

**CAP 4530**

**Data Structures**

Section 001, Credit Hours 3

College Engineering, Department Computer Science

**COURSE SYLLABUS**

Last Updated: 8/16/2024

**Course Prefix Number Course Title**

CRN, Section #, Credit Hours

College Name, Department Name

**COURSE SYLLABUS**

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| --- | --- | --- | --- |
| *Assistant Professor of Instruction:* | Valentina N. Korzhova | *E-Mail:* | korzhova@cse.usf.edu |
| *TA/GA:* | On Canvas | *TA E-Mails:* | On Canvas |
| *Term:* | Fall 2024 | *Dates:* | 26/08/23-12/12/23 |
| *Delivery Method:* | CL (in person) | *Days, Time, and Location:* | TR 2:00pm -3:15pm  CPR 103 |
| *Office location* | ENB 343 G | | |
| *Office hours* | *TR 12:00pm -1:30pm* | | |

# Welcome!

* 1. Dear students welcome to the COP 4530 class. I hope we will have very productive semester.

# University Course Description

Understand and implement fundamentals of concise data structure and organization for program efficiency, clarity and simplification. Implementation of different data types and structures. Understanding of current data structures. Functional programming concepts will be covered.

# Course Prerequisites

* 1. COP 3514, CDA 3103

# Course Purpose

# A data structure is a specialized format for organizing, processing, retrieving and storing data. While there are several basic and advanced structure types, any data structure is designed to arrange data to suit a specific purpose so that it can be accessed and worked with in appropriate ways.

# Instructor Contact Information and Communication

The students can reach me regarding any questions through office hours. Also students can use the email system through Canvas or USF email. I will check the email every working day (Monday-Friday).

# First Week Attendance Policy

For the first day attendance, you have to take the attendance quiz during the first week.

# Course Objectives

# Create and modify object-oriented software solutions using C++.

# Identify Abstract Data Types (ADTs) and associated constraints to accomplish information hiding.

# Create and use standard ADTs, such as stacks, queues, linked lists, trees, graphs, and hash tables.

1. Analyze, compare, and contrast different implementations of an ADT.
2. Design and implement solutions to complex tasks utilizing appropriate ADTs and   
   concrete data structures.
3. Compose software solutions using functional programming principles to manipulate   
   data.

# Student Learning Outcomes

# *By the end of this course,*

1. Students will learn C++ object-oriented design and develop software solutions utilizing inheritance and polymorphism.
2. Students will understand the concept of abstract data types and the associated constraints for the use and application of abstract data types.
3. Students will implement and utilize standard ADTs, such as stacks, queues, lists, vectors, trees, dictionaries, and graphs with their associated concrete data structures such as arrays, linked lists, hash tables, heaps, and matrices.
4. Students will compare the different costs and benefits that come with the implementations of an abstract data type.
5. Students will design, analyze, and give solutions to complex programming tasks by modelling using appropriate abstract data types and implementing concrete data structures.
6. Students will employ functional programming principles such as immutable data structures, recursion, pure functions, first-class functions, and higher-order functions to solve programming problems and manipulate data.

# Course Topics

1. Recursive Functions
2. Data Structure Analysis
3. Linked Lists and Arrays
4. Stacks, Queues, and Deque
5. Lists, Vectors, and Sequences
6. Iterators
7. General Trees, Binary Trees
8. Tree Traversal
9. Priority Queues and Heaps
10. Maps and Hashes
11. Search Trees
12. Merge Sort and Quicksort
13. Graphs Data Structures
14. Graph Traversal
15. Functional Programming Concepts

# Required Course Materials

Data Structures and Algorithms in C++, 2nd Edition

By Michael T. Goodrich, Roberto Tamassia, David M. Mount ISBN-13: 978-0470383278

# Supplementary (Optional) Texts and Materials

*Unless otherwise indicated, all materials in Canvas are required.*

# Grading Scale

|  |  |  |
| --- | --- | --- |
| Grading Scale (%) | |  |
| 90-100 | A |  |
| 80 - 89 | B |  |
| 70 - 79 | C |  |
| 60 - 69 | D |  |
| 0 - 59 | F |  |

