Advanced C++ Programming
CS144 – Section 01

Department of Computer Science
San Jose State University
Fall 2020

ABOUT THIS COURSE

Advanced features of C++, including operator overloading, memory management, templates, exceptions, multiple inheritance, RTTI, namespaces, tools.

Prerequisites

CS 46B and CS 49C (with a grade of C- or better in each), or equivalent knowledge of object-oriented programming and C, or instructor consent.

Course

Class Lecturer	: Dominic Abucejo
Course Number	: 47824
Units	: 3 units
Duration	: August 19, 2020 to December 7, 2020
Day/Time	: Monday and Wednesday 7:30pm-8:45pm PST (Pacific Standard Time)
Where	: Online Zoom Meeting (to be provided)
Office Hours	: Online (by appointment/request)
Email	: dominic.abucejo@sjsu.edu *always prepend "[CS144-01]" in the subject field
Telephone	: Please use email for all future communications

SCHEDULE INFORMATION

Fall Semester August 19, 2020 to December 18, 2020

Event	Fall 2020
First Day of Instruction	August 19, 2020
Last Day To Drop Class without a 'W'	August 31, 2020
Last Day To Add Classes via MySJSU	September 8, 2020
Enrollment Census Date	September 16, 2020
Last Day of Instruction	December 7, 2020

SJSU Schedule

Events/Holidays: https://www.sjsu.edu/classes/calendar/2020-2021.php#holidays
Final Exams: https://www.sjsu.edu/classes/final-exam-schedule/fall-2020.php

Course Schedule

*Subject to change with fair notice.

Week/Date	Topic
Week 1 - August 19 (Wed) Introduction	*Course Information* *C++ basics* *Flow of control* *Simple input and output (I/O)*
Week 2 - August 24 (Mon), August 26 (Wed)	*Procedural abstraction* *Functions*
Week 3 - August 31 (Mon), September 2 (Wed)	*I/O streams* *Introduction to classes and objects* *Arrays* *Strings* *Vectors*
Week 4 - September 9 (Wed) **no class on September 7 (Mon)	*Pointers* *Dynamic arrays*
Week 5 – September 14 (Mon), September 16 (Wed)	*Structures* *Classes* *Public and private members* *Constructors and destructors* *Friend functions* *Abstract data types (ADT)*
Week 6 – September 21 (Mon), September 23 (Wed)	*Analysis precedes design* *Where do classes come from?* *UML class and sequence diagrams* *Separate compilation* *Namespaces* *Inlining*
Week 7 – September 28 (Mon), September 30 (Wed)	*A class design example* *Accessors and mutators* *Immutable classes* *The Law of Demeter and the Principle of Least Knowledge* *Cohesion and consistency* *The Liskov Substitution Principle*
Week 8 – October 5 (Mon), October 7 (Wed) Midterm exam on Monday, October 5	*MIDTERM* *Class hierarchies* *Inheritance* *Overriding and overloading functions* *Operator overloading* *The Open-Closed Principle*
Week 9 – October 12 (Mon), October 14 (Wed)	*Copy constructors* *The assignment operator* *The "Big Three"* *A "safe" array type*

	Linked lists *Stacks* *Queues*
Week 10 – October 19 (Mon), October 21 (Wed)	*Polymorphism* *Virtual destructors* *Abstract classes and interfaces* *Multiple inheritance* *Runtime type identification (RTTI)* *The Principle of Coding to the Interface* *The Principle of Favoring Delegation over Inheritance*
Week 11 – October 26 (Mon), October 28 (Wed)	*Recursion* *Binary search* *Mergesort* *Exception handling* *Template functions and classes*
Week 12 – November 2 (Mon), November 4 (Wed)	*Standard Template Library (STL)* *STL Containers* *STL vectors* *STL linked lists* *STL iterators* *STL sorting*
Week 13 – November 9 (Mon), November 11 (Wed)	*The Model-View-Controller architecture* *Interactive programming with a graphical user interface (GUI)* *Introduction to wxWidgets* *Inversion of control* *Callback functions* *Events and event handlers* *Lambda expressions* *The auto keyword* *The decltype pseudo-function*
Week 14 – November 16 (Mon), November 18 (Wed)	*Constructor and destructor calls* *How does an STL vector grow?* *Why did my program crash?* *Shallow vs. deep copy* *Pointers vs. references* *Raw pointers vs. unique and shared smart pointers* *Move semantics*
Week 15 – November 23 (Mon) ** no class on November 25 (Wed)	*Introduction to multi-threaded programming* *Critical regions, mutexes, and semaphores* *Introduction to algorithm analysis* *Recurrence relations* *Proof by induction* *Big-O notation*

