Continuing Education
1717 S. Chestnut Ave.
Fresno, CA 93702-4709
(800) 372-5505
https://ce.fresno.edu

CSED-740/904: Data Structures, Algorithms & Software Engineering

Independent Study Online Course Syllabus

Instructor: Simon Sultana, PhD **Phone:** (559) 492-9878 **Email:** simon.sultana@fresno.edu	**Number of Graduate Semester Units:** 4 units **Target Audience:** K-14th grade teachers **Course Access:** https://connect.fresno.edu

Course Description

The course aims to prepare educators to successfully teach advanced computer programming for high school students in all curricular areas. Students will continue to develop their background in computer programming with the study of data structures; including arrays, linked lists, stacks, queues, and hash tables. Algorithms to manage these structures will also be a focus, including searching and sorting. Software engineering techniques will also be presented throughout the course. Active learning and teaching techniques will be emphasized. All students should have a computer with webcam, headset with microphone, and reliable internet connection.

Note: Required book must be acquired separately.

Required Texts and Course Materials

Book: zyBooks, register and connect via Moodle before first meeting. Click on your zyBooks link in Moodle (Do not go to the zyBooks website and create a new account); Subscribe to zyBooks.

Note: Students are responsible for purchasing their own subscription to this course-specific title, analyzing the content, and applying what they learned to the course assignments.

Online Resources: Relevant online resources that support the course content and encourage further investigation will be available throughout the course assignments. Active hyperlinks are utilized throughout the course and will link to the appropriate information when clicked. These include videos, podcasts, worksheets, online activities, journal articles and other resources.

Canvas: This course will be delivered totally online. Canvas is a web-based learning management system (LMS) that provides students access to online resources, documents, videos, assignments, quizzes, forums, etc. Canvas is easy to learn and has a user-friendly interface.

Course Dates

Self-paced; students may enroll at any time and take up to one year, from the date of registration, to complete assignments. Students may complete assignments in no less than three weeks for a 3-unit course (one week per unit).

National Standards Addressed in This Course

National Board for Professional Teaching Standards (NBPTS)
(http://www.nbpts.org/standards-five-core-propositions/)

First published in 1989 and updated in 2016, *What Teachers Should Know and Be Able to Do* articulates the National Board's Five Core Propositions for teaching. The Five Core Propositions - comparable to medicine's Hippocratic Oath — set forth the profession's vision for accomplished teaching. Together, the propositions form the basis of all National Board Standards and the foundation for National Board Certification. Course assignments have been designed so students can demonstrate excellence against these professional teaching standards whenever possible.

- Proposition 1: Teachers are committed to students and their learning
- Proposition 2: Teachers know the subject they teach and how to teach those subjects to students
- Proposition 3: Teachers are responsible for managing and monitoring student learning
- Proposition 4: Teachers think systematically about their practice and learn from experience
- Proposition 5: Teachers are members of learning communities

California K-12 Computer Science Standards (Computer Science Content Standards)
The California Computer Science Standards (hereafter referred to as "the standards") are based on computer science core concepts and core practices, aligned to the K12 Computer Science Framework at https://k12cs.org/. The standards were developed by educators (members of the State Board of Education-appointed Computer Science Standards Advisory Committee), utilizing work done by the Computer Science Teachers Association. The standards are designed to be accessible to each and every student in California. The standards inform teachers, curriculum developers, and educational leaders to ensure all students receive quality computer science instruction. (California Computer Science Standards Introduction, 2018)

California K-12 Computer Science Standards addressed in this course include:

- 9-12.CS.1: Describe ways in which abstractions hide the underlying implementation details of computing systems to simplify user experiences.
- 9-12.AP.12: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9-12.AP.14: Justify the selection of specific control structures by identifying tradeoffs associated with implementation, readability, and performance.
- 9-12.AP.15: Iteratively design and develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.
- 9-12.AP.16: Decompose problems into smaller subproblems through systematic analysis, using constructs such as procedures, modules, and/or classes.
- 9-12.AP.17: Create computational artifacts using modular design.
- 9-12.AP.18: Systematically design programs for broad audiences by incorporating feedback from users.
- 9-12.AP.20: Iteratively evaluate and refine a computational artifact to enhance its performance, reliability, usability, and accessibility..

