



## CSCI 2100: Data Structures

### Catalog Description:

"The design, implementation and use of data structures. Principles of abstraction, encapsulation and modularity to guide in the creation of robust, adaptable, reusable and efficient structures. Specific data types to include stacks, queues, lists, priority queues, dictionaries, trees and graphs."

### Class Meeting Time/Location:

**Time:** Mon, Tue (Lab), Wed, Fri 9:00am – 9:50am

**Location:** 115 Ritter Hall (Linux Classroom)

### Instructor:

Tae-Hyuk (Ted) Ahn, PhD

Assistant Professor

Department of Computer Science

Program of Bioinformatics and Computational Biology

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*Phone:* (314) 977-3633

*Office Hour:* Mon 10:30-12:30pm, Tue 2:30-3:30pm, or by appointment

### Credits/Pre-requisites:

Credits: 4 Credits

Pre-requisites: The official prerequisite is a C- or better in CSCI 1300 and a passing grade or concurrent enrollment in MATH 1660 or equivalent.

### Detailed Course Description:

This is an undergraduate follow-up course to introductory programming, where the focus is primarily on learning how to solve a problem using an object-oriented framework. However, in this course, we focus on the fact that there are often multiple ways to solve a problem, with tradeoffs in the approaches that are possible. The goal of this course is to learn the various types of data structures which are commonly used throughout computer science, as these are the building blocks of most larger projects.

In particular, we will discuss tradeoffs between various operations, as many data structures will be faster at some operations only at the cost of other ones. In addition, space is a factor, since some algorithms require more space on the computer than others, which can be a huge factor with large data sets.

### Topical Outline:

- Why Data Structures?
- C++ Crash Course for Python programmers
- Introduction to analysis of algorithms, big-O
- Linear data structures: lists, stacks, queues, vectors, heaps
- Binary trees, binary search, heaps, AVL trees, Huffman trees
- Dictionaries and hashing
- Graph implementations and algorithms

### Student Learning Outcomes:

After successfully complete this course, students are expected:



- Understand underlying fundamental concepts of data structures
- Demonstrate the inner workings of fundamental data structures such as stacks, queues, vectors, linked lists, heaps, trees, and graphs
- Implement generic versions of any of these data structures, using low-level programming concepts such as pointers and dynamic memory management
- Select an appropriate data structure and use it to solve a given programming problem, understanding any tradeoffs involved
- Analyze the asymptotic time and space efficiency of data structure operations using standard notations

**Course Textbook and Resources:**

The required textbook for this course is:

Data Structures and Algorithms in C++ (Second Edition)  
Michael T. Goodrich, Roberto Tamassia and David M. Mount  
John Wiley & Sons, 2011.  
ISBN-13 978-0-470-38327-8

For the beginning of the semester, we will also rely on the document  
A Transition Guide from Python 2.x to C++  
by Michael Goldwasser and David Letscher

Additional online resources:

[www.cplusplus.com](http://www.cplusplus.com)

Git will be used to

- Assign and submit homework

Email with Instructor

Face-to-face contact in class and in office hours is most desirable. Yet email is a convenient form of communication as well. I try to respond to email promptly, including at least once each evening when possible.

If your question involves your progress on a current programming assignment, my response will be more informative if you can point out the specific problem you have encountered, and if I am able to see all of your source code. Therefore I strongly suggest that you either attach all relevant files to the email or submit preliminary versions of such files through git system.

**Computer and Cell Phone Policy**

Computers will be an integral part of this course, both inside and outside of class. However, out of courtesy to both the instructor and other students, please do not use the lab computers for non-class related activity. In particular, you do not need to be using a computer unless an exercise or in class activity requiring them is in progress.

You are unlikely to need cell phones during the course of lecture. Please ensure that your cell phone is set to vibrate or silent during lecture, and do not send text messages of any kind.

**Grading:**

**Written Homework Assignments (15%)**



We expect there to be a total of 6-10 written homework assignments during the course. At the end of the semester, we will ignore your lowest of the homework grades, with the remaining homeworks contributing equally to this portion of the grade.

These will generally be due at the beginning of class on the assigned due date. The problems will consist of short questions reinforcing the material in the lectures, readings and programs. Each homework will contain one or more practice problems that are not to be turned in and which can be discussed freely between classmates. The problems that are to be submitted for a grade, however, must be done entirely individually. A more complete explanation of our policy towards Academic Integrity is given below.

### **Lab Assignments (10%)**

Most Tuesday will be devoted to a hands-on "lab" problem. Each will have a formal "pre-lab" exercise that must be submitted individually at the beginning of class that Tuesday. The rest of the lab will be completed in pairs, ideally during the Tuesday class period. However, we will allow for the lab (but not the prelab) to be submitted until 11:59pm on the subsequent Wednesday.

The labs will be graded on a simple 3-point scale. One point is awarded for successfully submit the prelab exercise. A second point is awarded for any sincere attempt at the lab activity, and a third point is awarded for successful completion of the lab activity. At the end of the semester, **we will ignore your lowest of the lab grades**, with the remaining scores contributing equally to this portion of the grade.

