Homework 3: Due Before Class, Thurs. Oct. 18 handin cs4230 hw3 <file>

- Problem 1 (Amdahl's Law):

   (i) Assuming a 10 percent overhead for a parallel computation, compute the speedup of applying 100 processors to it, assuming that the overhead remains constant as processors are added. (ii) Given this speedup, what is the efficiency? (iii.) Using this efficiency, suppose each processor is capable of 10 Gflops peak performance. What is the best performance we can expect for this computation in Gflops?
- Problem 2 (Data Dependences): Does the following code have a loop-carried dependence? If so, identify the dependence or dependences and which loop carries it/them. for (i=1; i < n-1; i++) for (j=1; j < n-1; j++) A[i][j] = A[i][j-1] + A[i-1][j+1];





Homework 3, cont.

Problem 3 (Locality):

Sketch out how to rewrite the following code to improve its cache locality and locality in registers. Assume row-major access order.

```
for (i=1; i<n; i++)
```

```
for (j=1; j<n; j++)
```

a[j][i] = a[j-1][i-1] + c[j];

Briefly explain how your modifications have improved memory access behavior of the computation.



## Homework 3, cont.

Problem 4 (Task Parallelism):

Construct a producer-consumer pipelined code in OpenMP to identify the set of prime numbers in the sequence of integers from 1 to n. A common sequential solution to this problem is the sieve of Erasthones. In this method, a series of all integers is generated starting from 2. The first number, 2, is prime and kept. All multiples of 2 are deleted because they cannot be prime. This process is repeated with each remaining number, up until but not beyond sqrt(n). A possible sequential implementation of this solution is as follows:

The parallel code can operate on different values of i. First, a series of consecutive numbers is generated that feeds into the first pipeline stage. This stage eliminates all multiples of 2 and passes remaining numbers onto the second stage, which eliminates all multiples of 3, etc. The parallel code terminates when the "terminator" element arrives at each pipeline stage.

10/04/2012

