EX L14 Performance measure

1. A certain microprocessor requires either 2, 3, 4, 8, or 12 machine cycles to perform various operations. Twenty-five percent of its instructions require 2 machine cycles, 20% require 3 machine cycles, 17.5% require 4 machine cycles, 12.5% require 8 machine cycles, and 25% require 12 machine cycles.

    a. What is the average number of machine cycles per instruction for this microprocessor?
    b. What is the clock rate (machine cycles per second) required for this microprocessor to be a "1 MIPS" processor?
    c. Suppose this system requires an extra 20 machine cycles to retrieve an operand from memory. It has to go to memory 40% of the time. What is the average number of machine cycles per instruction for this microprocessor including its memory fetch instructions?

Ans.

    a. 0.25 * 2+ 0.2*3 + 0.175 * 4 + 0.125 * 8 + 0.25 * 12 = 5.8 cycles/instruction
    b. 5.8 cycles/instruction * 1,000,000 instructions/second = 5.8 MHz
    c. 5.8 * 0.6 + 25.8 * 0.4 = 13.8 cycles

2. A company that is selling database management optimization software contacts you to pitch its product. The representative claims that the memory management software will reduce page fault rates for your system. She offers you a 30-day free trial of this software. Before you install it, however, you decide to first determine a baseline for your system. At specific times of the day, you sample and record the page fault rate of your system (using the system's diagnostic software). You do the same after the software has been installed. How much of an average performance improvement has the new software provided? (Hint: Use the harmonic mean.)

The fault rates and times of day are shown in the table below.

Time	Fault Rate Before	Fault Rate After
02:00-03:00	35%	45%
10:00-11:00	42%	38%
13:00-14:00	12%	10%
18:00-19:00	20%	22%

Ans.

Before, the average rate is 21.5%. After, the rate is 20.6%. This gives approximately a 4% improvement.

Fault rate before = 4/(1/35+1/42+1/12+1/20)

Fault rate after = 4/(1/45+1/38+1/10+1/22)