### **Programming Assignments (35%)**

We expect there to be a total of 6-10 programming assignments during the course. At the end of the semester, **we will ignore your lowest of the program grades**, with the remaining programs contributing equally to this portion of the grade.

On certain assignments, you will be required to work individually; on others you will be allowed to work in pairs. Early in the course you will have approximately one week for each assignment; later in the course you will often have two weeks. The assignments will be submitted electronically and generally due at 11:59pm on the assigned due date.

### **Exams (40%)**

- First Exam (10%), Monday, 9 October 2017, 9:00-9:50am (tentative)
- Second Exam (10%), Friday, 10 November 2017, 9:00-9:50am (tentative)
- Final Exam (20%), Monday, 18 December 2017, 8:00-9:50am (university schedule)

**Attendance to all exams is mandatory.** If you must miss an exam you must contact the instructor and submit a written request for a makeup exam prior to the exam. Your written request should include detailed information about the conflict and provide documentation of the conflict and any relevant contact information. Legitimate conflicts and excuses are limited to death or near-death instances in the immediate family, a student's illness that requires immediate doctor's care, a University sponsored event (not club sports) and regularly scheduled religious obligations. Excuses that will **NOT** be considered include personal travel arrangements, non-University sponsored events, a conflicting appointment, a previous illness that interfered with your study



time or an illness that does not prevent you from coming to the exam. Unexcused exam absences will be counted as zero in the calculation of your final grade.

**Extra Credit**

Both homework and programming assignments will generally include a small extra credit challenge. Please notice, however, that the actual extra credit given for these challenges is relatively insignificant. Students who are seriously concerned about improving their overall grade would be best advise to focus all efforts on doing as well as possible on the required work and in preparing for exams.

**Grading Scale:**

Final grades for the course will be based on the following scale. The instructor reserve the right to make adjustments to grades based on overall performance in the course. There will be **no opportunity for “extra credit” to improve grades that have already been earned**. Bargaining for grades will not be tolerated.

Letter Grade	F	D	C-	C	C+	B-	B	B+	A-	A
%	<60	≥60 <70	≥70 <73	≥73 <77	≥77 <80	≥80- <83	≥83 <87	≥87 <90	≥90 <93	≥93

**Late Policies**

Late homework or programming assignments will suffer a penalty of 20% for every day they are late. For example, homework which is submitted between midnight and 11:59pm next day will be worth at most 80% of the total credit. After five days of the due, submission will get zero point as the formula. For the lab session, 1 point reduction for every day if they are late.

**Regrade Requests**

I am happy to regrade any assignments, programs, quizzes or exam problems which you think were unfair or incorrect. Please bring me the original assignment, plus a written explanation of your question or complaint, within two weeks of the time the paper in question is graded and returned to you.

**Academic Integrity and Honesty**

Academic integrity is honesty, truthful and responsible conduct in all academic endeavors. The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity." Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care, and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern.

The governing University-level Academic Integrity Policy can be accessed on the Academic Polices website (<https://www.slu.edu/online/current-students/academic-policies.php#>). A more detailed policy statement is given by the College of Arts & Science, also applying to this course (<http://www.slu.edu/arts-and-sciences/student-resources/academic-honesty.php>)

In addition to those general statements, we wish to discuss our policy in the context of this course. When it comes to learning and understanding the general course material, you may certainly use other reference



materials and you may have discussions with other students in this class or other people from outside of this class. This openness pertains to material from the text, practice problems, general syntax and use of the C++ language or other computing tools.

However, when it comes to work that is submitted for this course, you are not to use or to search for any direct or indirect assistance from unauthorized sources, including but not limited to:

- other students in this class
- past students, whether from this school or other schools
- other acquaintances
- other texts or books
- online information other than that referenced by course materials

Acceptable sources of information include consultations with the instructor, teaching assistants, or members of organized tutoring centers on campus, as well as any materials explicitly authorized in an assignment. Even in these cases, if you receive significant help you should make sure to document both the source of the help as well as the extent.

On certain programming assignments, we will explicitly allow students to work in pairs. In this case, conversations between partners is both permissible and required. Furthermore, both students are expected to contribute significantly to the development of the submitted work. It is unethical to allow a partner to "sign on" to a submission if that partner did not significantly contribute to the work.

Any violations of these policies will be dealt with seriously. Penalties will apply as well to a student who is aiding another student. Any such violations will result in a minimum penalty of a zero on the given assignment that cannot be dropped, and severe or repeated violations will result in an immediate failing grade in the course. Furthermore all incidents will be reported in writing to the Department and/or the Dean, as per the College procedure.

### **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.

### **Tutoring**

Our department employees many junior/senior computer science majors to help out in our department labs. Those students are also available to provide assistance with course materials at such times.



Our department web page maintains a current list of the available times and locations (<http://cs.slu.edu/undergrad-cs/lab-hours>).

As stated in the Academic Integrity policy above, these workers are an acceptable resource for help, yet you should still document both the source of the help as well as the extent, if significant.

### **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.