FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

COMPUTER SCIENCE

HONORS COMPUTER SCIENCE IV

COURSE DESCRIPTION

Grade Level: 12   Department: Computer Science

Course Title: Honors Computer Science IV   Credits: 5

Course Code: 296650

Board of Education adoption date: August 22, 2011

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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Honors Computer Science IV - Introduction

Introduction

Course Philosophy

This course is designed to provide the students with a fluency in the C++ Language. The students will understand how to program data structures in C++ that were learned from the Java courses. This course will also expose the students to Database Programming. The final part of this course will require the students to choose, research, and present a Senior Project that involves advanced computer science topics.

Course Description

In this course the students will learn how to program in C++. Industry still uses C++ and this will provide the students with the ability to easily apply the concepts learned in the Java Programming language to the C++ Language. This course will also expose the students to Database Programming. They will use Microsoft Access as their Database Management System to learn Database Programming. Finally, the students will have to develop a Senior Project. They can choose any advanced computer science topic that is approved. They will research the topic and present their findings at the end of the school year. The presentation will consist of working code and a Multimedia presentation.

Course Map and Proficiencies/Pacing

Course Map

Relevant Standards	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic	Formative	Summative
MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	C++ Code involves preprocessor directives, conditionals and loops.	What is a preprocessor directive? What is a while loop? What is a for loop? What is a conditional? How do you implement conditionals and loops in a C++ program?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.F-BF.1.A TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Designing software properly involves using user defined methods.	What is a function? What is the difference between a value parameter and a reference parameter? Which type of parameter do we use when we want the function or method to return more than one piece of information?	Oral questions & discussion	Programming assignment	Graded programs Test

MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Arrays are data structures that are used to represent data by using just one variable and subscripts. Arrays can be multi-dimensional.	How do you create a one dimensional array in C++? How do you create a multi-dimensional array? How do you use an initialized list to create an array? How do you print out the data in an array?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Dynamic memory is memory that is allocated at runtime, rather than fixed, before the program is written.	What is a pointer? How do you dereference a pointer? How do you create a dynamic allocated array? What are the big three when dealing with dynamic memory? Why do you need to write your own code for the big three when using dynamic memory? How do you write the copy constructor, assignment operator and destructor for an object that has dynamic memory?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.F-BF.1.A TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Files need to be read and created in every computer science language.	How do you use the infile object to read a file? How do you use the outfile object to create and output a file?	Oral questions & discussion	Programming assignment	Graded programs Test

MA.9-12.F-BF.1.A TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Creating objects and using inheritance for organizing and creating hierarchies of classes is a crucial part of object oriented programming in C++.	What is an object? What is a class? What is polymorphism? How do you create a class in C++? How do you create a child of a class in C++?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.F-BF.1.A TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	A template function is a function that can be used for any type of data including primitive types and objects.	What is the heading of each template functions? Why are template functions useful? How do you create and use a template function? What are the similarities between template functions in C++ and static generic methods in Java?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	A template class is a class that can be designed for any type of data.	What is a template class? What is the syntax for a template class? What are the similarities between a template class in C++ and a generic class in Java?	Oral questions & discussion	Programming assignment	Graded programs Test

| | | What is a database?

What is referential integrity?

What are a primary key and a foreign key?

What does one to many, one to one, and many to many indicate? | Oral questions & discussion | Programming assignment | Graded programs

Test |
|---|---|---|---|---|---|
| MA.9-12.N-Q.2
TEC.9-12.8.2.12
TEC.9-12.8.2.12.B | Relational databases are sophisticated data structures that are used to access and categorize data. | | | | |
| MA.9-12.N-Q.2
TEC.9-12.8.2.12
TEC.9-12.8.2.12.B | You can query an Access Database by example called QBE. | What does QBE indicate?

How do you create a query by example?

How do you set the conditions for a Query?

Where do you find the automatically created SQL?

How do you join tables in a QBE?

How do you group fields in a QBE? | Oral questions & discussion | Programming assignment | Graded programs

Test |
| MA.9-12.N-Q.2
TEC.9-12.8.2.12.A
TEC.9-12.8.2.12
TEC.9-12.8.2.12.B | Queries are usually written by a programmer using Structured Query Language. | What is SQL?

Why is it better to write your own SQL statements rather then having them generated by Access?

How do you join tables in SQL statements?

How do you create tables in SQL?

How do you create computer fields in SQL? | Oral questions discussion | Programming assignment | Graded programs

Test |

MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	The normalization of a database enables the programmer to identify the existence of potential problems usually called update anomalies.	What is a functional dependency? What is first normal form and how do you put your database into first normal form? What is second normal form and how do you convert your database to second normal form? What is third normal form and how do you convert your database to third normal form? What is fourth normal form and how do you convert your database to fourth normal form?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Creating a database is essential in the business world either on a large scale or small scale.	How do you create a database? How do you create relationships in a database? How do you normalize your database?	Oral questions & discussion	Programming assignment	Graded programs Test
MA.9-12.F-BF.1.A MA.9-12.N-Q.2 TEC.9-12.8.2.12 TEC.9-12.8.2.12.B	Researching an advanced computer science topic is a culmination of the material that was learned in the Computer Science Academy.	What have we studied in the Computer Science Academy? What are some of the topics that you are interested in Computer Science? What algorithms or topics would be great ideas for your Senior Project? What platforms and Computer Languages are available to you?	Oral questions & discussion	Senior Project	Presentation of working code Multimedia presentation Professional paper

