**CS370 - Homework 1**

**DUE Thursday, Feb 8th - Canvas**

1. (2pts) - Your job is to evaluate the potential performance of two processors, each implementing a

different ISA. The evaluation is based on its performance on a particular benchmark. On the

processor implementing ISA A, the best compiled code for this benchmark performs at the rate

of 10 IPC (instructions per cycle). That processor has a 0.5 GHz clock.

On the processor implementing ISA B, the best compiled code for this benchmark performs at the rate of 2 IPC. That processor has a 0.6 GHz clock.

a. What is the performance in Millions of Instructions per Second (MIPS) of the

processor implementing ISA A?

Answer:  
 MIPS = = = = =

b. What is the performance in MIPS of the processor implementing ISA B?

Answer:

MIPS = = = = =

2. (2pts) Consider three different processors P1, P2, and P3 executing the same instruction set.

P1 has a 3 GHz clock rate and a CPI of 1.5

P2 has a 2.5 GHz clock rate and a CPI of 1.0

P3 has a 4.0 GHz clock rate and has a CPI of 2.2.

a. Which processor has the highest performance expressed in instructions per second?

Answer: P2

To confirm, I’ll be using the formula for performance

P2 has the highest performance as indicated by having the highest MIPS of the three processors.

b. If the processors each execute a program in 10 seconds, find the number of cycles and the number of instructions for each processor.

Answer:

c. For processor P1, we are trying to reduce the execution time by 30% but this leads to an increase of 20% in the CPI. What clock rate should we have to get this time reduction?

Answer:

3. (2pts) Consider two different implementations of the same instruction set architecture (ISA). The

instructions can be divided into four classes according to their CPI (class A, B, C, and D). P1

with a clock rate of 2.5 GHz have CPIs of 1, 2, 3, and 3 for each class, respectively. P2 with a

clock rate of 3 GHz and CPIs of 2, 2, 2, and 2 for each class, respectively.

Given a program with a dynamic instruction count of 1,000,000 (1.0 \* 10^6) instructions divided into classes

as follows: 10% class A, 20% class B, 50% class C, and 20% class D, which implementation is

Faster?

1. What is the global CPI for each implementation?

Answer:

b. Find the clock cycles required in both cases.

Answer:

4. (2pts) Memory operations currently take 30% of execution time of program A.

A new widget called a “cache” speeds up 80% of memory operations by a factor of 4.

What is the total speed up?

Answer: