EDG 4431: Data Representation and Structures for Teachers.

3 Credits

COURSE SYLLABUS

Semester: Fall 2026
Course Type: 100% Full Distance Learning
Instructor: Dr. Zafer Unal
Office Hours: Online with Appointment
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I. Welcome!

This course provides a foundational understanding of how computers represent, organize, and manipulate data, specifically designed for K-12 educational settings. We will explore fundamental concepts including data types, number systems, and essential data structures. You will learn to distinguish between different variable types, convert between binary, decimal, and hexadecimal, and understand the characteristics and uses of arrays, linked lists, stacks, and queues. We will also delve into object-oriented programming concepts, focusing on class design and data encapsulation. By the end of this course, you'll have a robust understanding of data representation, empowering you to demystify computer science concepts for your students and enhance their computational literacy!

II. University Course Description

This course provides educators with foundational understanding of data representation and structures. Students learn to distinguish data types, convert between number systems (binary, decimal, hexadecimal), and understand fundamental data structures including arrays, linked lists, stacks, and queues. Topics include object-oriented design principles, variable scope, and class declarations with access specifiers.

III. Course Prerequisites

None

IV. Course Purpose

This course serves as a foundational introduction to data representation and structures. As digital literacy becomes increasingly vital, this course equips K-12 teachers with the theoretical knowledge and practical understanding of how data is stored and organized by computers. The course focuses on exploring and practicing these core concepts, making it essential for educators seeking to build a strong foundation in computer science principles and foster logical reasoning in their students.

V. Course Format

This fully online course is structured through weekly modules that combine asynchronous recorded lectures with hands-on technical demonstrations and projects. Students engage through discussion boards for peer interaction and complete practical assignments applying AI tools to educational scenarios. The course offers flexibility through asynchronous learning while maintaining support through individual consultation sessions with the instructor as needed.

VI. Student Learning Outcomes

Upon completion of this course, students will be able to:

- Distinguish between constants and variables and between local and global identifiers.
- Distinguish between integer, real number, character, string, Boolean, and object data types.
- Recognize and convert between binary, decimal, and hexadecimal number systems.
- Identify characteristics and uses of data structures, including arrays, linked lists, stacks, queues, and sets.
- Distinguish between instance, class, and local variables in an object-oriented design.
- Identify components of class declarations for an object-oriented program and distinguish between public and private access specifiers.

VII. Course Objectives

Students will:

- Differentiate the use of constants and variables through practical coding examples and classroom scenario analyses.
- Select appropriate data types for representing different kinds of information in program designs.
- Demonstrate proficiency in converting numbers between binary, decimal, and hexadecimal systems.
- Model real-world scenarios using the appropriate data structure (array, stack, queue, etc.) and justify the selection.
- Create simple class diagrams that correctly implement instance, class, and local variables.
- Develop a simple class declaration that appropriately uses public and private access specifiers to enforce encapsulation.

VIII. Required Texts and/or Readings and Course Materials

- There are no required text in this course. All of the course materials (videos, readings etc. will be available on the course website with free access. A computer with internet access and capable of running AI applications is required for this course.

IX. Supplementary (Optional) Texts and Materials

NA

X. How to Succeed in this Course

To succeed in this course, students should establish strong study habits from the beginning. This includes completing all weekly readings prior to attempting practical exercises and actively engaging with technical demonstrations. Time management is crucial - start assignments well before deadlines to allow for troubleshooting and maintain detailed documentation of your technical implementation process. Regular engagement with course materials, peers, and AI tools

is essential for building practical skills. Finally, always maintain backup copies of all project work to prevent any potential data loss during technical exercises.

XI. Academic Continuity

As this course is already fully online, any disruptions due to emergencies or severe weather will have minimal impact on course delivery. All course materials, including recorded lectures, assignments, and resources, will remain accessible through Canvas. If USF systems are impacted, backup copies of essential materials will be made available through Microsoft Teams. The instructor will communicate any changes or contingency plans through Canvas announcements and email. While most activities are asynchronous, any scheduled synchronous sessions (like individual consultations) will be rescheduled if disrupted, with alternative times communicated through Canvas.

XII. Communication

Primary communication for this course will be through Canvas messaging and announcements. For urgent matters, you may contact your instructor with the email provided on top. Your instructor typically responds to messages within 24 hours during weekdays and 48 hours on weekends. Virtual office hours are available by appointment through Microsoft Teams. Professional communication etiquette is expected in all interactions - please include your name and course number in email subjects.

XIII. Grading Scale

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

XIV. Grade Categories and Weights

The final grade is directly tied to the mastery of each sub-competency. Each assignment will be graded using a specialized rubric designed to assess mastery of its corresponding sub-competency.