- 9-12.AP.22: Document decisions made during the design process using text, graphics, presentations, and/or demonstrations in the development of complex programs.
- 9-12.IC.23: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 9-12.IC.24: Identify impacts of bias and equity deficit on design and implementation of computational artifacts and apply appropriate processes for evaluating issues of bias.
- 9-12.IC.25: Demonstrate ways a given algorithm applies to problems across disciplines.
- 9-12S.AP.12: Implement searching and sorting algorithms to solve computational problems.
- 9-12S.AP.13: Evaluate algorithms in terms of their efficiency.
- 9-12S.AP.14: Compare and contrast fundamental data structures and their uses.
- 9-12S.AP.15: Demonstrate the flow of execution of a recursive algorithm.
- 9-12S.AP.19: Plan and develop programs for broad audiences using a specific software life cycle process.
- 9-12S.AP.24: Evaluate key qualities of a program through a process such as a code review.

Continuing Education Student Learning Outcomes (CE-SLO)

CE-SLO 1	Demonstrate proficient written communication by articulating a clear focus, synthesizing arguments, and utilizing standard formats in order to inform and persuade others, and present information applicable to targeted use.
CE-SLO 2	Demonstrate comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
CE-SLO 3	Reflect on their personal and professional growth and provide evidence of how such reflection is utilized to manage personal and professional improvement.
CE-SLO 4	Apply critical thinking competencies by generating probing questions, recognizing underlying assumptions, interpreting and evaluating relevant information, and applying their understandings to the professional setting.
CE-SLO 5	Reflect on values that inspire high standards of professional and ethical behavior as they pursue excellence in applying new learning to their chosen field.
CE-SLO 6	Identify information needed in order to fully understand a topic or task, organize that information, identify the best sources of information for a given enquiry, locate and critically evaluate sources, and accurately and effectively share that information.

Course Student Learning Outcomes (C-SLO)

Student Learning Outcomes for This Course By the end of this course student will be able to:		**National Standards Addressed***	**CE-SLO Addressed****
C-SLO 1	Utilize advanced concepts in programming; including classes, exceptions, and graphics	NBPTS 2, 4	CE 2, 4
C-SLO 2	Implement algorithms using classic data structures; including lists, dictionaries, linked	NBPTS 2, 4	CE 2, 4

	lists, stacks, queues, hash tables to solve problems.		
C-SLO 3	Analyze algorithm efficiency of classic solutions to problems.	NBPTS 2, 4	CE 2, 4
C-SLO 4	Demonstrate practices used in the development of software.	NBPTS 2, 4	CE 2, 4
C-SLO 5	Develop a summative project that utilizes classic data structures and algorithms covered in this course.	NBPTS 1, 2, 4	CE 1, 2, 4, 6
C-SLO 6	Discuss the ethical implications of software projects.	NBPTS 1, 2, 4	CE 1, 2, 3, 4, 5

* Please refer to the section on **National Standards Addressed in This Course**
** Please refer to the section on **Continuing Education Student Learning Outcomes**

Topics, Assignments, and Activities

Module Title	Module Assignments and Activities	Points Possible for Each Assignment
Welcome Module	• Welcome Video • Course Syllabus • Introduce Yourself Forum • Course Forum: Data and Christianity	
Module 1 – Classes & Objects; Inheritance	1.1 zyBooks Participation Activities Module 1 1.2 Problems 1.3 POGIL Walkthrough – Classes 1.4 Project Idea Summary	8 40 25 15
Module 2 – Exceptions	2.1 zyBooks Participation Activities Module 2 2.2 Problems 2.3 POGIL – Exceptions 2.4 Project: Problem Statement & Scope 2.5 Discussion Forum – Code Reviews & Stand-Ups	3 10 15 25 25
Module 3 – Lists & Dictionaries	1.1 zyBooks Participation Activities Module 3 1.2 Problems 1.3 POGIL – Lists, Dictionaries, & Software Development 1.4 Project – List or Dictionary	9 40 25 40
Module 4 – Arrays & Recursion	4.1 zyBooks Participation Activities Module 4 4.2 Problems 4.3 POGIL – Data Structures: Arrays 4.4 Project – Stand-Up Video	7 10 15 15
Module 5 – Searching, Sorting, & Algorithm Analysis	5.1 zyBooks Participation Activities Module 5 5.2 Problems 5.3 POGIL – Searching, Sorting, & Algorithm Analysis 5.4 Project – Searching and Sorting	16 20 30 40
Module 6 – Linked Lists	6.1 zyBooks Participation Activities Module 6 6.2 Problems 6.3 POGIL – Linked Lists, Software Development Life Cycles 6.4 Project – Linked List	13 30 25 40
Module 7 – Stacks & Queues	7.1 zyBooks Participation Activities Module 7 7.2 Problems 7.3 POGIL – Stacks and Queues 7.4 Project – Stack or Queue	6 20 25 40

