CSE 1222 (Approved): Introduction to Computer Programming in C++ for Engineers and Scientists

Course Description

Introduction to computer programming and to problem solving techniques using computer programs with applications in engineering and the physical sciences; algorithm development; programming lab experience.

Prior Course Number: CSE 202
Transcript Abbreviation: Prgrmng C++
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Freshman, Sophomore
Course Offerings: Autumn, Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 2.0 hr Lec, 1.5 hr Lab
Expected out-of-class hours per week: 5.5
Graded Component: Lecture
Credit by Examination: Yes
Exam Types: Departmental Exams
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: co-req: Math 1151 or Math 1161
Exclusions: Not open to students with credit for Engr 1281.01 or Engr 1281.02 or CSE 202
Cross-Listings: Engr 1222

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.0901
Subsidy Level: Baccalaureate Course

General Information

C++ is taught.

Course Goals

Be competent with writing simple C++ programs performing numerical calculations.
Be competent with using basic C++ constructs; declarations and various statements including loops and conditionals.
Be familiar with using C++ functions.
Be familiar with using C++ arrays.
Be familiar with using file input and output.
Be exposed to algorithms.
Be exposed to pointers.

Be exposed to the C++ string and vector classes.
Be exposed to defining C++ classes.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction, simple input and output, cin and cout.	2.0		1.5					
Variables and assignments.	2.0		1.5					
Selection statements, if, then, else.	2.0		1.5					
Loops, for and while.	3.0		3.0					
File input and output.	2.0		1.5					
Formatting output.	1.0		1.5					
Functions	3.0		1.5					
Arrays.	4.0		3.0					
2D arrays.	1.0		1.5					
Pointers, new and delete[] operators.	2.0		1.5					
C++ string and C++ vector classes.	2.0		1.5					
Intro to defining C++ classes.	2.0							

Representative Assignments

Programming assignment (due week 3): Download two C++ programs which contain compilation errors and fix the compilation errors so that the programs perform as specified.
Programming assignment (due week 4): Write a program that computes and outputs the intersection point of the two lines {(x,y): ax + by + c = 0} and {(x,y): a'x + b'y + c' = 0}. (Output a message if the lines are parallel.)
Programming assignment (due week 6): Write a program that reads in two integers a and b and computes and outputs all the prime numbers between a and b.
Programming assignment (due week 8): Let f be the function f(x,y) = cos(x)*sin(y)*ln(x+y+1). Write a program that reads in integers n and m and computes and writes f(i/5,j/5) to the file "outdata.txt" for 0 <= i < n and 0 <= j < m. Visualize the surface defined by the output of your program using Matlab.
Programming assignment (due week 10): The main routine of a program is provided in a file named vector_angle_template.cpp. Implement the five functions, normalize(), dot_product(), radians2degrees(), compute_vector_angle(), and output_angle() called by this main routine. The resulting program should read in a pair of 2D vectors and output the angle between the vectors in degrees.
Programming assignment (due week 12): Write a program that reads from a file a list of numbers representing the function values and outputs the original data, smoothed data and the first and second derivatives of the data points. (The formulas for smoothing the data and computing the first and second derivatives are provided in the assignment instructions.)
Programming assignment (due week 14): Write a program that reads in a list of integers, removes any duplicates from the list (leaving only the first occurrence of each integer) and then outputs the new list. Elements of the new list should be in the same order as in the original list.
Lab (week 1): Write a program to print your name, favorite color, favorite song and favorite food.
Lab (week 2): Write a program that reads an integer r and computes and outputs the surface area and volume of a sphere with radius r.
Lab (week 3): Write a program that reads in the coordinates of two points, computes the slope of the line through the two points, and outputs the message "Negative slope", "Zero slope", "Positive slope" or "Infinite slope" depending upon whether the slope is negative, zero, positive or infinite.
Lab (week 4): Write a program that reads in n numbers and outputs their average and standard deviation.
Lab (week 5): Write a program which reads in numbers a and b and computes a root of (a x^2 - b x ln(x)) up to a given precision \epsilon. (The incremental-search (bisection) algorithm for root finding is described in the text.)

Lab (week 6): Write a program that reads in numbers from a file and prints each number and its cosine to a second file.
Lab (week 7): Write a program which prints a table of conversions from radians to degrees starting at 0, incrementing by pi/10 and ending at 2*pi. Format the output so that the decimal points in each column line up.
Lab (week 8): The main routine of a program is provided in file triangle_area_template.cpp. Implement three functions, diff(), determinant() and output_area() called by the main routine. The resulting program should read in the three vertices of a triangle and output the area of the triangle.
Lab (week 9): Write a program to read in an array of integers and then output the elements of the array in reverse order.
Lab (week 10): The main routine of a program is provided in file distance_template.cpp. Write functions which compute the L1, L2 and L_inf distance between two n dimensional points given as arrays.
Lab (week 11): A distance matrix M is a matrix which stores distances to a point (x,y). More specifically, M[i,j] is the distance from (i,j) to (x,y). Write a program which reads the coordinates (x,y) of a point p and an integer N and computes an NxN distance matrix representing distances to p. Output the distance matrix so that decimal points in each column line up.
Lab (week 12): Write a program which reads in a list of numbers and then reorders the list so that all the negative numbers precede all the positive ones. Allocate and free arrays used in your program using the new and delete[] operations. (The algorithm for reordering uses three arrays: one containing the negative numbers, one containing the positive numbers and one containing the final result. The algorithm is given in the lab instructions.)
Lab (week 13): Write a program which reads text from a file and formats the text so that words are separated by a single blank space and each line has at most 80 characters.

Grades

Aspect	Percent
Programming assignments.	30%
Labs	20%
Two midterms	25%
Final	25%

Representative Textbooks and Other Course Materials

Title	Author
Engineering Problem Solving with C++	Etter and Ingber

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
**	a	An ability to apply knowledge of mathematics, science, and engineering.
*	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
**	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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