Sub-Competency	Assessments	Weight of final Grade
2.1: Distinguish between constants and variables and between local and global identifiers.	Discussion 2.1: Constants in the Classroom, Quiz 2.1: Identifiers and Scope	15%
2.2: Distinguish between integer, real number, character, string, Boolean, and object data types.	Discussion 2.2: Choosing the Right Data Type, Data Type Application Assignment 2.2	20%
2.3: Recognize and convert between binary, decimal, and hexadecimal number systems.	Discussion 2.3: Number Systems in Everyday Tech, Quiz 2.3: Number Base Conversion	15%

2.4: Identify characteristics and uses of data structures, including arrays, linked lists, stacks, queues, and sets.	Discussion 2.4: Real-World Data Structures, Data Structure Modeling Project 2.4	20%
2.5: Distinguish between instance, class, and local variables in an object-oriented design.	Discussion 2.5: Variable Scope in OOP, Quiz 2.5: Instance, Class, and Local Variables	15%
2.6: Identify components of class declarations and distinguish between public/private access specifiers.	Discussion 2.6: The Principle of Data Hiding, Class Design Assignment 2.6	10%
Course Participation	Consistent engagement in weekly modules and discussions	5%
TOTAL		100%

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XV. Instructor Feedback Policy & Grade Dissemination

Course modules open every Monday at 12:00 AM and close Sunday at 11:59 PM EST. All assignments must be submitted within this one-week window; late submissions are not accepted given the full week provided for completion. Individual feedback and grades will be posted in Canvas by Wednesday 5:00 PM of the following week. Major assignments like projects and the final portfolio may require additional grading time, which will be communicated in advance. All grades and feedback can be accessed through the Canvas gradebook.

XVI. Course Schedule.

Week	Topics & Subitems	Assessment/Assignment
1	**Constants, Variables, and Identifiers (Sub-competency 2.1):** (1) Variables as named storage (2) Constants vs. Variables (3) Defining sensible names (4) Introduction to scope	**Discussion 2.1: Constants in the Classroom** Identify and describe a real-world scenario from your classroom or school that would be best represented by a constant versus a variable. Justify your choice.
2	**Understanding Scope (Sub-competency 2.1):** (1) Local vs. Global identifiers (2) Procedure and function boundaries (3) The concept of variable lifetime (4) Best practices for variable scope	**Quiz 2.1: Identifiers and Scope** Covers the distinguishing characteristics of constants/variables and local/global identifiers.
3	**Primitive Data Types (Sub-competency 2.2):** (1) Integer and Real numbers (2) Character and String data (3) The Boolean type (4) Choosing the right type for the data	**Discussion 2.2: Choosing the Right Data Type** Given a list of data items (e.g., student grade average, student ID, attendance status, school name), propose the most appropriate primitive data type for each and explain your reasoning.

4	**Object Data Types and Manipulation (Sub-competency 2.2):** (1) Static vs. Dynamic typing (2) The String class as an object (3) Common string methods (e.g., .substring(), .charAt()) (4) Introduction to wrapper classes	**Data Type Application Assignment 2.2** Design a simple student record structure by selecting appropriate data types (both primitive and object) for each field and write a short justification for each choice.
5	**Positional Number Systems (Sub-competency 2.3):** (1) Base-10 (Decimal) fundamentals (2) Base-2 (Binary) fundamentals (3) The role of bits and bytes (4) Introduction to Base-16 (Hexadecimal)	**Discussion 2.3: Number Systems in Everyday Tech** Research and post an example of where binary or hexadecimal numbers are used in computing or technology (e.g., color codes, memory addresses). Explain why a base other than 10 is used in your example.
6	**Number Base Conversion (Sub-competency 2.3):** (1) Conversion techniques (binary/decimal/hex) (2) Practical conversion exercises (3) The relationship between binary and hex (4) Applications in computing	**Quiz 2.3: Number Base Conversion** Tests proficiency in converting numbers between binary, decimal, and hexadecimal systems.
7	**Introduction to Data Structures (Sub-competency 2.4):** (1) What is a data structure? (2) The Array: random access, fixed size (3) The Linked List: sequential access, dynamic size (4) Comparing arrays and linked lists	**Discussion 2.4: Real-World Data Structures** Describe a real-world analog for either a stack or a queue (e.g., a stack of plates, a line of people). Explain how the addition and removal of items follows the LIFO or FIFO principle.
8	**Linear Data Structures (Sub-competency 2.4):** (1) The Stack (LIFO) and its operations (2) The Queue (FIFO) and its operations (3) The Set and uniqueness (4) Use cases for each structure	**Data Structure Modeling Project 2.4** Choose a classroom process (e.g., handing in assignments, asking questions, managing a resource) and model it using two different data structures. Create a diagram and explain which structure is more efficient and why.
9	**Variables in Object-Oriented Design (Sub-competency 2.5):** (1) Instance variables (object state) (2) Class variables (static, shared) (3) Local variables (method scope) (4) Memory allocation for variables	**Discussion 2.5: Variable Scope in OOP** Consider a Student class. Propose example data that would be stored as an instance variable, as a class variable, and as a local variable within a method. Explain the scope and lifetime of each.
10	**Implementing Variable Types (Sub-competency 2.5):** (1) Syntax for declaring instance/class/local variables (2) The static keyword (3) When to use each type (4) Debugging scope issues	**Quiz 2.5: Instance, Class, and Local Variables** Tests the ability to distinguish between instance, class, and local variables in provided code snippets and class diagrams.
11	**Class Declarations and Blueprints (Sub-competency 2.6):** (1) Classes as blueprints for objects (2) Components of a class (name, variables, methods)	**Discussion 2.6: The Principle of Data Hiding** Why is it a good practice to make instance variables private in a class? Discuss the benefits of controlling access through public methods versus allowing direct access to data.