Module Title	Module Assignments and Activities	Points Possible for Each Assignment
Module 8 – Hash Tables	8.1 zyBooks Participation Activities Module 8 8.2 Problems 8.3 POGIL – Hashing, Handling Collisions 8.4 Project – Hash Table	12 20 20 40
Module 9 – Graphics & Engineering Ethics	9.1 zyBooks Participation Activities Module 9 9.2 Real Python's Tkinter tutorial 9.3 Design-a-POGIL Activity: Python Graphics 9.4 Software Engineering Ethics Module/Discussion Forum 9.5 Project – Stand-Up Video	2 9 30 40 15
Module 10 - Projects	10.1 Completed Course Project 10.2 Grade 9-12 Modified Course Project Assignment	120 60
Course Wrap-up – Grading and Evaluation	• Final Reflection Forum • Course Evaluation • Course Completion Checklist • Grade Request / Transcript Request	
	TOTAL POINTS	**1000 points**

Grading Policies, Rubrics, and Requirements for Assignments

Grading Policies

- Assignments will be graded per criteria presented in the course rubrics.
- The discernment between letter grades is at the discretion of the instructor based on the quality of work submitted (see appropriate course rubric).
- All assignments must be completed to receive a grade and are expected to reflect the quality that teacher-training institutions require of professional educators. If completed assignments do not meet this standard, students will be notified with further instructions from the instructor.

Grading Rubrics (for CSED-740)

Grade	Percent	Description	Rubric
A A -	92.0-100% 90.0-91.9%	Outstanding Outstanding -	Outstanding in every way. Meets all course / assignment requirements with significant evidence of subject mastery and demonstration of outstanding graduate level scholarship.
B + B B -	88.0-89.9% 82.0-87.9% 80.0-81.9%	Good + Good Good -	Meets criteria for all course/assignment requirements - demonstrates subject competency with good graduate level scholarship.
C + C C -	78.0-79.9% 72.0-77.9% 70.0-71.9%	Marginal + Marginal Marginal -	Marginally meets criteria for all course/assignment requirements - demonstrates marginal graduate level scholarship.
F	Below 70.0%	Unsatisfactory	Does not meet the minimum criteria for all course/assignment requirements and demonstrated little, if any, evidence of satisfactory graduate level scholarship.

Grading Rubrics (for CSED-904)

Grade	Percent	Description	Rubric
A	90.0-100%	Outstanding	Outstanding in every way. Meets all course / assignment requirements with significant evidence of subject mastery and demonstration of outstanding graduate level scholarship.
B	80.0-89.9%	Good	Meets criteria for all course/assignment requirements - demonstrates subject competency with good graduate level scholarship.
N/C	Below 80.0%	Unsatisfactory	Does not meet the minimum criteria for all course/assignment requirements and demonstrated little, if any, evidence of satisfactory graduate level scholarship.

Writing Requirements

- **Superior:** Writing is clear, succinct, and reflects graduate level expectations. Clearly addresses all parts of the writing task. Maintains a consistent point of view and organizational structure. Includes relevant facts, details, and explanations.
- **Standard:** Writing is acceptable with very few mistakes in grammar and spelling. Addresses most parts of the writing task. Maintains a mostly consistent point of view and organizational structure. Includes mostly relevant facts, details, and explanations.
- **Sub-standard:** Writing contains noticeable mistakes in grammar and spelling. Does not address all parts of the writing task. Lacks a consistent point of view and organizational structure. May include marginally relevant facts, details, and explanations.

Lesson Plan Requirements

- **Superior:** Instructional goals and objectives clearly stated. Instructional strategies appropriate for learning outcome(s). Method for assessing student learning and evaluating instruction is clearly delineated and authentic. All materials necessary for student and teacher to complete lesson clearly listed.
- **Standard:** Instructional goals and objectives are stated but are not easy to understand. Some instructional strategies are appropriate for learning outcome(s). Method for assessing student learning and evaluating instruction is present. Most materials necessary for student and teacher to complete lesson are listed.
- **Sub-standard:** Instructional goals and objectives are not stated. Learners cannot tell what is expected of them. Instructional strategies are missing or strategies used are inappropriate. Method for assessing student learning and evaluating instruction is missing. Materials necessary for student and teacher to complete lesson are missing.

Instructor/Student Contact Information

Throughout the course participants will be communicating with the instructor and their classmates on a regular basis using asynchronous discussion forums. Students are provided with instructor contact information in the event they want to make email or phone contact. In addition, students are encouraged to email or phone the instructor at any time. Students will also receive feedback on the required assignments as they are submitted.

