

2020 Fall Computer Architecture

Homework 1

B07902129 何政勳

1-a

$$\text{IPS of P1} = 6 * 10^9 / 1.5 = 4 * 10^9$$

$$\text{IPS of P2} = 7.5 * 10^9 / 3 = 2.5 * 10^9$$

$$\text{IPS of P3} = 3.5 * 10^9 / 1.0 = 3.5 * 10^9$$

1-b

$$\# \text{ of cycles of P1} = 6 * 10^9 * 8 = 48 * 10^9, \# \text{ of instructions of P1} = 4 * 10^9 * 8 = 32 * 10^9$$

$$\# \text{ of cycles of P2} = 7.5 * 10^9 * 8 = 60 * 10^9, \# \text{ of instructions of P2} = 2.5 * 10^9 * 8 = 20 * 10^9$$

$$\# \text{ of cycles of P3} = 3.5 * 10^9 * 8 = 28 * 10^9, \# \text{ of instructions of P3} = 3.5 * 10^9 * 8 = 28 * 10^9$$

1-c

$$\text{Execution time} * 0.6 = (\# \text{ of instructions} * \text{CPI} * 1.8) / (\text{Clock Rate} * n), n = 3$$

$$\text{Clock rate of P1} = 6 * 10^9 * 3 = 18 * 10^9$$

$$\text{IPS of P2} = 7.5 * 10^9 * 3 = 22.5 * 10^9$$

$$\text{IPS of P3} = 3.5 * 10^9 * 3 = 10.5 * 10^9$$

2-a

$$\text{Global CPI of P1} = 0.15 * 1 + 0.25 * 3 + 0.25 * 3 + 0.35 * 1 = 2$$

$$\text{Global CPI of P2} = 0.15 * 2 + 0.25 * 4 + 0.25 * 1 + 0.35 * 1 = 1.9$$

2-b

$$\text{Clock cycles of P1} = 2 * 10^6$$

$$\text{Clock cycles of P2} = 1.9 * 10^6$$

2-c

$$\text{CPU time of P1} = 2 * 10^6 / 1.7 * 10^9$$

$$\text{CPU time of P2} = 1.9 * 10^6 / 2.3 * 10^9$$

$$\text{CPU time of P2} < \text{CPU time of P1. P2 is faster.}$$

3-a

$$\text{CPI} = 550 / 0.333 / 10^{-9} / 2.389 / 10^{12} \approx 0.691$$

3-b

$$\text{SPECratio} = 8750 / 550 \approx 15.9$$

3-c

$$\text{original CPU time} = \# \text{ of instructions} * \text{CPI} * \text{cycle clock time}$$

$$\text{new CPU time} = 1.15 * \text{original CPU time} = 632.5\text{s}$$

3-d

original CPU time = # of instructions * CPI * cycle clock time

new CPU time = 1.1 * 1.2 * original CPU time = 726s

3-e

original SPECratio ≈ 15.9

new SPECratio = $8750 / 726 \approx 12.1$