



## CSCI 4850/5850 High Performance Computing

### Instructor:

Tae-Hyuk (Ted) Ahn , PhD

Assistant Professor

Department of Math & Computer Science

*Email:* ahnt@slu.edu

*Office:* 305 Ritter Hall

*Phone:* (314) 977-3633

*Office Hours:* Mon 10:30am-12:00pm, Thu 2:30pm-4:00pm or by appointment

### Class Meeting Time/Location/Credit:

Time: Tue, Thu 12:45pm-2:00pm

Location: 115 Ritter Hall

Credit: 3 Credits

### Course Description:

High-performance computing refers to a specialized use and parallel programming of supercomputers, computer clusters, and everything from software to hardware to speed up computations. This course introduces state-of-the-art technologies and programming skills for the HPC. Main topics include basic HPC hardware architectures, parallel programming languages, new trends of HPC, and more. The contents of the course provide a balance of theoretical and practical aspects in parallel computing. A student of this course is expected to develop the right skills to design parallel applications and to effectively use modern HPC platforms.

### Pre-requisites:

- CSCI 2100 Data Structure and
- CSCI 3100 Algorithms

(Exceptions if non-mathcs major students have strong programming skills and computer/numerical concepts) with enthusiasm for learning HPC.

Overall requirements: Students will be expected to have knowledge of algorithms and data structures, and linear algebra at an undergraduate level. Students are expected to be proficient in either C, C++, or FORTRAN, and to be familiar with the Unix environment.

### Course Textbook:

No textbook is required for this course. Assigned slides/materials will be posted on class website (blackboard). However, several reference books are recommended as below:

- Introduction to High Performance Computing for Scientists and Engineers by Georg Hager and Gerhard Wellein, 1st Edition (Chapman & Hall/CRC Computational Science , ISBN-13: 978-1439811924)
- An Introduction to Parallel Programming by Peter Pacheco (Morgan Kaufman, 2011, ISBN:978-0123742605).
- Introduction to Parallel Computing by Ananth Grama, George Karypis, Vipin Kumar, and Anshul Gupta (Addison-Wesley, 2nd edition, 2003, ISBN:978-0201648652).



- Principles of Parallel Programming by Calvin Lin, and Larry Snyder (Addison-Wesley, 2008, ISBN:978-0321487902). Bioinformatics and Functional Genomics 2nd or 3rd Edition by Jonathan Pevsner (Hoboken, N.J. : Wiley-Blackwell, c2009)

**Topical Outline:**

- Introduction (modern processors, trend of HPC, basic optimization techniques for serial code)
- Parallelization (parallel computers, parallel concept, scalability, and more)
- Shared-memory parallelism with OpenMP
- Distributed-memory parallelism with MPI
- New HPC techniques (GPU accelerators, Intel Phi, MPI+OpenMP, Cloud)

**Grading:**

Course Item	Percent of Final Grade	Percent of Final Grade
Homework Assignments		60%
Take-home Midterm Exam		20%
Take-home Final Exam		20%
Miss class without in advance notice		-1%

**Attendance policy:**

You are expected to attend every lecture and take notes. There is no makeup for exams unless you demonstrate in advance (and agreed by the instructor) that a significant life-event prevents you from attending class or if you have a documented emergency. If you schedule something else during a class when you take an exam, you will get a zero for that grade.

**ACADEMIC INTEGRITY AND HONESTY**

Students are expected to be honest in their academic work. The University reserves the right to penalize any student whose academic conduct at any time is, in its judgment, detrimental to the University. Such conduct shall include cases of plagiarism, collusion, cheating, giving or receiving or offering or soliciting information in examinations, or the use of previously prepared material in examinations or quizzes. Violations should be reported to your course instructor, who will investigate and adjudicate them according to the policy on academic honesty of the College of Arts and Sciences. If the charges are found to be true, the student may be liable for academic or disciplinary probation, suspension, or expulsion by the University. Students should review the College of Arts and Sciences policy on Academic Honesty (<http://www.slu.edu/x16363.xml>).

**STUDENTS WITH SPECIAL NEEDS-DISABILITY SERVICES**

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:



- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Student Success Center (BSC 331) or by going to [www.slu.edu/success](http://www.slu.edu/success). Students who believe that, due to a disability, they could benefit from academic accommodations are encouraged to contact Disability Services at 314-977-8885 or visit the Student Success Center. Confidentiality will be observed in all inquiries.

Course instructors support student accommodation requests when an approved letter from Disability Services has been received and when students discuss these accommodations with the instructor after receipt of the approved letter.

### **COURSE CONTENT DISCLAIMER**

In this course, students may be required to read text or view materials that they may consider offensive. The ideas expressed in any given text do not necessarily reflect the views of the instructor, the English Department, the Writing Program, or Saint Louis University. Course materials are selected for their historical and/or cultural relevance, or as an example of stylistic and/or rhetorical strategies and techniques. They are meant to be examined in the context of intellectual inquiry of the sort encountered at the university level.

### **WRITING CENTER**

I encourage you to take advantage of the writing services in the Student Success Center; getting feedback benefits writers at all skill levels. Trained writing consultants can help with any writing, multimedia project, or oral presentation. During the one-on-one consultations, you can work on everything from brainstorming and developing ideas to crafting strong sentences and documenting sources. These services do fill up, so please make an appointment! For more information, or to make, change, or cancel an appointment, call 977-3484 or visit <http://www.slu.edu/writingservices.xml>.