Forums

Participation is an important expectation of this course and all online courses. Online forums promote reflection and analysis while allowing students to appreciate and evaluate positions that others express. While students may not be engaging with the same students throughout this course they will be expected to offer comments, questions, and replies to the discussion question whenever possible. The faculty role in the discussion forum is that of an observer and facilitator.

Coursework Hours

Based on the Carnegie Unit standard, a unit of graduate credit measures academic credit based on the number of hours the student is engaged in learning. This includes all time spent on the course: reading the textbook, watching videos, listening to audio lessons, researching topics, writing papers, creating projects, developing lesson plans, posting to discussion boards, etc. Coursework offered for FPU graduate credit adheres to 60 hours per semester unit for the 700-level courses and 45 hours per semester unit for the 900-level courses. Therefore, a student will spend approximately 180 hours (700-level) or 135 hours (900-level) for a typical 3-unit course.

Services for Students with Disabilities

Students with disabilities are eligible for reasonable accommodations in their academic work in all classes. In order to receive assistance, the student with a disability must provide the Academic Support Center with documentation, which describes the specific disability. The documentation must be from a qualified professional in the area of the disability (i.e. psychologist, physician or educational diagnostician). Once documentation is on file, arrangements for reasonable accommodations can be made. For more information and for downloadable forms, please go to https://www.fresno.edu/departments/disability-access-education.

Plagiarism and Academic Honesty

All people participating in the educational process at Fresno Pacific University are expected to pursue honesty and integrity in all aspects of their academic work. Academic dishonesty, including plagiarism, will be handled per the procedures set forth in the Fresno Pacific University Catalogue - https://www.fresno.edu/students/registrars-office/academic-catalogs

Technology Requirements

To successfully complete the course requirements, course participants will need Internet access, can send and receive email, know how to manage simple files in a word processing program, and have a basic understanding of the Internet. Please remember that the instructor is not able to offer technical support. If you need technical support, please contact your Internet Service Provider.

Getting Help with Canvas: If you need help with Canvas, please contact the FPU Help Desk by phone: (559) 453-3410 or email: helpdesk@fresno.edu. Help is available Mon-Fri 8:00 am to 7:00 pm.

Final Course Grade and Transcripts

When all work for the course has been completed, students will need to logon to the Continuing Education website (https://ce.fresno.edu/my-account) and “Request Final Grade”. Once the

instructor receives the requests and submits the grade online, students may log back in to view their Final Grade Report or order transcripts online. Please allow at least two weeks for the final grade to be posted. For more information, see the Continuing Education Policies and Procedures at https://ce.fresno.edu/ce-policies-and-procedures.

University Policies and Procedures

Students are responsible for becoming familiar with the information presented in the Academic Catalog and for knowing and observing all policies and procedures related to their participation in the university community. A summary of university policies may be found on the university website at https://www.fresno.edu/departments/registrars-office/academic-catalogs.

Fresno Pacific University Student Learning Outcomes (FPU-SLO)

FPU-SLO 1	**Student Learning Outcomes Oral Communication:** Students will *exhibit* clear, engaging, and confident oral communication – in both individual and group settings – and will critically *evaluate* content and delivery components.
FPU-SLO 2	**Written Communication:** Students will *demonstrate* proficient written communication by *articulating* a clear focus, *synthesizing* arguments, and utilizing standard formats in order to *inform* and *persuade* others.
FPU-SLO 3	**Content Knowledge:** Students will *demonstrate* comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts.
FPU-SLO 4	**Reflection**: Students will *reflect* on their personal and professional growth and *provide evidence* of how such reflection is utilized to manage personal and vocational improvement.
FPU-SLO 5	**Critical Thinking:** Students will *apply* critical thinking competencies by *generating* probing questions, *recognizing* underlying assumptions, *interpreting* and *evaluating* relevant information, and *applying* their understandings to new situations.
FPU-SLO 6	**Moral Reasoning:** Students will *identify* and *apply* moral reasoning and ethical decision-making skills, and *articulate* the norms and principles underlying a Christian world-view.
FPU-SLO 7	**Service**: Students will *demonstrate* service and reconciliation as a way of leadership.
FPU-SLO 8	**Cultural and Global Perspective:** Students will *identify* personal, cultural, and global perspectives and will employ these perspectives to *evaluate* complex systems.
FPU-SLO 9	**Quantitative Reasoning**: Students will accurately *compute* calculations and symbolic operations and *explain* their use in a field of study.
FPU-SLO 10	**Information Literacy:** Students will *identify* information needed in order to fully understand a topic or task, *explain* how that information is organized, *identify* the best sources of information for a given enquiry, *locate* and critically *evaluate* sources, and accurately and effectively *share* that information.