

Teleclass - Introduction Parallel Programming
Final exam
Tuesday December 15th, 1998, 8:00 am to 11:00 am (3 hours)

FOUR pages.

Attempt all questions in the spaces provided.

Name:

Use additional paper if necessary.

You may refer to “Appendix A Basic PVM routines,” “Appendix B Basic MPI routines,” and “Appendix C Basic Pthread routines” (provided). Do not refer to any other materials.

Mark/40

Qu. 1 Answer each of the following briefly:

(a) Draw a three-dimensional hypercube, giving a suitable address for each node. 2

(b) What does a gather routine do in a message passing system? 2

(c) What is a bitonic sequence? 2

(d) What is a condition variable? 2

- (e) What is meant by the phrase systolic array? 2
- (f) What is the purpose of Gaussian elimination? 2
- (g) Why is the Gauss-Seidel method for solving Laplace's equation not very suitable for parallelization? 2
- (h) What is the purpose of the Hough transform? 2
- (i) What is a *sparse matrix*? 2

Qu. 2 Write a parallel program in Pthreads to sum n numbers held in an array $a[]$, using two threads, each computing half of the sum. The final result is to be held in a single location. Give clear comments explaining the code.

10

Qu. 3 Write a parallel program in PVM or MPI to solve the one-dimensional heat distribution problem based upon finite difference equation:

$$x_i^k = \frac{x_{i-1}^{k-1} + 2x_i^{k-1} + x_{i+1}^{k-1}}{2}$$

($0 \leq i < 10$) where x_i^k is the k th iteration value of a point x_i , given $x_0 = 10$ and $x_{10} = 250$. Give clear comments explaining the code.

12