Carlo Quitoria
9/15/21

CSCI 113 Assignment 3

1) comp C1: clock rate = 700 MHz
comp C2: clock rate = 800 MHz
run prog 1 on C1: 10 sec on C2: 15 sec
run prog 2 on C1: 6 sec on C2: 8 sec
# of instruc done C1: 400 mill
C2: 500 mill

C1	C2
700 MHz	800 MHz
P1 10 sec	15 sec
400 mill	500 M
CPI = 12.5	24

	C1	C2
	700 MHz	800 MHz
P2	6 sec	8 sec
	400 mill	500 mill
	10.5	12.8

prog 2
C1: $CPI = \frac{6}{\frac{1}{2\times10^9} \times 400\times10^6} = 10.5$
C2: $CPI = \frac{8}{\frac{1}{8\times10^8} \times 500\times10^6} = 12.8$

$CPU_{exe} = IC * CPI * CCT$

$CPI = \frac{CPU_{exe}}{CCT * IC}$

Prog 1
C1: $CPI = \frac{10}{\frac{1}{2\times10^9} * 400\times10^6} = \frac{10}{0.5714} = 17.5$
C2: $CPI = \frac{15}{\frac{1}{8\times10^8} \times 500\times10^6} = \frac{15}{0.625} = 24$

2)

C1	C2
700 MHz	800 MHz
6 sec	8 sec
CPI: 12.5	24
IC = 240 mill	266 mill

$CPU_{exe} = IC * CPI * CCT$

$IC = \frac{CPU_{exe}}{CPI * CCT}$

C1: $IC = \frac{6}{12.5 \times (\frac{1}{2\times10^9})} = \frac{6}{2.5\times10^{-9}} = 240$ million

C2: $IC = \frac{8}{24 \times (\frac{1}{8\times10^8})} = \frac{8}{3\times10^{-8}} = 266$ million

3) C1: clock rate: 600 MHz

CPI A: 1 CPI B: 2 CPI C: 3 CPI D: 4

C2: clock rate: 700 MHz

CPI A: 2 CPI B: 2 CPI C: 4 CPI D: 3

Find peak performances as instructions per second. use MIPS rate

$$MIPS = \frac{\text{Clock rate}}{CPI \times 10^6}$$

C1: $MIPS = \frac{600\,MHz}{1 \times 10^6} = \frac{6 \times 10^8}{1 \times 10^6} = 600$ MIPS

C2: $MIPS = \frac{700\,MHz}{2 \times 10^6} = \frac{7 \times 10^8}{2 \times 10^6} = 350$ MIPS

4) Each version gets 25% of the total # of instructions done (IC)

$CPU_{exe\_C1} = IC * (0.25*1 + 0.25*2 + 0.25*3 + 0.25*4) * \frac{1}{600\,MHz}$

$CPU_{exe\_C2} = IC * (0.25*2 + 0.25*2 + 0.25*4 + 0.25*3) * \frac{1}{700\,MHz}$

C1: $IC * (2.5) * \frac{1}{6 \times 10^8}$

C2: $IC * (2.75) * \frac{1}{7 \times 10^8}$

$$\rightarrow \frac{IC * (2.5) * \frac{1}{6 \times 10^8}}{IC * (2.75) * \frac{1}{7 \times 10^8}} = \frac{4.167 \times 10^{-9}}{3.93 \times 10^{-9}} = 1.0606$$

Computer C2 is 1.606 times faster than C1

5) $CPU_{exe}\,C1 = IC * CPI * \frac{1}{\text{clock rate}}$ $CPU_{exe}\,C2 = IC * CPI * \frac{1}{\text{clock rate}}$

$IC * CPI_2 * \frac{1}{\text{clock rate}_2} = IC * CPI_1 * \frac{1}{\text{clock rate}_1}$

$2.75 * \frac{1}{7 \times 10^8} = 2.5 * \frac{1}{\text{clock rate}} = \frac{2.5(7 \times 10^8)}{2.75 \times 10^8} = \frac{17.5}{2.75} = 636.364\,MHz$

6) comp C1: CCT = 2.0 GHz CPU_{exe} = 20 sec

comp C2 is double C1's performance

$$CCT_{C2} = \frac{\text{Clock Cycle}_{C2}}{CPU_{exe\,C2}} = \frac{1.4 * \text{Clock Cycle}_{C1}}{10} =$$

$$\text{Clock Cycle}_{C1} = \text{CPU time}_{C1} \times \text{Clock rate}_{C1}$$

$$= 10 \times 2\,GHz$$

$$= 40 \times 10^9$$

$$\text{clock rate}_{C2} = \frac{1.4 \times 40 \times 10^9}{10} = \frac{56 \times 10^9}{10} = 5.6 \times 10^9 = \boxed{5.6\ GHz}$$