# Grade Categories and Weights

|  |  |
| --- | --- |
| Assessment | Percent of Final Grade |
| Final Project | 10% |
| Midterm 1 | 20% |
| Midterm 2 | 20% |
| Midterm 3 | 20% |
| Final exam | 20% |
| Programming projects (3) | 20% (6.67% each) |
| Online Quizzes | 5% |
| Participation | 5% |

## Exams

There will be four exams (total 60%) in this course (one exam with the lowest score will be dropped). These exams will relate to current and previous topics covered throughout the material. For the first three exams, students will have an entire class period to complete the exam. The class periods of the first three exams are on the schedule. The final exam will be a comprehensive exam covering all the material explored in the course. The USF final exam matrix gives the time and place of the final exam. There will be no make-up exams.

## Programming Projects

Students will complete Programming Projects in group of two throughout the semester. These projects require the use of the concepts learned in class as well as some creative thinking to implement a programmatic solution to a problem. There will be no make-up programming projects. Projects that do not compile will be given an automatic zero, with no partial credit considered. The assistant teachers will grade your project. Contact your ATs with any questions related to the projects.

## Quizzes

There will be 6 quizzes (one quiz with lowest score will be dropped). Quizzes will relate to current and coming topics. There will be no make-up quizzes.

**Final Project:**

You will need to complete a course project in group with four students. If you work in a group then all members of the group will get the same grade for the project, exclude presentation.

# Project:

*Due Date: November 22 at 11:59pm*

*Working in teams of four, your project must consist of an abstract, design drawings, and a discussion paper that includes the theories used and their applications in your design. This project is meant to provide you with a chance to unify the skills and concepts learned throughout the semester into one culminating project, and to showcase your ability to transfer these concepts into new contexts. Projects will be graded on originality, completeness, functionality, scientific depth, engineering applicability and design, and integration of concepts. The grading rubric:*

|  |  |  |
| --- | --- | --- |
| *Project* | *Points* | *Due date* |
| *Report and codes* | *7* |  |
| *Presentation* | *3* |  |

# Policy Regarding Regrading:

You will have one week (seven calendar days) following the posting of a grade to ask a teaching assistant for a regrade if you believe there is an error. If the regrade is not requested by 5 pm (Eastern) on the seventh day, then the grade posted will stand as final. If the seventh day falls on a holiday, then you will have until the next business day. To submit a regrade request, please message the teaching assistant who graded your work with a subject line of ‘regrade request’ and a body with your name, the course, the assignment, and a brief explanation of why you are requesting a regrade. This shall constitute notice of your intention to request a regrade.

Late Work Policy  
Submissions must be made via Canvas (they will not be accepted via email), and the timestamp provided by Canvas will be utilized as the official recorded time of submission. I do not allow late work to be submitted unless there is prior written approval by me based on special circumstances or unless there is a documented medical emergency.

**Extra Credit Policy**:

*Extra credits will be included into exams.*

# Instructor Feedback Policy & Grade Dissemination

*Instructor will respond to email communication relevant to the subject matter within 24 hours of the date received. Instructor will provide feedback on assignments within one week of the posted deadline, and feedback on final papers within two weeks of the posted deadline. Graded tests and materials in this course will be not returned individually. You can access your scores at any time using "Grades" in Canvas.*

1. **Course Schedule**

Notice: Schedule is subject to revision. CQ = Canvas Reading Quiz, PP = Programming Project