	(3) The concept of encapsulation (4) Introduction to access specifiers	
12	**Access Specifiers and Data Hiding (Sub-competency 2.6):** (1) public, private, and protected (2) Enforcing integrity with private (3) Providing controlled access with public methods (4) Writing a simple class declaration	**Class Design Assignment 2.6** Write a simple class declaration for a Book object used in a school library. Include at least three instance variables and choose appropriate public or private access specifiers for each, justifying your choices.
13	**Integration & Application:** (1) Case study analysis (2) Applying all competencies to a complex problem (3) Peer review of final portfolio components	**Final Review Discussion** Analyze a case study of a simple program that failed due to poor data representation (e.g., wrong data type, global variable misuse). Identify which sub-competencies were likely neglected and propose a better design.
14	**Synthesis & Portfolio Finalization:** (1) Course synthesis (2) Portfolio assembly and review (3) Future application in K-12 settings	**All Final Assignments Due** Final, polished versions of all major assignments (2.2, 2.4, 2.6) must be submitted as a cumulative portfolio by the end of Week 14.

* Note: The Schedule is subject to revision

XVII. General Education Statement (undergraduate only – Required if a Gen Ed course)

NA

XVIII. Integration of This Course into Your Academic Experience (Gen Ed courses only)

NA

XIX. Global Citizens Project (only required if a GCP course; must be verbatim)

NA

XX. USF Core Syllabus Policies

USF has a set of central policies related to student recording class sessions, academic integrity and grievances, student accessibility services, academic disruption, religious observances, academic continuity, food insecurity, pregnancy and related conditions, and sexual harassment that **apply to all courses at USF**. Be sure to review these online: usf.edu/provost/faculty-success/resources-policies-forms/core-syllabus-policy-statements.aspx

XXI. Course Policies: Grades

Late Work Policy: Offer specifics about your policy on late work.

Each module provides a full 7-day window for completion, and no late submissions will be accepted after the weekly deadline. To ensure success in this course, it is strongly recommended to begin each module on Monday rather than waiting until the weekend. Starting early allows time to troubleshoot technical issues, engage meaningfully in discussions, and seek clarification if needed. Students who consistently complete work early in the module week typically perform better and experience less stress than those who leave work until the last minute.

Medical Excuses:

If illness prevents coursework completion, students must immediately notify the instructor and submit medical documentation. While this is an online course with no physical attendance requirements, prompt communication regarding any medical issues impacting your ability to complete coursework is essential for arranging accommodations.

Grades of "Incomplete":
For 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.

Attendance Policy:
For this online course, regular participation is measured through timely completion of weekly modules and engagement with course materials. Students are expected to log in to the course per week to review content, participate in discussions, and complete assignments.

Campus Free Expression:
It is fundamental to the University of South Florida's mission to support an environment where divergent ideas, theories, and philosophies can be openly exchanged and critically evaluated. Consistent with these principles, this course may involve discussion of ideas that you find uncomfortable, disagreeable, or even offensive. In the instructional setting, ideas are intended to be presented in an objective manner and not as an endorsement of what you should personally believe. "Objective" means that the idea(s) presented can be tested by critical peer review and rigorous debate, and that the idea(s) is supported by credible research. In this course you may be asked to engage with complex ideas and to demonstrate an understanding of the ideas. Understanding and engaging with an idea does not require you to believe it or to agree with it.

Final Examinations Policy:
No exam, non-applicable

XXII. Course Policies: Technology and Media (include sections as applicable to your course)

Canvas:
This course is fully delivered through Canvas Learning Management System. Students must log in regularly to access course materials, assignments, and announcements. Weekly modules open Monday 12:00 AM and close Sunday 11:59 PM EST. All course communication, submission of assignments, and grade distribution will be conducted through Canvas. For technical support, contact USF IT at (813) 974-1222 or help@usf.edu.

