# CS 4431 Homework I

CS4431 Fall 2016
Homework One
**Due: Tuesday, Sep 13, class time**

## Problem 1

Suppose that a CPU can be enhanced so it can execute floating point instructions x times faster than a given implementation.

**a**. What is the minimal frequency of floating point instructions in a given program that will yield an overall speedup of 1.7, as a function of x?

**b**. Suppose that the relative frequency of floating point instructions in an application program is 50 %. How high need x to be in order to achive an overall speed-up of 1.25?

## Problem 2

Assume that we make an enhancement to a computer that improves some mode of execution by a factor of 10. Enhanced mode is used 50 % of the time, measured as a percentage of the execution time *when the enhanced mode is in use*. In other words, after the enhancement, 50 % of the execution time uses the enhanced mode. Recall that Amdahl's law depends on the fraction of the original, *unenhanced* execution time that could make use of enhanced mode. Thus, we cannot directly use this 50 % measurement to compute speedup with Amdahl's law.

**a.** What is the speedup we have obtained from the fast mode?

**b.** What percentage of the original execution time has been converted to fast mode?

## Problem 3

Show that for any two positive rates, `r` and `s`, the arithmetic mean is always greater than or equal to the harmonic mean. When are the two equal?