Team #:_____ 11/21/06
Absent:

1. Amdahl's Law: Speedup with Enhancement = $\frac{\text{Execution Time without Enhancement}}{\text{Execution Time with Enhancement}}$

$= \frac{1}{(1-F) + (F/S)}$, where F is the fraction of the task where the enhancement applies and S is the speedup factor of the enhancement.

a) Consider an enhancement which runs 20 times faster but which is only usable 25% of the time. What would be the speedup with the enhancement?

Speedup with Enhancement =

b) What if the enhancement is usable only 15% of the time?

Speedup with Enhancement =

c) To get a speedup of 99 from 100 processors, what percentage of the original program could be scalar? ("scalar" - the part of the program that cannot be parallelized.)

Summing 100,000 Numbers on 100 Processors

Processors start by running a loop that sums their subset of vector A numbers (vectors A and sum are shared variables, Pn is the processor's number, i is a private variable)

```
sum[Pn] = 0;
for (i = 1000*Pn; i < 1000*(Pn+1); i = i + 1)
     sum[Pn] = sum[Pn] + A[i]
```

The processors then coordinate in adding together the partial sums (half is a private variable initialized to 100 (the number of processors))

```
repeat
   synch();              /* synchronize first */
   if (half%2 != 0 && Pn == 0)
      sum[0] = sum[0] + sum[half-1];
   half = half/2;
   if (Pn < half)
      sum[Pn] = sum[Pn] + sum[Pn+half];
until (half == 1);       /* final sum in sum[0] */
```

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2. Trace the second segment of code that adds together the partial sums assuming 10 processors (Pn = 10).

sum[P0] sum[P1] sum[P2] sum[P3] sum[P4] sum[P5] sum[P6] sum[P7] sum[P8] sum[P9]

P0 P1 P2 P3 P4 P5 P6 P7 P8 P9 half = 10