CSCI 115 SYLLABUS

ALGORITHMS AND DATA STRUCTURES

INTRODUCTION

In computer science, a data structure is a particular way of organizing and storing data in a computer so that it can be accessed and modified efficiently. For example, in an application, information has to be searched very often in the data structure, therefore it is critical to select a data structure that will provide the most efficient methods in terms of speed for searching information. If the data will change over time, through the addition or deletion of information, it is critical to select the right data structure that will not reduce the performance of the system. In this core computer science course, students will learn the main types of data structures, the analysis of their complexity and associated methods, and how they are implemented. Different applications will illustrate the rationale of the choice of the data structures, from operating systems to image processing and video games.

SYLLABUS FOR ALGORITHMS AND DATA STRUCTURES (CSCI 115)	
Semester: Semester 2 – Spring 2020	**Program/Department** **California State University, Fresno**
Course Name: Algorithms and Data Structures	**Instructor Name: Dr. Hubert Cecotti (class)** **Dr. Dhanyu Amarasinghe (labs)**
Units: 4	**Office Location: 263 Sci2**
Time: MWF 9-9:50AM (classes)	**E-Mail: hcecotti@csufresno.edu (classes)** **dhanyu@mail.fresnostate.edu (labs)** **(subjects must include [CSCII115])**
Location: Industrial Tech Bldg Rm 294	**Telephone: 559.278.4373**
Website: Canvas (section content)	**Office Hours: Tu-Th 8-12am**

Course description: Review of basic data structures. Graph, search paths, and spanning trees. Algorithm design and analysis of sorting, merging, and searching. Memory management, hashing, dynamic storage allocation. Integration of data structures into system design. Algorithms and data structures is a fundamental and core course in computer science. This course is important and provides the key concept for analyzing

the complexity of an algorithm and the main data structures that are used in various domains, including operating systems.

Prerequisites for the course: CSCI 41, CSCI 60, MATH 75.

REQUIRED COURSE MATERIALS

The course will be based on the following books:

- Introduction to Algorithms, 3rd Edition, by T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, The MIT Press.
- Algorithms and data structures, by N. Wirth (available online for free)
- Data structures and Algorithm analysis in C++, 4th Edition, by M. A. Weiss, Pearson.

It is not essential to acquire the books as some equivalent content can be found online. Links will be provided on Canvas for the different classes.

- A book (pdf file) will provided for free containing the implementation of all the algorithms given in the class.

COURSE SPECIFICS

Summary/outline of the course: The course will start with an introduction about algorithms and data structures. The students will analyze and implement various data structures and their associated methods to insert, delete, and search data. The course will start with the analysis of the complexity of algorithms, and how algorithms can be analyzed. Some statistical tools will be provided to evaluate the significance of recorded times during simulations. The course will start with arrays, queues, stacks, then lists (linked lists, doubly linked lists, skip lists). Hash tables will be presented. A substantial part of the course will be dedicated to trees (binary, AVL, B-trees, Red Black). Different types of heaps will be presented. The third part of the course will be about graphs. Finally, the course will end with strategies about the implementation of matrices and tensors and the effects of multithreading on data structures.

The outline may change in response to the feedback of the students.

Course goals: At the end of this course, you will know all the main data structures that are used, you will be able to implement all these data structures in C++ by managing appropriately the memory. You will be able to analyze algorithms and select the most appropriate algorithms for a particular problem.

Student Learning Outcomes:

- Students should demonstrate solid understanding of fundamental concepts and principles of data structures, and how they are applied in problems.

- Students should demonstrate solid problem solving skills in algorithms by choosing the appropriate implementation, data structures, and methods to manage data (in particular insertion, deletion, and search).
- Students should be able to program in C++ to implement data structures by using appropriately classes and managing memory efficiently.
- Students should embrace the love of well-written, well-structured and well-documented code refactoring the examples given during the class and the lab.
- Students should be able to work as a team to solve larger scale problem and use current social media tools to communicate efficiently and share files in their projects.
- Students should be able to present technical findings effectively, write well-structured and well-presented reports and presentations to communicate their findings with both computer science professionals and general audience.