XXIII. Course Policies: Student Expectations

Health and Wellness: Example statement supporting student health and wellbeing.

Your health is a priority at the University of South Florida. We encourage members of our community to look out for each other and to reach out for help if someone is in need. If you or someone you know is in distress, please make a referral at www.usf.edu/sos so that the Student Outreach & Support can contact and provide helpful resources to the student in distress. A 24-hour licensed mental healthcare professional, offered through the counseling center, is available by phone at 813-974-2831, option 3. Please remember that asking for help is a sign of strength. In case of emergency, please dial 9-1-1.

Title IX Policy: Title IX provides federal protections for discrimination based on sex, which includes discrimination based on pregnancy, sexual harassment, and interpersonal violence. In an effort to provide support and equal access, **USF has designated all faculty (TA, Adjunct, etc.) as Responsible Employees, who are required to report any disclosures of sexual harassment, sexual violence, relationship violence or stalking.** The Title IX Office makes every effort, when safe to do so, to reach out and provide resources and accommodations, and to discuss possible options for resolution. Anyone wishing to make a Title IX report or seeking accommodations may do so online, in person, via phone, or email to the Title IX Office. For information about Title IX or for a full list of resources please visit: https://www.usf.edu/title-ix/gethelp/resources.aspx. *If you are unsure what to do, please contact Victim Advocacy – a confidential resource that can review all your options – at 813-974-5756 or va@admin.usf.edu.*

Generative Artificial Intelligence (AI) Policy:

Students may use AI tools (e.g., ChatGPT) for brainstorming and learning support, but all submitted work must be the student's own original work. AI-generated content may not be submitted as final coursework unless explicitly authorized by the instructor. Students must acknowledge AI assistance when used. Unauthorized use of AI to complete assignments will be considered a violation of the USF Academic Integrity Policy.

Course Hero / Chegg Policy: The USF Academic Integrity Policy prohibits the use of contract cheating services and online platforms that facilitate academic dishonesty. Students may not upload, download, or use course materials or solutions from websites such as CourseHero, Chegg, or similar platforms for the purpose of completing assignments or assessments. Violations of this policy will be reported and may result in disciplinary action in accordance with university procedures.

Professionalism Policy: All course interactions must maintain professional etiquette. Students will communicate respectfully in discussion boards, emails, and group work. Written communications must be clear, appropriate, and maintain a professional tone. Disruptive behavior in online interactions may affect your final grade. For group activities, timely responses and meaningful contributions are required.

Netiquette Guidelines

Professional communication is essential in our online learning environment. When participating in course activities, maintain the same respect and courtesy as in face-to-face interactions. Consider diverse perspectives and remember that written communication lacks verbal cues. Keep messages clear, focused, and constructive. Always proofread for clarity, avoiding all caps and informal language. Complete thoughts on one topic before introducing new ones. Avoid sarcasm and

humor that could be misinterpreted. Following these guidelines in Canvas will create a positive learning environment.

End of Semester Student Evaluations:
All classes at USF make use of an online system for students to provide feedback to the University regarding the course. These surveys will be made available at the end of the semester, and the University will notify you by email when the response window opens. Your participation is highly encouraged and valued.

XXIV. Learning Support and Campus Offices

Academic Accommodations
Students with disabilities are responsible for registering with Student Accessibility Services (SAS) to receive academic accommodations. Information about accommodations and resources is available through SAS for all USF campuses.

Canvas Technical Support
This course is delivered through Canvas. Students experiencing technical difficulties should consult the Canvas Help resources within the course or contact USF IT Support at **813-974-1222** or **help@usf.edu**.

Center for Victim Advocacy
The Center for Victim Advocacy provides confidential support and resources for students affected by violence, abuse, or harassment. Additional information and contact details are available on the USF Center for Victim Advocacy website.

Counseling Center
The USF Counseling Center offers confidential counseling services, consultations, and mental health resources for students. Students are encouraged to seek support as needed. Contact information is available on the USF Counseling Center website.

Tutoring Services
The Tutoring Hub offers free academic tutoring for USF students. Appointments are recommended but not required. Additional information is available through the USF Tutoring Hub website.

Writing Studio
The USF Writing Studio provides free writing support for undergraduate and graduate students at any stage of the writing process. Appointments are recommended but not required. Information is available on the USF Writing Studio website.

XXV.Important Dates to Remember

All dates, assignments, and course content are tentative and subject to change at the instructor's discretion. Note: While modules follow a weekly schedule, changes will be announced through Canvas at least one week in advance

For official USF academic deadlines and holidays, refer to the Academic Calendar at http://www.usf.edu/registrar/calendars/