

CS352 – Assignment #11

Nov. 17, 2008

Weight: 30 points

Due date: Mon, Nov. 24, 2008

1. We are going to make three blueberry cakes. We have to mix up the ingredients for each cake in a bowl, use the bowl in the mixer to combine the ingredients into cake batter; put the batter and the blueberries into a cake pan and bake for 60 minutes. Assume that mixing 1 batch, etc. takes 15 minutes.
 - a. Your job is to cook 3 cakes as efficiently as possible. Assuming that you have only 1 oven large enough to hold 1 cake, 1 bowl, 1 cake pan and 1 mixer, come up with a schedule to make three cakes as quickly as possible. Identify the bottlenecks in completing this task.
 - b. Assume now that you have 3 bowls, 3 cake pans and 3 mixers. How much faster is the process now that you have additional resources?
 - c. Assume now that you have 2 friends that will help you cook and that you have an oven large enough to accommodate all 3 cakes. How will this change the schedule you devised in part a?
 - d. Compare the cake-making task to computing three iterations of a loop on a parallel computer. Identify data-level parallelism and task-level parallelism in the cake-making loop.

Note: this is from the 4th edition of the textbook for the class.

2. Suppose that we want to sum 100,000 numbers in a message-passing multiprocessor with 100 processors, each with a private memory. Assume that you have routines that can send a sequence of words of length n from arr to processor p :

send(p , arr, n)

and a routine that can receive a message of length n and put it into arr.:

p = receive(arr, n).

Also assume that processor 0 is the “boss” and processors 1-99 are the “slaves”.

Write a C routine that operates as follows:

- a. the boss send a block of data to each slave
- b. each slave and the boss all compute the sum of the data it receives (or has), and
- c. each slave sends its partial sum back to the boss.
- d. give a formula for the time required to complete this task, assuming that the boss can only send and receive one message at a time.
- e. devise a new scheme that lets the results be accumulated in parallel by the slaves