Slide 1

Administrivia

- One more homework: Homework 3.
- Posted (see schedule). Due date somewhat negotiable.

Slide 2

Example Application: Heat-Diffusion Problem

- We talked, some time ago, about this problem. How to parallelize?
- The numerical integration example was best addressed in terms of a *Task Decomposition*; this one, however, I say is best addressed in terms of a *Data Decomposition*.
- And overall, while the numerical integration example fit our *Task Parallelism*, this one fits our *Geometric Decomposition* pattern.

  (And these two patterns between them cover probably the majority of actual applications.)

Slide 3

Heat-Diffusion Problem, Revisited

- Review sequential code again and then look at two parallel versions . . .

Slide 4

Heat-Diffusion Problem — OpenMP

- OpenMP version is fairly straightforward:
- Parallelize inner loop.
- Only somewhat-tricky part is the reduction operation to compute `maxdiff`, since there's no built-in reduction operator.

Slide 5

Heat-Diffusion Problem — MPI

- MPI version is less straightforward; "right" (most efficient) way involves applying *Distributed Array* pattern to the two big arrays:
- Partition into "local sections", one per process.
- Surround each with "ghost cells" to hold values from neighbor processes (this makes the code for the update simple).
- Exchange boundary information at start of each time step.
- All of this is simple but full of messy details. Messiest part may be printing. To avoid having to store whole array anywhere, code has other processes send to process 0, which handles printing.

Slide 6

Homework 3

- Like Homeworks 1 and 2, where what I had in mind was for you to use the numerical integration example as a model, with this homework I have in mind for you to use this heat-equation example as a model.
- (Look at homework writeup.)

Slide 7

Minute Essay

- Questions?