{(P3)} \times CR_{(P3)} = 10\times4\times10^9 = 4\times10^{10}$

$IC_{(P1)} = IPS_{(P1)} \times CPU\ time_{(P1)} = 2\times10^9\times10 = 2\times10^{10}$

$IC_{(P2)} = IPS_{(P2)} \times CPU\ time_{(P2)} = 2.5\times10^9\times10 = 2.5\times10^{10}$

$IC_{(P3)} = IPS_{(P3)} \times CPU\ time_{(P3)} = 1.82\times10^9\times10 = 1.82\times10^{10}$

C. $CPI'_{(P1)} = 1.5 \times 1.2 = 1.8$

$CPI'_{(P2)} = 1 \times 1.2 = 1.2$

$CPI'_{(P3)} = 2.2 \times 1.2 = 2.64$

$$CR'_{(P1)} = \frac{IC_{(P1)} \times CPI'_{(P1)}}{time} = \frac{2 \times 10^{10} \times 1.8}{10 \times 0.7} = 5.14GHz$$

$$CR'_{(P2)} = \frac{IC_{(P2)} \times CPI'_{(P2)}}{time} = \frac{2.5 \times 10^{10} \times 1.2}{10 \times 0.7} = 4.28GHz$$

$$CR'_{(P3)} = \frac{IC_{(P3)} \times CPI'_{(P3)}}{time} = \frac{1.82 \times 10^{10} \times 2.64}{10 \times 0.7} = 6.85GHz$$

$$\frac{time_{新}}{time_{旧}} = \frac{CPI'}{CPI} \times \frac{CR}{CR'} = 1.2 \times \frac{3}{5.14} = 0.7$$

$\frac{1}{0.7} = 1.42$ 故快3 1.42倍

6. a. $CPI_{(P1)} = \frac{10^6 \times 10\% \times 1 + 10^6 \times 20\% \times 2 + 10^6 \times 50\% \times 3 + 10^6 \times 20\% \times 3}{10^6}$

$= 2.6$

$CPI_{(P2)} = \frac{10^6 \times 10\% \times 2 + 10^6 \times 20\% \times 2 + 10^6 \times 50\% \times 2 + 10^6 \times 20\% \times 2}{10^6}$

$= 2$

b. P1 时钟周期 $= 10^6 \times 10\% \times 1 + 10^6 \times 20\% \times 2 + 10^6 \times 50\% \times 3 + 10^6 \times 20\% \times 3$

$= 2.6 \times 10^6$

P2 时钟周期 $= 10^6 \times 10\% \times 2 + 10^6 \times 20\% \times 2 + 10^6 \times 50\% \times 2 + 10^6 \times 20\% \times 2$

$= 2 \times 10^6$

7. a. $CPI_{(A)} = \frac{time_{(A)}}{IC_{(A)} \times CC} = \frac{1.1}{10^9 \times 1 \times 10^{-9}} = 1.1$

$CPI_{(B)} = \frac{time_{(B)}}{IC_{(B)} \times CC} = \frac{1.5}{1.2 \times 10^9 \times 1 \times 10^{-9}} = 1.25$

b. $\frac{f_B}{f_A} = \frac{1.25 \times 1.2 \times 10^9}{1.1 \times 1 \times 10^9} = 1.37$

c. $\frac{t_A}{t_{new}} = \frac{1.1 \times 1 \times 10^9}{1.1 \times 6 \times 10^8} = 1.67$

$\frac{t_B}{t_{new}} = \frac{1.25 \times 1.2 \times 10^9}{1.1 \times 6 \times 10^8} = 2.27$