	Rates of growth and scalability *The quicksort algorithm*
Final exam Monday, December 11 Time: 7:15pm to 10:00pm PST ** This is the Group I schedule Room: Online	*FINAL EXAM*

GRADING INFORMATION

Grading Bracket

Percentage	**Letter Grade**
93.50 - 100%	A
89.50 - 93.49%	A-
86.50 - 89.49%	B+
82.50 - 86.49%	B
79.50 - 82.49%	B-
76.50 - 79.49%	C+
72.50 - 76.49%	C
69.50 - 72.49%	C-
66.50 - 69.49%	D+
62.50 - 66.49%	D
59.00 - 62.49%	D-
0 - 58.99%	F

Your final class grade will be weighted as follows:

- 40% Assignments
- 10% Project
- 15% In-class quizzes
- 15% Midterm exam
- 20% Final exam

C.L.O. (Course Learning Outcomes)

Upon successful completion of this course, you will be able to:

- CLO 1: Apply object-oriented features of C++, including polymorphism and recursion.
- CLO 2: Apply advanced features of C++, including operator overloading, memory management, templates, the Standard Template Library (STL), exceptions, multiple inheritance, runtime type identification (RTTI), namespaces, etc.
- CLO 3: Apply modern features of C++, including lambda expressions, smart pointers, move semantics, etc.
- CLO 4: Develop interactive GUI-based applications in C++ that use inversion of control and callback functions as event handlers.

- CLO 5: Understand the concepts of multithreaded programming.
- CLO 6: Use high-level software development tools, including an integrated development environment (IDE), compilers, linkers, and source-level debuggers to implement and debug C++ applications.
- CLO 7: Write efficient programs in C++ that adhere to good design principles while avoiding pitfalls of the language.
- CLO 8: Document program design with Unified Modeling Language (UML) diagrams.

CLASS FORMAT

Classes will be taught online via Zoom Video Call Conferencing. In class programming practice, quizzes, surveys, as well as topic presentation will be provided (not in any specific order). Assignments, quizzes, projects, and exams will be provided via Canvas. All classes will be recorded and recordings will be made available for reference.

CANVAS

Course materials, syllabus, assignments, grading criteria, exams, and other information will be posted on the Canvas Learning Management System (course login website at http://sjsu.instructure.com).

WEEKLY ASSIGNMENTS

One assignment per week (40%). Assignments will be posted on Canvas every Sunday night at 9:30pm PST. The problems are mostly related to the topic that will be covered on that week's lecture. You will be able to spend time to look at the problems and then have the opportunity to try to get ready to solve them by attending the upcoming classes and by asking questions. All assignments are due at 11:30 pm PST on the following Sunday.

NO LATE ASSIGNMENTS ACCEPTED FOR FULL CREDIT. You will have exactly 3 days to submit any late assignment but you will not receive full credit even if the assignment results are correct.. Late submissions will only receive up to 70% of the original assignment grade. Note: by the end of the 3rd day, turn in what you have for any partial credit even if you can't complete an assignment but you must indicate in a message/note to describe what was completed and what was not completed if you happen to fall into this category; do not email a note or message to your instructor, but add the message, in Canvas, when you submit that specific assignment. After the 3rd day, any assignment not turned in will get a grade of zero.

QUIZZES

There will be a minimum of one quiz per week. Quizzes will be given on every Wednesday during class.