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Day** | **Topic** | **Read Before** | **Due** | **Notice** |
| **Tues, Aug**  **27** | C++ | Chapter 1 |  | First day attendance in class  PP0 –tutorial Opens until  Sep. 8 at 11:59 pm  Practice exercise 1 opens until Sep.1 |
| **Thu, Aug 29** | OO Software Development  ADT, Templated Functions/Classes | Chapter 2.1 to 2.3 |  |  |
| **Tues, Sep.3** | Arrays, | Chapter 2.1 to 2.3 |  | Practice exercise 2 opens until Sep.8 |
| **Thu, Sep. 5** | Linked Lists | Chapter 3.2 to 3.4 |  |  |
| **Tues, Sep.**  **10** | Linked Lists (continue) | Chapter 3.2-3.4 |  | PP1 opens until Sep. 22 at 11:59 pm |
| **Thu, Sep.**  **12** | Recursion and  Analysis | Chapters 3.5, 4.1 to 4.2 | CQ1 |  |
| **Tues, Sep.**  **17** | Stacks | Chapter 5.1 |  |  |
| **Thu, Sep. 19** | Queues and Deque | Chapter 5.2 to 5.3 | CQ2 |  |
| **Tues, Sep. 24** | Review for exam 1 | Chapter 6.1 to 6.3 |  | PP2 opens until Oct. 6 at 11:59pm |
| **Thu, Sep. 26** | Exam 1 |  |  | In class |
| **Tues, Oct.**  **1** | Lists and Iterators  Towers of Hanoi |  |  |  |
| **Thu, Oct. 3** | Trees and Traversal | Chapter 7.1 to 7.2 |  |  |
| **Tues, Oct.**  **8** | Binary Trees | Chapter 7.3 |  | PP 3 Opens until Oct. 27 at 11:59 pm |
| **Thu, Oct.**  **10** | Priority Ques | Chapters 8.1, 8.2 |  | Class activity |
| **Tues, Oct.**  **15** | Heaps | Chapter 8.3 |  |  |
| **Thu, Oct.**  **17** | Maps and Hashes | Chapters 9.1, 9.2 | CQ 3 |  |
| **Tues, Oct.**  **22** | Review for exam 2 |  |  |  |
| **Thu, Oct. 24** | Exam 2 |  |  |  |
| **Tues, Oct. 29** | Binary Search and AVL | Chapters 10.1, 10.2 |  | PP4 opens until Nov. 13 |
| **Thu, Oct 31** | Merge sort and Quick |  | CQ4 |  |
| **Tues, Nov.**  **5** | Graphs | Chapter 13.1 to 13.2 |  |  |
| **Thu, Nov.**  **7** | Graphs Searching  Shortest path | Chapter 13.3 to 13.5 | CQ5 |  |
| **Tues, Nov.**  **12** | Functional Programming |  |  |  |
| **Thu, Nov. 14** | Functional Programming |  | CQ6 |  |
| **Tues, Nov.**  **19** | Review for exam 3 |  |  |  |
| **Thu, Nov.**  **21** | Exam 3 |  | CQ6 |  |
| **Tues, Nov 26** | Presentations |  |  |  |
| **Thu, Nov 28** |  |  |  | Thanksgiving Nov. 27-28 |
| **Tues, Dec. 3** | Presentations |  |  |  |
| **Thu, Dec. 5** | Presentations  Review for final exam |  | Final exam, Dec.10, 12:30pm -2:30pm |  |

\*Note: The final project presentations will be on the free week.

# USF Standard University Policies

Policies about disability access, religious observances, academic grievances, academic integrity and misconduct, academic continuity, food insecurity, and sexual harassment are governed by a central set of policies that apply to all classes at USF. These may be accessed at: <https://www.usf.edu/provost/faculty/core-syllabus-policy-statements.aspx>

**Grades of "Incomplete"**: Offer specifics about your policy on incomplete grades.

The current university policy concerning incomplete grades will be followed in this course.

For USF Tampa undergraduate courses and USFSM undergraduate and graduate courses: An “I” grade may be awarded to a student only when a small portion of the student’s work is incomplete and only when the student is otherwise earning a passing grade. The time limit for removing the “I” is to be set by the instructor of the course. For undergraduate students, this time limit may not exceed two academic semesters, whether or not the student is in residence, and/or graduation, whichever comes first. For graduate students, this time limit may not exceed one academic semester. “I” grades not removed by the end of the time limit will be changed to “IF” or “IU,” whichever is appropriate.

