**CISC 372: INTRODUCTION TO PARALLEL PROGRAMMING**
**Fall 2003**
**Midterm Exam Study Guide**
**Midterm Time and Date: classtime on Thursday, October 23, 2003**

# 1 References

- Lectures notes from start of course through October 21.
- Textbook: all readings posted on course schedule web page through October 21.
- Beginner's Guide to MPI on the University of Delaware Cluster: introduction, getting started, and basics of writing MPI programs.
- Individual Labs 1 and 2.
- All inclass handouts (copies of slides) through October 21.
- Weekly quizzes.

# 2 Topic Coverage

- analyzing a problem for its potential parallelization opportunities
- phases of parallel programs: distribution, computation, results gathering
- determination of an approach's communication and load balancing characteristics
- attacking a problem via Foster's parallel algorithm design process
- parallel algorithm models: data parallel, task graph, work pool, pipelining
- (kinds of problems best suited for each model)
- SPMD versus MIMD style programming
- task dependency graphs, critical path, (max and average) degree of concurrency,
- regular versus irregular problems and domain decomposition
- domain decomposition and consequences in communication
- basic MPI program components and format and purpose of each component
- standard message passing in MPI: purpose of each field
- example applications and different solutions with tradeoffs: e.g., numerical integration, matrix vector multiply
- collective communication: barrier, broadcast, reduce, scatter(v), gather(v)
- allgather(v), allreduce, alltoall(v)

# 3 Format of Exam

The exam is closed book, closed neighbor and you will have the full class period to work. You will be given a list of relevant MPI commands with their parameters (with types) for reference. You do not have to memorize the order of parameters for each command. You need to be familiar with how to call the commands using each of the parameters, so you need to understand what each parameter typically holds.. In general, the exam will be a combination of testing your basic knowledge and understanding of the concepts covered in class and application of the concepts. The questions will be of the form:
- Short answer.
- Briefly describe a parallel algorithm for a particular problem, using a particular model of parallel computing.
- Explain what will happen when a particular code segment is executed.
- Write a short (5-10) line MPI program, given a list of MPI commands with parameters.
- Compare two different approaches to parallelizing a problem in terms of its communication or load balancing characteristics.
- Write a call to an MPI command to achieve some described action.
- Choose between data distributions and justify the choice.

- Choose between parallelism models for solving a particular problem.
- Draw pictures of memory contents after certain operations have been performed.
- Choose between different communication mechanisms to achieve a certain data distribution/result gathering.

The questions are NOT true/false or multiple choice. Instead, partial credit will be given when possible on any question in the exam.

# 4   How to Study

Review your lecture notes, labs, and textbook chapters. Try doing some of the kinds of tasks specified above that might be part of the assessment.