PROJECT

There will be one project (10%) that will be started during the middle of the semester where students will spend 2 to 3 weeks to complete it. Students will work on a scientific topic which will

have students explore the various kinds of algorithms and techniques to apply to reading and writing specific scientific data.

CLASS TOOLS

All students must have access to the following online tools:

1. Kahoot (https://kahoot.com/) – Class Quiz/Learning Tool
2. Paiza.io (https://paiza.io/en/projects/new?language=cpp) – Online C++ Compiler
3. JDoodle (https://www.jdoodle.com/online-compiler-c++/) – Online C++ Compiler

The above tools will be used during class discussion.

REFERENCES (BOOKS)

Book purchases can be made at online stores: i.e. Amazon (www.amazon.com)

The following book is required:

Title : Programming: Principles and Practice Using C++ (2nd Edition)
Author : Bjarne Stroustrup
Paperback : 1312 pages
Publisher : Addison-Wesley Professional; 2 edition (May 25, 2014)
Language : English
ISBN-10 : 0321992784
ISBN-13 : 978-0321992789

The following books are recommended:

Title : Murach's C++ Programming
Author : Joel Murach, Mary Delamater
Paperback : 770 pages
Publisher : Mike Murach & Associates (September 21, 2018)
Language : English
ISBN-10 : 1943872279
ISBN-13 : 978-1943872275

Title : Effective C++: 55 Specific Ways to Improve Your Programs and Designs (Professional Computing) 3rd Edition
Author : Scott Meyers (Author)
Paperback : 316 pages
Publisher : Addison-Wesley Professional; 3 edition (May 12, 2005)
Language : English
ISBN-10 : 0321334876
ISBN-13 : 978-0321334879

TECHNOLOGY REQUIREMENTS

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students. Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor, as soon as possible

CLASSROOM/ZOOM MEETING ETIQUETTE

It is very important for each student to attend classes and to participate. For all zoom meetings that you are invited to, all audio must be initially muted and laptop video camera must be started or enabled when joining any meeting.

Remember that you are joining a video meeting, and so there are a several important things to keep in mind:

- Be on time to class
- Always dress appropriately when joining any video conferencing meeting. Any complaints related to this must be brought to the instructor's attention and will then be addressed by the instructor and by school officials.
- Mute Your Microphone: To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- Be Mindful of Background Noise and Distractions: Find a quiet place to "attend" class, to the greatest extent possible. ○ Avoid video setups where people may be walking behind you, people talking/making noise, etc. ○ Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- Position Your Camera Properly: Be sure your webcam is in a stable position and focused at eye level.
- Limit Your Distractions/Avoid Multitasking: You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- Use Appropriate Virtual Backgrounds: If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.
- Do not screen capture or record video meetings (due to privacy and copyrights)
- Do not share any passwords to Zoom meetings with other people who are not participating in the course
- Unmute your audio if you have any questions, and mute when you are done.

Use of Camera in Class

- PC or laptop cameras should initially be enabled once joining a meeting. If you have any special needs or requests for any accommodations on a case by case basis please inform the class lecturer.

- Please consider the fact that students may be concerned about appearing on camera themselves, for disability-related or religious reasons, or concern for other family members, including children, who live with you in close quarters. The privacy of a student's home life and access to a room for privacy should not be a barrier to a student's success in a particular course.

Recording of Zoom Classes

- All Zoom meetings will be recorded by the class lecturer for all meetings.
- Many students indicated in the Spring 2020 Student Success Survey that having recordings of class lectures was helpful for studying and reviewing material, or catching up on portions missed due to internet connectivity issues or other disruptions. Recordings will be made available for viewing but they will not be made available for downloading and then viewing.
- This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording)
- Students are not allowed to record without instructor permission.
- Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor.
- The university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.
- University policy (S12-7) requires consent from all individuals who will appear in a class recording. If a student does not wish to be identified in a class recording, please let the class lecturer know so that you can be set to an "anonymous" option (e.g., student temporarily turning off identifying information from the Zoom session, including name and picture, prior to recording).

UNIVERSITY POLICIES

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo.