1. Compute the CPI for the following program and machine:
   - Program: 10% floating-point operations, 20% memory access instructions, 40% branch/jump instructions, and the rest are ALU operations.
   - Machine: cycles required for each of the following operations:
     - floating-point operations: 11 cycles
     - memory access instructions: 50 cycles*
     - branch/jump instructions: 5 cycles*
     - ALU operations: 2 cycles

2. Assume that we are running the *same application (not necessarily the same executable)* with the *same inputs* on two different systems. **What is the *speedup* of System B relative to System A?**
   - System A:
     - Instruction count: 3 million
     - Cycles per instruction: 4.7
     - Seconds per cycle: 1ns
   - System B:
     - Instruction count: 4 million
     - Cycles per instruction: 2.3
     - Seconds per cycle: 1ns

3. Assume that we are running the *same program* with the *same inputs* on two different systems. **What is the *speedup* of System B relative to System A?**

   - System A:
     - Instructions per cycle: 0.4
     - Clock speed: 3.7 GHz
   - System B:
     - Instructions per cycle: 0.3
     - Clock speed: 4.0 GHz

4. You have a processor that runs at 4.9 GHz with a CPI of 1.4.

   You can either spend \$10,000 to hire a CS@Mines graduate for two weeks to optimize your algorithm so that it requires 37% less instructions to execute as before (assume same CPI).

   Or, you can spend \$1500 on a new CPU that runs at 5.3 GHz (with the same CPI).

   Which option gives you the biggest speedup per dollar spent?