2020 Fall Computer Architecture

Homework 1

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1-a

IPS of P1 = 6 \* 109 / 1.5 = 4 \* 109IPS of P2 = 7.5 \* 109 / 3 = 2.5 \* 109  
IPS of P3 = 3.5 \* 109 / 1.0 = 3.5 \* 109

1-b

# of cycles of P1 = 6 \* 109 \* 8 = 48 \* 109, # of instructions of P1 = 4 \* 109 \* 8 = 32 \* 109# of cycles of P2 = 7.5 \* 109 \* 8 = 60 \* 109, # of instructions of P1 = 2.5 \* 109 \* 8 = 20 \* 109# of cycles of P3 = 3.5 \* 109 \* 8 = 28 \* 109, # of instructions of P1 = 3.5 \* 109 \* 8 = 28 \* 109

1-c

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

Clock rate of P1 = 6 \* 109 \* 3 = 18 \* 109IPS of P2 = 7.5 \* 109 \* 3 = 22.5 \* 109  
IPS of P3 = 3.5 \* 109 \* 3 = 10.5 \* 109

2-a

Global CPI of P1 = 0.15 \* 1 + 0.25 \* 3 + 0.25 \* 3 + 0.35 \* 1 = 2 Global CPI of P2 = 0.15 \* 2 + 0.25 \* 4 + 0.25 \* 1 + 0.35 \* 1 = 1.9

2-b

Clock cycles of P1 = 2 \* 106Clock cycles of P2 = 1.9 \* 106

2-c

CPU time of P1 = 2 \* 106 / 1.7 \* 109CPU time of P2 = 1.9 \* 106 / 2.3 \* 109CPU time of P2 < CPU time of P1. P2 is faster.

3-a

CPI = 550 / 0.333 / 10-9 / 2.389 / 1012 ≈ 0.691

3-b

SPECratio = 8750 / 550 ≈ 15.9

3-c

original CPU time = # of instructions \* CPI \* cycle clock time  
new CPU time = 1.15 \* original CPU time = 632.5s

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 ≈ 12.1