CSE 531
Homework-3

1. If a problem of size W has a serial component W_s, prove that W/W_s is an upper bound on its speedup, no matter how many processing elements are used.

2. ***Scaled speedup*** is defined as the speedup obtained when the problem size is increased linearly with the number of processing elements; that is, if W is chosen as a base problem size for a single processing element, then

$$Scaled\ speedup = \frac{pW}{T_P(pW, p)}$$

   For the problem of adding n numbers on p processing elements (mentioned in class), plot the speedup curves, assuming that the base problem for p = 1 is that of adding 256 numbers. Use p = 1, 4, 16, 64, and 256. Assume that it takes 10 time units to communicate a number between two processing elements, and that it takes one unit of time to add two numbers. Now plot the standard speedup curve for the base problem size and compare it with the scaled speedup curve.

3. Illustrate the use of recursive locks using a binary tree search algorithm. The program takes in a large list of numbers. The list is divided across multiple threads. Each thread tries to insert its elements into the tree by using a single lock associated with the tree. Show that the single lock becomes a bottleneck even for a moderate number of threads.