Exercises on Computer Performance

⊙ **Suppose we have two implementations of the same instruction set architecture. Machine A has a clock cycle time of 1 ns and a CPI of 2.0 for some program, and machine B has a clock cycle time of 2 ns and a CPI of 1.2 for the same program. Which machine is faster for this program, and by how much?**

- Our favorite program runs in 10 seconds on computer A, which has a 400 MHz clock. We are trying to help a computer designer build a machine, B, that will run this program in 6 seconds. The designer has determined that a substantial increase in the clock rate is possible, but this increase will affect the rest of the CPU design, causing machine B to require 1.2 times as many clock cycles as machine A for this program. What clock rate should we tell the designer to target?

⊙ **A compiler designer is trying to decide between two code sequences for a particular machine. The hardware designers have supplied the following facts:**

Instruction Class	CPI for this Instruction Class
A	1
B	2
C	3

For a particular high-level language statement, the compiler writer is considerign two code sequences that require the following instruction counts:

Code Sequence	Instruction Counts for Instruction Class		
	A	B	C
1	2	1	2
2	4	1	1

Which code sequence executes the most instructions? Which will be faster? What is the CPI for each sequence?

⊙ **Consider the machine with three instruction classes and CPI measurements from the previous problem. Now suppose we measure the code for the same program from two different compilers and obtain the following data:**

Code From Compiler	Instruction Counts (in billions) for Instruction Class		
	A	B	C
1	5	1	1
2	10	1	1

Assume that the machine's clock rate is 500 MHz. Which code sequence will execute faster according to MIPS? According to execution time?