1 Syllabus

CSc 8530
Spring, 2015

Sushil K. Prasad

Course Syllabus

Course Title: Parallel Algorithms

Prerequisites: Csc 4520/6520 Design and Analysis of Algorithms. (Or, CSc 4310/6310 Parallel and Distributed Computing)

Instructor: Sushil K. Prasad; Room 717, 25 Park Place; (Do not leave phone messages – send email instead). Email sprasad@gsu.edu.

Class Time and Place: (1:00-2:45, MW, Sparks 328) Rescheduled Wed 8:30-12 in Room 755, 25 Park Place (Suntrust Bldg.)

Office Hours: Wed 2:00-3:30 p.m. Office hour may be cancelled occasionally due to academic meetings.

GTA/Office Hours: Michael Mcdermott;
   Mon 10:30-12:30; Fri 12:30-2 Room 650 cubicles at Suntrust
   Email: mmcdermott2@student.gsu.edu

Content: The goal is to study various design techniques and representative algorithms on shared memory and network models of parallel computation, and, possibly, a few emerging topics in distributed and network computing arena. Topics may include algorithms for sorting, searching, selection, trees, graphs, data structures, etc., and new and emerging models and applications.

References:
1. Text: Akl, Parallel Computation, Model and Methods, Prentice Hall, 1997 - out of print, but author has allowed to make copies for class use.

Attendance: You may be dropped if you have more than one absence. Students are responsible for all the material covered or assigned (whether or not in the text).

Withdrawals: If you withdraw by the published withdrawal date then you may get a grade of ‘W.’

Grading Policy:

Homework and Seminar Presentations 30%
Term Project and Presentation 50%
Final Project Due One Week before last day of class;

Project Presentation: last few weeks
Quiz/Test(s) 20%

See sample projects, etc., on course website http://www.cs.gsu.edu/~cscskp/teaching/node4.html

Any absence from scheduled seminar presentations must be arranged with the instructor at least two weeks in advance; it remains the responsibility of the absentee to find his/her replacement.

Final grade would be relative to the class performance. To ensure a grade, however, 90 and above will result in a grade of ‘A,’ 80-89 a ‘B,’ 70-79 a ‘C’ and 65-69 a ‘D.’ There will be zero credit for late submissions. Incomplete projects and assignments will not be accepted.

Disclaimer: The course syllabus provides a general plan for the course; deviations may be necessary.
A teacher can never truly teach unless he is still learning himself. A lamp can never light another lamp unless it continues to burn its own flame. The teacher who has come to the end of his subject, who has no living traffic with his knowledge but merely repeats his lesson to his students, can only load their minds, he cannot quicken them.

Rabindranath Tagore, Indian Poet
Nobel Laureate in Literature, 1913
2 Survey-based Term Project

Term Project: Survey Paper
CSC 8530

The goal is to choose a suitable topic, in consultation with the instructor, perform exhaustive literature search of the recent material (proceedings, journals, theses/dissertations and technical reports), catalog published material on the chosen topic, browse through the papers and read the important ones, classify the results obtained so far, and write a survey paper on the state-of-the-art the research on the chosen topic. Use ACM Computing Survey papers as guides for style, content, and level of detail (check out samples in the ACM’s digital library available through GSU library).

The final survey paper should typically report on (i) 4 foundational papers, (ii) 8 most recent (and relevant) journal papers and (iii) 8 most recent and relevant conference papers and technical reports to convey the state-of-the-art techniques and knowledge.

Course Website: Each student sets up a web site for this survey, where all components are to be posted by the following deadlines - hard copies need to be submitted to the instructor as well. For all online references cited, have links available on this site. Use this cite to also post your presentations a week before your deadline for review. Send a link to your site within a week to the GTA for linking off the course site.

Deadlines:

- Topic Selection: Feb 17
  Submit a half-page write-up defining the scope of your survey. Also, by this date, post the write-up at your web site.

- Bibliography of literature found: Mar 3
  This may be a partial list to be complemented as the literature search continues. Have links to these references on your web site.

- Annotated Bibliography of the literature found: March 17
  (Scan through the papers and write a brief comment on its content not exceeding 4-5 lines - not from their abstracts/intro. Identify 25 to 30 main papers to be read more thoroughly.)

