Managing Data in C++

ITP 365 (3 Units)

Fall 2014

USC Viterbi School of Engineering
Information Technology Program

Description

Overview of basic data structures and algorithms including linked lists, stacks, queues, binary trees, and hash tables.

Objective

This course is an overview of core data structures. These data structures are the building blocks required for further study of a variety of programming disciplines. By the conclusion of the course, students will have:

1. Familiarity with several fundamental data structures.
2. An understanding of big-O notation and time complexity.
3. Knowledge of several basic and advanced sorting algorithms.
4. Learn advanced object-oriented paradigms.

Concepts

Arrays/Vectors. Templates. Recursion. Sorting. Linked Lists. Stacks/Queues. Heaps.

Prerequisites

ITP 109x, ITP 115, ITP 165x, or equivalent experience.

Instructor	Sanjay Madhav (madhav@usc.edu)
Office Hours	M-Th 2:30-4:30 in OHE 530H
Lab Assistants	Brian Chen
Lecture	12:30 pm – 1:50 pm, Tuesday and Thursday in KAP 267

Textbook

Programming Abstractions in C++. Eric Roberts. Prentice Hall. ISBN-13: 978-0133454840.

Website

All course material will be posted on Blackboard (http://blackboard.usc.edu), and we will use Piazza for discussions/questions outside of class.

Grading

The following percentage breakdown will be used in determining the grade for the course.

Homework (percentages vary)	50%
Midterm exam	25%
Final exam	25%
Total	**100%**

Grading Scale

The following shows the grading scale to be used to determine the letter grade.

93% and above	A
90% - 92%	A-
87% - 89%	B+
83% - 86%	B
80% - 82%	B-
77% - 79%	C+
73% - 76%	C
70% - 72%	C-
69%	D+
67% - 68%	D
66%	D-
65% and below	F

Policies

Exams

Make-ups are only allowed under extraordinary circumstances. The student must provide a satisfactory reason (as determined by the instructor) along with proper documentation.

The midterm and final are comprehensive of all topics covered.

Homework

Homework must be completely *individually*. There are not any group projects in this class.

The homework will be posted on Blackboard under the "Assignments" section. Each lab assignment will include instructions, a due date, and a link for electronic submission. Labs must be submitted using this link.

It is your responsibility to submit your assignments on or before the due date. Assignments turned in one day late will have 20% of the total points deducted from the graded score. Assignments turned in two days late will have 50% of the total points deducted from the graded score. After two days, submissions will not be accepted and you will receive a 0.

Policies (Continued)

Lab facilities

During class sections, students may have opportunities to work on homework using the classroom's computers. However, keep in mind that when you log out of a classroom computer, all of the files will be deleted. You will need to save this work using a USB flash drive or a website such as Dropbox. ITP is not responsible for any work lost.

Furthermore, students will be able to install all of the necessary software on their own computers in order to be able to work on the homework at any time. Both Mac and PC are supported. Students without their own personal computers are able to utilize the 24-hour USC computing centers.

Incomplete and Missing Grades

Excerpts for this section have been taken from the University Grading Handbook, located at http://www.usc.edu/dept/ARR/grades/gradinghandbook/index.html. Please see the link for more details on this and any other grading concerns.

A grade of Missing Grade (MG) "should only be assigned in unique or unusual situations… for those cases in which a student does not complete work for the course before the semester ends. All missing grades must be resolved by the instructor through the Correction of Grade Process. One calendar year is allowed to resolve a MG. If an MG is not resolved [within] one year the grade is changed to [Unofficial Withdrawal] UW and will be calculated into the grade point average a zero grade points.

A grade of Incomplete (IN) "is assigned when work is no completed because of documented illness or other 'emergency' **occurring after the twelfth week** of the semester (or 12th week equivalency for any course scheduled for less than 15 weeks)."

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* *http://emergency.usc.edu/* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

A Further Note on Plagiarism

In this class, all homework submissions will be compared with current, previous, and future students' submissions using MOSS, which is a code plagiarism identification program. If your code significantly matches another student's submission, you will be reported to SJACS with the recommended penalty of an F in the course.

It is okay to discuss solutions to specific problems with other students, but it is not okay to look through another student's code. It does not matter if this code is online or from a student you know, it is cheating. Do not share your code with anyone else in this or a future section of the course, as allowing someone else to copy your code carries the same penalty as you copying the code yourself.

Course Outline

W	Date	Topic(s)	Reading	Homework
1	8/26	C++ Review; Creating Libraries	Ch. 1, §2.1-2.7	
	8/28	Strings; Streams	§3.1-3.2; §3.4-3.5; §4.3-4.4	
2	9/2	Stanford C++ Library; Using Vectors	§2.9; §5.1	HW1 – Prime Numbers (Due 9/15 @ 11:59PM)
	9/4	Using Stacks and Queues	§5.1-5.2	
3	9/9	Using Maps and Sets; Range-based for loops	§5.4-5.5	
	9/11	Implementing Classes; Operator Overloading	§6.1-6.3	
4	9/16	More Classes and Operator Overloading; Recursion Basics	§6.3-6.5; §7.1-7.3	HW2 – itpPhone (Due 9/29 @ 11:59PM)
	9/18	More Recursion	§7.4-7.5	
5	9/23	Even More Recursion	§7.6-7.7	
	9/25	Basic Sorting and Algorithmic Analysis	§10.1-10.2; §10.4	
6	9/30	Memory and Pointer Basics	§11.1-11.3	HW3 – TBD (Due 10/13 @ 11:59PM)
	10/2	Dynamic Memory; Dynamic Memory and Classes;	§12.1; §12.3	
7	10/7	const; Implementing Templates	§12.8; §14.1	
	10/9	**MIDTERM EXAM**		
8	10/14	Implementing Vector; Unit Testing	§14.4; §12.6	HW4 – TBD (Due 10/27 @ 11:59PM)
	10/16	Pointer Arithmetic	§11.4	
9	10/21	Linked Lists	§12.2	
	10/23	STL Containers; Copying Concerns	§12.7	
10	10/28	Implementing Stack as a Linked List	§14.2	HW5 – TBD (Due 11/10 @ 11:59PM)
	10/30	Implementing Queue as a Linked List	§14.3	
11	11/4	Efficiency Comparisons (Vectors, Lists, Stacks, and Queues)	Ch. 13	
	11/6	Basic Lookups and Hashing	§15.2-15.3	
12	11/11	HashMap (and comparison to Map)	§15.3-15.4	HW6 – TBD (Due 11/24 @ 11:59PM)
	11/13	Tree Basics	§16.1	
13	11/18	Implementing BSTs	§16.2	
	11/20	Implementing Map as a BST	§16.4	
14	11/25	Iterators	§20.1	HW7 – TBD (Due 12/5 @ 11:59PM)
	11/27	***Thanksgiving Holiday (No class)***		
15	12/2	STL Algorithms	§20.4	
	12/4	Graph Basics	§18.1-18.2	
	12/16	**FINAL EXAM – Tuesday, 12/16 @ 11AM**		