Instruction for significant assignments:

The following elements represent the different assignments for the module. More information about each assignment will be given on Canvas and during the class:

- **Project: Shortest paths (group project – 2 students maximum)**
  - **Project Based-Learning**
  - It is a 2D application where the user select a character in the environment and a target location. The view is from the top. Then, the character will move case by case towards to target location by using the shortest path. There are multiple types of characters: the regular human who can just walk and not go in the water or cross the high mountains, the bird that can fly over mountains but that cannot go in the desert, the fish that must stay in the water, and the frog that can go everywhere except on the mountains and the desert.
  - The human, bird, fish, and frog cannot be on the same cell.
  - We consider the environment represented as a matrix. The environment contains different types of cells high mountain, middle mountain, foothills, plain, forest, desert, beach, ocean. In relation to the terrain, the character can take more time to move to one vertex to another vertex in the graph.
  - The terrain should include special features such as tunnels in the mountains.
  - The terrain should be created randomly or loaded from a file.
  - The environment can be stored in a text file where each character represents a type of cell in the matrix.

Grading policy:
The percent score is computed according to the following division:

- Attendance: 5%
- Lab assignments: 15%
- Project : 20%
- Midterm 1: 15% (from week 1 to the week of Midterm 1)
- Midterm 2: 15% (from the week of Midterm 1 to the week of Midterm 2)
- Final exam: 30% (comprehensive: from week 1 to week 16)

Cut-off points on percent for each grade:

- A: [85-100]%
- B: [70-84]%
- C: [60-69]%
- D:[50-59]%
- F: [0-49]%

All midterm and final examinations are close book and comprehensive, unless otherwise stated on Canvas and during the class. Seating in examinations may be assigned by the instructor randomly. The final grading scale could be modified lower, subject to criteria of uniformity and fairness. All the assignments and communication must be sent directly to the instructor.

Assignment and examination schedule

Due Date	Assignment	Points/Percent
NA	Attendance and participation (a maximum of 3 justified absences will not impact the mark)	5
NA	Lab assignments	15
W15	Project : Shortest path	20
TBA	Midterm 1: Week 8 (during lab session)	15
TBA	Midterm 2: Week 13 (during lab session)	15
	Final exam	30

A course calendar will be available on Canvas.

ONLINE CLASS UPDATE

As part of your participation in virtual/online instruction, please remember that the same student conduct rules that are used for in-person classroom instruction also apply for virtual/online classrooms.

Students are prohibited from any unauthorized recording, dissemination, or publication of any academic presentation, including any online classroom instruction, for any commercial purpose. In addition, students may not record or use virtual/online instruction in any manner that would violate copyright law.

Students are to use all online/virtual instruction exclusively for the educational purpose of the online class in which the instruction is being provided. Students may not re-record any online recordings or post any online recordings on any other format (e.g. electronic, video, social meda, audio recording, web page, internet, hard paper copy, etc.) for any purpose without the explicit written permission of the faculty member providing the instruction.

Exceptions for disability-related accommodations will be addressed by Student Disability Services working in conjunction with the student and faculty member.

COURSE POLICIES & SAFETY ISSUES

Cell phones and tablets should be off during the class. Chewing gum, tobacco, wearing baseball caps, reading newspapers in class or other distracting behavior, bringing visitors, children or guests will not be allowed during the class. If you are caught using social media (Facebook, Twitter, Snapchat,…) during the class, you will be asked to leave the room. During parts of the class where you are asked to solve a problem, to suggest a solution, you will be allowed to work in collaboration.

The University Policy on Disruptive Classroom Behavior (APM 419) is well worth reading and can be found in the Class Schedule and the Academic Policy Manual.

Late work and make-up work policy. Give your make-up work policy due to student absence. Finally, include your late work policy if that is separate from the make-up work policy, and make clear the requirements for attendance of the final examination and the impact on his/her grade.

Adding and Dropping Classes: Students are responsible for understanding the policies and procedures about the adding/dropping of classes, academic renewals, etc. Students can find more information on adding and dropping at http://www.fresnostate.edu/studentaffairs/classschedule/registration/add-drop.html.

If you are absent from class, it is your responsibility to check on announcements made while you were away.

