ITSC 3181 Homework 1

Landon Leigh

**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.

1. CPI Compiler A = (2.6\*10^6)/10^6 = 2.6

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

1. 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