CSE 560 – Practice Problem Set 2

Both of these problems come from Hennesy & Patterson's *Computer Architecture: A Quantitative Approach*, 3rd edition.

1. Sometimes, we have a set of performance measurements that vary from very small to very large. A single statistic, such as a mean, may not do a very good job of representing a useful sense of the data as a whole. For example, the processor's ALU and disk subsystem perform primitive operations at speeds that differ by a factor of up to 10^7. This is a speed difference in excess of that between a jet airliner (~1000 kilometers per hour) and a snail gliding on a leaf (~ 1 meter per hour). This problem examines what happens when measurements with such a large range are summarized by a single number.

    (a) What are the arithmetic means of two sets of benchmark measurements, one set with nine values of 10^7 and one value of 1 and the other set with nine values of 1 and one value of 10^7? How do these means compare with the data set medians? Which outlying data affects the arithmetic mean more, a large or a small value?

    (b) What are the harmonic means of the two sets of measurements specified in part (a)? How do these means compare with the data set medians? Which outlying data point affects the harmonic mean more, a large or a small value?

    (c) Which mean, arithmetic or harmonic, produces a statistic closest to the median?

    (d) Repeat parts (a) and (b) for two sets of 10 benchmark measurements with the outlying value only a factor of 2 larger or smaller. How representative of the entire set do the arithmetic and harmonic mean statistics seem for this narrow range of performance values?

2. Dhrystone is a well-known integer benchmark. Computer *A* is measured to perform D_A executions of the Dhrystone benchmark per second, and to achieve a millions per second instruction rate of $MIPS_A$ while doing Dhrystone. Computer *B* is measured to perform D_B executions of the Dhrystone benchmark per second. What is the fallacy in calculating the MIPS rating of computer *B* as $MIPS_B = MIPS_A \times (D_B / D_A)$?

    As a hint, do some dimensional analysis (i.e., reason about the units).