HW#13 Additional Questions

Q1. (6%) Assume that a machine includes a floating point (FP) unit. Suppose we have the following measurements: Frequency of FP operations = 30%, Average CPI of FP operations = 4.0, and Average CPI of other instructions (non-FP instructions) = 1.4.

- a. What is the average CPI of the machine?
- b. If the average CPI of FP is decreased to 2.5, what is the average CPI of the new machine? And what is the speedup?

Q2. (6%) Assume that we are considering enhancing a machine by adding vector hardware to it. When a computation is run in vector mode on the vector hardware, it is 8 times faster than normal mode of execution. We call the percentage of time that can be spent using vector mode the percentage of vectorization.

a. What is the speedup if the percentage of vectorization is 50%?

b. What percentage of vectorization is needed to achieve a speedup of 2?

Q3. (4%) Measurements have shown that for a machine A, the instruction mix and the average Clock cycle Per Instruction (CPI) are as shown in the following table. An improvement on the memory system can reduce the CPI for loads and stores to 3. This improvement, however, leads to a 10% increase in the clock cycle time. Is this improvement useful? Justify your answer quantitatively.

Operation	Frequency	CPI
ALU instruction	40%	3
Load/Store	40%	5
Branch	20%	4