ITSC 3181 Homework 1

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1.5: a) IPS P1 = 3GHz/1.5 = 2*10^9

IPS P2 = 2.5 GHz/1 = 2.5*10^9

IPS P3 = 4 GHz/ 2.2 = 1.82*10^9

P2 has highest performance expressed in IPS.

b) P1: Inst = 2*10*10^9 = 2*10^10

Cycles= 3*10*10^9 = 3*10^10

P2: Inst = 2.5*10*10^9 = 2.5*10^10

Cycles = 2.5*10*10^9 = 2.5*10^10

P3: Inst = 1.82*10*10^9 = 1.82*10^10

Cycles = 4*10*10^9 = 4*10^10

c) We want 0.7*original exe time so we must set up ratio because we now have 1.2*original CPI. So (new CPI/new clock rate) = 0.7(original CPI/original clock rate). Then (1.2/new clock rate) = (0.7/original clock rate). Which gives us new clock rate = 1.71*old clock rate. So clock rate increases by 71% to achieve this.

1.6: Compiler A clock cycles = (1*10^5)+(2*2*10^5)+(3*5*10^5)+(3*2*10^5) = 2.6*10^6

Exe time = (2.6*10^6)/(2.5*GHz) = 1.04 ms

Compiler B clock cycles = (2*10^5)+(2*2*10^5)+(2*5*10^5)+(2*2*10^5) = 2*10^6

Exe time = (2*10^6)/(3*GHz) = 0.67 ms

So compiler B is faster.

a) CPI Compiler A = (2.6*10^6)/10^6 = 2.6

CPI Compiler A = (2*10^6)/10^6 = 2

b) Compiler A clock cycles = 2.6*10^6

Compiler A clock cycles = 2*10^6

1.7: a) Compiler A: CPI = 1/(10^9 * 10^-9) = 1

Compiler B: CPI = 1.5/(1.2*10^9 * 10^-9) = 1.25

b) Compiler A clock rate = (10^9 * 1)/(1.2*10^9 * 1.25) Compiler B clock rate

Compiler A clock rate = 0.67 Compiler B clock rate. So, Compiler A's clock rate is 67% as fast as Compiler B's clock rate.

1.14.1: Clock cycles = (50*10^6* 1)+(110*10^6 * 1)+(80*10^6 * 4)+(16*10^6 * 2) = 512*10^6

Exec time = (512*10^6)/(2*10^9) = 256*10^-3

CPI of FP = (((512*10^6)/2)-((110*10^6 * 1)+ (80*10^6 * 4)+(16*10^6 * 2)))/(50*10^6) = -4.12 so CPI of FP would not improve because it is negative.

1.14.2: CPI of L/S = (((512*10^6)/2)-((110*10^6 * 1)+ (80*10^6 * 4)+(16*10^6 * 2)))/(80*10^6) = 0.8 so 4/0.8 = 5 which means the CPI of L/S must improve 5 times its current amount.

1.14.3: CPI of FP now = 1-(1*0.4) = 0.6

CPI of INT now = 1-(1*0.4) = 0.6

CPI of L/S now = 4-(4*0.3) = 2.8

CPI of Branch now = 2-(2*0.3) = 1.4

Clock cycles = (50*10^6* 0.6)+(110*10^6 * 0.6)+(80*10^6 * 2.8)+(16*10^6 * 1.4) = 342.4*10^6

Exec time = (342.4*10^6)/(2*10^9) = 171.2*10^-3

(256*10^-3)/(171.2*10^-3) = 1.497 is how much it is improved by.

1.16: a) 1110 = 8+4+2=14

b) 100100 = 32+4=36

c) 11010111 = 128+64+16+4+2+1 = 215

d) 011101010100100 = 8192+4096+2048+512+128+32+4 = 15012