- Detailed Annotated Bibliography and Classification of the Results: Mar 31
  (i) Detailed comments on papers read thoroughly. (ii) Classification scheme should be a natural one which makes it easier to understand the major developments in an area, and identifies the sub-hierarchies. For each class of major result obtained on the chosen topic, identify the primary and secondary papers associated. The classification scheme will yield the organization of the survey paper.

- Survey Paper: Apr 21
  Start with an abstract, explain the topic/problem and define basic terminologies, present various approaches taken or major results obtained justifying your classification, present each major result and briefly discuss minor results within each category giving illustrations where needed, give the current trend and future work remaining in the area, and include the bibliography. All work and explanations must be adequately referenced throughout the survey. Have a table of contents in the beginning.
  Appendix contains (1) classification and (2) annotated bibliography.

A good survey paper would be of publishable quality.
3 Implementation-based Term Project

Term Project: Algorithm Development and Implementation Option
CSC 8530: Parallel Algorithms

Choose a suitable problem, perform a brief literature search, select three recent and competing state-of-the-art algorithms, and implement them on shared memory and/or distributed memory platform. Study their performances, perform fine tuning, and write an implementation based paper describing the problem, major approaches, selected algorithms with justifications, implementations details and performance tuning, plots, discussion of plots, and possible future work and your conclusions. A plus would be to come up with your own algorithm (either theoretical or practical).

A good implementation paper would be of publishable quality.

Due Dates:

Initial half-page writeup containing problem statement: Feb 11
   Link to web site with writeup posted.

Bibliography and a brief description of your chosen algorithms: Feb 25
   Have links to all online references on your web site.

Algorithm 1: March 11
   Post all files - source codes, adequately documented, and timing data files.

Algorithm 2: Mar 25
   Meld Algo 1 writeup with Algo 2 writeup and post - to become the Implementation paper.

Algorithm 3: Apr 8 Meld the three writeups and post.

Implementation paper: Apr 15
   Organized, polished and updated.

With each algorithm, submit (and post) the following:

1. A 1-2 page description (hard copy) of
   (a) your problem,
   (b) chosen algorithm,
   (c) associated data structures,
   (d) underlying communication pattern for PVM/MPI program,
   (e) amount of read and write contention and synchronization overheads for the shared memory for shared-memory program,
   (f) parallel time complexity for each implementation with a break down of communication/synchronization time and of computation time,
   (g) timing experiment details (description of what parameters have been varied in what range, and how many runs have used for performance data),
   (h) performance of each program with reference to the plots for (a) execution time and for (b) speedup as number of processes varies, and
   (i) your conclusions containing your interpretation of the performance of these programs, their limitations, and possible future improvements.
Some Reference Books for Parallel Computing

5. Ian Foster, Designing and Building Parallel Programs, Addison-Wesley Pub. (Available online on Web at www.mcs.anl.gov/dbpp)
6. K. M. Chandy and Taylor, An Introduction to Parallel Programming, Jones and Bartlett Pub.
8. Lester, The Art of Parallel Programming, Prentice-Hall
9. Chandy and Misra, Parallel Program Design, (Addison Wesley),
10. Lewis, El Rewini, Intro to Parallel Computing, (Prentice Hall),
11. Moldovan, Parallel Processing - From Applications to Systems, (Morgan KAUFMAN)

Some Conferences and Journals related to Parallel Computing

Journals:
1. IEEE Transactions on Parallel and Distributed Systems
2. International Journal of Parallel Programming
3. Journal of Parallel and Distributed Computing
4. Parallel Computing
5. Parallel Algorithms and Applications
6. Parallel Processing Letters

Annual Conferences:
1. IEEE International Parallel Processing Symposium (IPPS)
2. ACM Symposium on Parallel Algorithms and Architectures (SPPA)
3. International Conf. on High Performance Computing (HiPC)
4. International Conference on Parallel Processing (ICPP)
5. Symposium on the Frontiers of Massively Parallel Computing
6. Supercomputing
Name:

Telephone numbers where you can be reached:

Email:

Optional – Company working for (Address):

Major and Minor

Where and When Algorithms/Parallel Computing course completed:

Where and When other Computer courses completed:

Your expectations of this course:

Any interesting problem that you will like to investigate for your project?