系别_____ 班级_____ 姓名_____ 第 页

1.2 a. 通过流水线提高性能 b. 通过冗余提高可靠性
c. 通过预测提高性能 d. 加速大概率事件
e. 存储层次 f. 通过并行提高性能
g. 使用抽象简化设计

1.5 a. P2 性能高

b. ①时钟周期数：
P_1: $3\times10^9\,Hz \times 10s = 3\times10^{10}$
P_2: $2.5\times10^9\,Hz \times 10s = 2.5\times10^{10}$
P_3: $4\times10^9\,Hz \times 10s = 4\times10^{10}$

②指令数：
P_1: $3\times10^{10} \div 1.5 = 2\times10^{10}$
P_2: $2.5\times10^{10} \div 1 = 2.5\times10^{10}$
P_3: $4\times10^{10} \div 2.2 = 1.818\times10^{10}$

c. P_1: $2\times10^{10}\times1.5\times1.2 \div (10\times0.7) = 5.14\,GHz$
P_2: $2.5\times10^{10}\times1\times1.2 \div (10\times0.7) = 4.28\,GHz$
P_3: $\frac{4\times10^{10}}{2.2}\times2.2\times1.2 \div (10\times0.7) = 6.85\,GHz$

1.8 a. A: $1.1\times\frac{1}{1\times10^9}\times\frac{1}{1\times10^9} = 1.1$
B: $1.5\times\frac{1}{1\times10^9}\times\frac{1}{1.2\times10^9} = 1.25$

b. $\frac{f_A}{f_B} = \frac{1\times10^9\times1.1}{1.2\times10^9\times1.25} = 0.73$ 快 27%

c. $\frac{f_A}{f} = \frac{1\times10^9\times1.1}{6\times10^8\times1.1} = 1.67$ $\frac{f_B}{f} = \frac{1.2\times10^9\times1.25}{6\times10^8\times1.1} = 2.27$

1.10 (1) 1) $T_1 = \frac{2.56\times10^9\times1 + 1.28\times10^9\times2 + 2.56\times10^8\times5}{2\times10^9} = 9.6\,s$

2) $T_2 = \frac{(2.56\times10^9\times1 + 1.28\times10^9\times2)\times\frac{1}{0.7\times2} + 2.56\times10^8\times5}{2\times10^9} = 7.04\,s$

4) $T_4 = \frac{(2.56\times10^9\times1 + 1.28\times10^9\times2)\times\frac{1}{0.7\times4} + 2.56\times10^8\times5}{2\times10^9} = 3.84\,s$

8) $T_8 = \frac{(2.56\times10^9\times1 + 1.28\times10^9\times2)\times\frac{1}{0.7\times8} + 2.56\times10^8\times5}{2\times10^9} = 2.24\,s$

故 $\frac{T_1}{T_1}=1$, $\frac{T_8}{T_2}=1.36$, $\frac{T_1}{T_4}=2.5$, $\frac{T_1}{T_8}=4.29$

(2) $T_1' = \frac{2.56\times10^9\times2 + 1.28\times10^9\times2 + 2.56\times10^8\times5}{2\times10^9} = 10.88\,s$

同理可得 $T_2'=7.95s$, $T_4'=4.30s$, $T_8'=2.47s$

故 $\frac{T_1'}{T_1}=1.13$ $\frac{T_2'}{T_2}=1.13$ $\frac{T_3'}{T_8}=1.12$ $\frac{T_4'}{T_4}=1.10$

(3) $\frac{2.56\times10^9\times1+1.28\times10^9\times CPI+2.56\times10^8\times5}{2\times10^9}=\frac{(2.56\times10^9\times1+1.28\times10^9\times2)\times\frac{1}{0.75\times4}+2.56\times10^8\times5}{2\times10^9}$

解得 $CPI=3$

1.13 (1) $T_1=\frac{5\times10^9\times0.9}{4\times10^9}=1.125$ $T_2=\frac{1\times10^9\times0.75}{3\times10^9}=0.25$

$\because T_2<T_1$ $\therefore$ 错误

(2) $T_1'=\frac{1\times10^9\times0.9}{4\times10^9}=0.225$ $n_B=\frac{0.225\times3\times10^9}{0.75}=9\times10^8$

$\because n_B<1\times10^9$ $\therefore$ 错误

(3) A: $MIPS=\frac{4\times10^9}{0.9\times10^6}=4444$ $\because A>B$

B: $MIPS=\frac{3\times10^9}{0.75\times10^6}=4000$ $\therefore$ 错误

(4) A: $MFLOPS=0.4\times4444=1777.6$

B: $MFLOPS=0.4\times4000=1600$