For USF Tampa graduate courses and USFSP undergraduate and graduate courses: An Incomplete grade ("I") is exceptional and granted at the instructor’s discretion only when students are unable to complete course requirements due to illness or other circumstances beyond their control. The course instructor and student must complete and sign the "I" Grade Contract Form that describes the work to be completed, the date it is due, and the grade the student would earn factoring in a zero for all incomplete assignments. The due date can be negotiated and extended by student/instructor as long as it does not exceed two semesters for undergraduate courses and one semester for graduate courses from the original date grades were due for that course. An "I" grade not cleared within the two semesters for undergraduate courses and one semester for graduate courses (including summer semester) will revert to the grade noted on the contract.

**Make-up Exams Policy**:

*If a student cannot be present for an examination for a valid reason (validity to be determined by the instructor), a make-up exam will be given only if the student has notified the instructor in advance that s/he cannot be present for the exam. Make-up exams are given at the convenience of the instructor.*

**Exam Retention Policy**:

*The exams will be retained for one semester following the current one, and then they will be destroyed.*

**Group Work Policy**:

*Everyone must take part in a group project. All members of a group will receive the same score for proposal, report, presentation, and codes.*

**Final Examinations Policy**: *All final exams are to be scheduled in accordance with the University’s final examination policy.*

# Course Policies: Technology and Media (as applicable)

**Canvas:**

This course will be offered via USF's learning management system (LMS), Canvas. If you need help learning how to perform various tasks related to this course or other courses being offered in Canvas, please view the following videos or consult the Canvas help guides. You may also contact USF's IT department at (813) 974-1222 or [help@usf.edu](mailto:help@usf.edu).

**Online proctoring (optional based on use):**

Canvas-based tests and/or quizzes within this course may require online proctoring. Students are therefore required to have a webcam with a microphone (either USB or mounted into your computer)

*Students understand that this remote recording device is purchased and controlled by the student and that recordings from any private residence must be done with the permission of any person residing in the residence. To avoid any concerns in this regard, students should select private spaces for the testing. The University library and other academic sites at the University offer secure private settings for recordings and students with concerns may discuss location of an appropriate space for the recordings with their instructor or advisor. Students must ensure that any recordings do not invade any third-party privacy rights and accept all responsibility and liability for violations of any third-party privacy concerns. Setup information will be provided prior to taking the proctored exam. For additional information about online proctoring you can visit the* [*online proctoring student FAQ*](http://www.usf.edu/innovative-education/resources/student-services/online-proctoring.aspx)*.*

# Course Technology & Student Support

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**Academic Accommodations:**

Students with disabilities are responsible for registering with Students with Disabilities Services (SDS) in order to receive academic accommodations. For additional information about academic accommodations and resources, you can visit the SDS website at <http://www.usf.edu/student-affairs/student-disabilities-services/> .

**Academic Support Services:**

The USF Office of Student Success coordinates and promotes university-wide efforts to enhance undergraduate and graduate student success. For a comprehensive list of academic support services available to all USF students, please visit the Office of Student Success website at- [http://www.usf.edu/student-success/](http://www.usf.edu/student-success/undergrads/)

**Canvas Technical Support:**

Include information where students can find technical support.

*Example: If you have technical difficulties in canvas, you can find access to the canvas guides and video resources in the “Canvas Help” page on the homepage of your canvas course. You can also contact the help desk by calling 813-974-1222 in Tampa or emailing* [*help@usf.edu*](mailto:help@usf.edu)*.*

# Important Dates to Remember

You can find all important date at:

<http://www.usf.edu/registrar/calendars/> I reserve the right   
to modify the course syllabus or schedule at any time during the course to address changes needed in content, course outline, exam dates, etc.

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