Plagiarism Detection: The campus subscribes to Turnitin and the SafeAssign plagiarism prevention service through Canvas, and you will need to submit written assignments to Turnitin/SafeAssign. Student work will be used for plagiarism detection and for no other purpose. The student may indicate in writing to the instructor that he/she refuses to participate in the plagiarism detection process, in which case the instructor can use other electronic means to verify the originality of their work. Turnitin/SafeAssign Originality Reports **will not be available for your viewing.**

UNIVERSITY POLICIES AND SERVICES

The syllabus must note the university **Policy on Students with Disabilities, the University Honor Code, the Policy on Cheating and Plagiarism**, a **statement on copyright**, and the **university computer requirement** University policies can be included in the syllabus by reference to statements in the University Catalog and Class Schedule. For example, you might state: "For information on the University's policy regarding cheating and plagiarism, refer to the Class Schedule (Legal Notices on Cheating and Plagiarism) or the University Catalog (Policies and Regulations)." You may also direct students to the online required syllabus policy statement page

(http://www.csufresno.edu/academics/documents/RequiredSyllabusPolicyStatements_001.doc)

Below are statements that provide more than just the reference. In all instances, it is recommended that specific examples of what you consider to be cheating and plagiarism be included in **your course policy section**.

Students with Disabilities: Students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Services to Students with Disabilities in the Henry Madden Library, Room 1202 (278-2811). Students with disabilities may contact the instructor if they require specific arrangements.

Honor Code: "Members of the Fresno State academic community adhere to principles of academic integrity and mutual respect while engaged in university work and related activities."

Cheating and Plagiarism: Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work. Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to expulsion from the university. For more information on the University's policy regarding cheating

and plagiarism, refer to the Class Schedule (Legal Notices on Cheating and Plagiarism) or the University Catalog (Policies and Regulations).

Computers: "At California State University, Fresno, computers and communications links to remote resources are recognized as being integral to the education and research experience. Every student is required to have his/her own computer or have other personal access to a workstation (including a modem and a printer) with all the recommended software. The minimum and recommended standards for the workstations and software, which may vary by academic major, are updated periodically and are available from Information Technology Services (http://www.fresnostate.edu/technology) or the University Bookstore (http://www.kennelbookstore.com). In the curriculum and class assignments, students are presumed to have 24-hour access to a computer workstation and the necessary communication links to the University's information resources."

Disruptive Classroom Behavior: "The classroom is a special environment in which students and faculty come together to promote **learning** and **growth**. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. Differences of viewpoint or concerns should be expressed in terms which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop an understanding of the community in which they live. Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."

Audio and video recordings of class lectures are prohibited unless I give you explicit permission to do it. Students with an official letter from the Services for Students with Disabilities office may record the class if SSD has approved that service.

Copyright Policy: Copyright laws and fair use policies protect the rights of those who have produced the material. The copy in this course has been provided for private study, scholarship, or research. Other uses may require permission from the copyright holder. The user of this work is responsible for adhering to copyright law of the U.S. (Title 17, U.S. Code). To help you familiarize yourself with copyright and fair use policies, the University encourages you to visit its

Copyright Web Page https:/library.fresnostate.edu/info/copyright-policy

Canvas course web sites contain material protected by copyrights held by the instructor, other individuals or institutions. Such material is used for educational purposes in accord with copyright law and/or with permission given by the owners of the original material. You may download one copy of the materials on any single computer for non-commercial, personal, or educational purposes only, provided that you (1) do not modify it, (2) use it only for the duration of this course, and (3) include both this notice and any copyright notice originally included with the material. Beyond this use, no material from the course

web site may be copied, reproduced, re-published, uploaded, posted, transmitted, or distributed in any way without the permission of the original copyright holder. The instructor assumes no responsibility for individuals who improperly use copyrighted material placed on the web site.

For free tutoring on campus, contact the Learning Center

(http://fresnostate.edu/studentaffairs/lrc) in the Collection Level (basement level) of the Henry Madden Library. You can reach them by phone at 559.278.3052.

Our campus has developed SupportNet

(http://fresnostate.edu/studentaffairs/lrc/supportnet) to connect students with specific campus resources promoting academic success. Students may be referred to it if you believe they need the services provided by SupportNet to succeed in your course.

SUBJECT TO CHANGE STATEMENT

This syllabus and schedule are subject to change in the event of extenuating circumstances. Students will be contacted promptly to avoid any inconvenience.

STUDENT HANDBOOK

Information on student rights, responsibilities, academic honesty, etc., can be found on the Fresno State Student Handbook web page. The web page is located at: http://www.fresnostate.edu/studentaffairs/division/general/studenthandbook/.