

# CS 452 Parallel Algorithm Design and Programming

Professor: Dr. Ankur Gupta  
E-mail: agupta@butler.edu  
Office: FB 158

Time: MW 2:25–3:40 PM

Room: FB 148

Office Hours: MWF 11:00–12:00 PM, MW 4:00–4:30 PM  
or by appointment

## Additional References

**An Introduction to Parallel Programming.** Peter Pacheco. Morgan-Kaufmann, 2011. ISBN 978-0-12-374260-5.

**Introduction to Parallel Computing** (2nd edition). Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar. Pearson Addison-Wesley, 2003. ISBN 0-201-64865-2.

**Introduction to Parallel Algorithms.** Joseph JáJá. Addison-Wesley, 1992. ISBN 0-201-54856-9.

## Grading

Your grades will be based on your performance on quizzes and exams, as follows:

Programming Projects (30%)	two major and three smaller projects in the semester
First Exam (20%)	6 February 2019
Second Exam (25%)	6 March 2019
Final Exam (25%)	3–6 PM, 1 May 2019

## Topics Covered

1. Introduction, Parallel Models, Lower Bounds
2. General Techniques for Parallelism
3. Lists and Trees
4. Searching, Sorting, Selecting, and Merging
5. Graphs and Planar (Computational) Geometry
6. String Processing
7. Complex Mathematical Computation (FFT, Recurrences)

## Motivation for the Course

Fundamental physical limitations on processing speed is forcing high-performance computation (and even everyday user computation) to rely on the notion of using multiple processing units at once, or in other words, *parallelism*. Algorithms designed specifically for parallel processing can dramatically affect the time required to perform a task, but if designed poorly, can be equally disastrous. In this course, we take a careful look at the framework for designing parallel algorithms that work. You will learn not only how to evaluate such algorithms, but you will learn general techniques that can be used on a wide variety of meaningful problems. Parallelism is the wave of the future; ride the wave, man. Study parallel algorithm design, and you will become super smart.



## Comments on the Course

Keeping up in this course is absolutely essential, as tomorrow's material will be dependent on today's. I have designed weekly quizzes to encourage you to begin pacing yourselves early. I will also be prepared to help you, as students, to succeed in this class as much as I can. If you have questions or are confused about any course material, please ask me! Feel free to stop by my office with any doubts you may have.

## Students With Disabilities

It is the policy and practice of Butler University to provide reasonable accommodations for students with properly documented disabilities. Written notification from Student Disability Services is required. If you are eligible to receive an accommodation and would like to request it for this course, please contact Student Disability Services. Allow one week advance notice to ensure enough time for reasonable accommodations to be made. Otherwise, it is not guaranteed that the accommodation can be provided on a timely basis. Students who have questions about Student Disability Services or who have, or think they may have, a disability (psychiatric, attentional, learning, vision, hearing, physical, medical, etc.) are invited to contact Student Disability Services for a confidential discussion in Jordan Hall, Room 136 or by phone at 317-940-9308.

## Religious Observance

Butler University respects all students right to religious observance and will reasonably accommodate students religious practice with regard to class attendance, examinations, and assignments when requests are made in a timely manner. Butler University recommends that each class should have a syllabus that provides a schedule of activities for the class. It is the students responsibility to inform instructors of course conflicts resulting from religious observations at least two weeks in advance of the observance, so that accommodations can be made. Requests must be made in writing, and the student should include a proposed alternative due date, examination date, or make-up outline. The professor should review the request and if the students proposed suggestion is acceptable, should notify the student of the agreement. Any solution that is mutually agreeable to both student and faculty member is acceptable. If accommodations cannot be agreed upon, the instructor and students should seek the advice of the associate dean in the appropriate college. No adverse or prejudicial effects will result to students because they have made use of these provisions. In addition, the beginning of a new academic year is a good time to remember our collective role in fostering a campus community free from discrimination and harassment. Indeed, all faculty members (as well as the vast majority of staff members) are mandatory reporters who are required to report any incidents of discrimination or harassment students may disclose to you. You may wish to remind students of your role as a mandatory reporter, as well as their options for confidential reports, with the language below:

## Reporting Discrimination or Harassment

Butler University is committed to fostering safe and productive living, learning, and working environments free from discrimination and harassment. Faculty members are required to report any incident of discrimination and/or harassment that students may report to them. Any sex/gender related incident reported to a faculty member will be in turn reported to the Title IX Coordinator; any non-sex/gender related incident reported to a faculty member will in turn be reported to the Associate Vice President for Human Resources. The Title IX Coordinator or Associate Vice President for Human Resources will then reach out to the reporting student for further discussion. If you wish to make a confidential report of discrimination and/or harassment, you may do so to personnel in Counseling and Consultation Services or to Pastoral Counselors.