Proficiencies and Pacing

Unit Title	Unit Understanding(s) and Goal(s)	Recommended Duration
Unit 1: Basic Concepts of C++	C++ Code involves preprocessor directives, conditionals and loops. At the conclusion of this unit, students will be able to: 1. compose conditional statements. 2. design programs that use loops effectively.	2 weeks
Unit 2: User Defined Functions	Designing software properly involves using user defined methods. At the conclusion of this unit, students will be able to: 1. create functions within programs that can use value or reference parameters. 2. understand that a value parameter is passed a value and a reference parameter is a memory address.	2 weeks
Unit 3: Arrays	Arrays are data structures that are used to represent data by using just one variable and subscripts. Arrays can be multi-dimensional. At the conclusion of this unit, students will be able to: 1. create arrays of primitive data as well as objects. 2. create multi-dimensional arrays. 3. design loops to print out data as well as populate data. 4. create arrays that use initialized loops.	2 weeks
Unit 4: Dynamic Memory	Dynamic memory is memory that is allocated at runtime, rather than fixed, before the program is written. At the conclusion of this unit, students will be able to: 1. use pointers to access data. 2. know how to deference pointers. 3. create one dimensional and multi-dimensional arrays using pointers. 4. write an assignment operator, copy constructor, and delete method when dynamic memory is used in an object. 5. understand why you have to write the above code when dynamic memory is involved.	3 weeks

Unit 5: Files	Files need to be read and created in every computer science language. At the conclusion of this unit, students will be able to: 1. use infile to read files. 2. use outfiles to create files.	3 weeks
Unit 6: User Defined Classes and Inheritance	Creating objects and using inheritance for organizing and creating hierarchies of classes is a crucial part of object oriented. At the conclusion of this unit, students will be able to: 1. create classes and use them in drivers. 2. create a hierarchy of classes that uses inheritance and exemplifies polymorphism.	2 weeks
Unit 7: Template Functions	A template function is a function that can be used for any type of data including primitive types and objects. At the conclusion of this unit, students will be able to: 1. create template functions that can be applied to any type of data. 2. understand the similarity of template functions to java generics.	3 weeks
Unit 8: Template Classes	A template class is a class that can be designed for any type of data. At the conclusion of this unit, students will be able to: 1. create template classes that can be used with any type of data 2. create a linked list class that can be used with any type of data. 3. understand the connection between template classes in C++ and generic classes in Java.	4 weeks
Unit 9: Introduction to Databases	Relational databases are sophisticated data structures that are used to access and categorize data. At the conclusion of this unit, students will be able to: 1. manipulate a database. 2. understand what referential integrity is and how to identify a primary key and a foreign key. 3. identify a one to many, many to many, and one to one relationship.	2 weeks
Unit 10: Query by Example	You can Query an Access Database by example called QBE. At the conclusion of this unit, students will be able to: 1. Query a database by example by placing the conditions in a GUI and running the Query. 2. find the SQL code that we generated by Access (DBMS). 3. Query a database by example using joined tables.	2 weeks

Unit 11: SQL(Structured Query Language)	Queries are usually written by a programmer using Structured Query Language. At the conclusion of this unit, students will be able to: 1. write a basic SQL statement. 2. write SQL statements that involve joined tables. 3. write SQL Statements that involve grouping fields together.	2 weeks
Unit 12: Normalization	The normalization of a database enables the programmer to identify the existence of potential problems usually called update anomalies. At the conclusion of this unit, students will be able to: 1. manipulate tables and relationships so that the database is in first, second, third, and fourth normal form. 2. understand the problems that a database will have if it not in normalized form.	2 weeks
Unit 13: Database Creation	Creating a database is essential in the business world either on a large scale or small scale. At the conclusion of this unit, students will be able to: 1. create a database that involves joined tables. 2. normalize the database. 3. create Queries that demonstrate the we extracting the correct data.	2 weeks
Unit 14: Senior Project	Researching an advanced computer science topic is a culmination of the material that was learned in the Computer Science Academy. At the conclusion of this unit, students will be able to: 1. choose an advanced topic and research it. 2. create working code that will demonstrate the project. 3. use a Multimedia presentation in their presentation to clearly explain their project.	3 weeks

Honors Computer Science IV - Unit 01

Basic Concepts of C++

Enduring Understandings:

C++ Code involves preprocessor directives, conditionals and loops.

Essential Questions:

What is a preprocessor directive?

What is a while loop?

What is a for loop?

What is a conditional?

How do you implement conditionals and loops in a C++ program?

Unit Goals:

Students will be able to compose C++ programs involving the basics structure including using conditionals and loops.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are conditionals used to control decisions?	Develop a program that will use conditionals to make decisions.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Quizzes and tests Graded programs Oral discussion
How are while loops used?	Develop a program that will use while loops.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Quizzes and tests Graded programs Oral discussion
How are for loops used?	Develop a program that will use for loops.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Quizzes and tests Graded programs Oral discussion

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Students with individual learning styles can be assisted by using a comparison of the basics of loops to previously learned languages such as Java.

Technology

The technology that students use in this unit prepares the students to become computer programmers. The basic premise of programming is implemented in this unit.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. This material provides the basic learning skills for all programming languages.

Honors Computer Science IV - Unit 02

User Defined Functions

Enduring Understandings:

Designing software properly involves using user defined methods.

Essential Questions:

What is a function?

What is the difference between a value parameter and a reference parameter?

Which type of parameter do we use when we want the function or method to return more than one piece of information?

Unit Goals:

Students will be able to write programs using functions and methods that use value or reference parameters.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How do you write functions that return one value?	Develop a program that uses functions that return one value.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Test and quizzes Graded programs
How do you convert a program with very little in the main?	Develop a program that does not use functions, and then convert the program into one that uses mostly functions, which breaks the program down into smaller pieces.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Test and quizzes Graded programs

MA.9-12.F-BF.1.A	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. User defined functions can be created by a variety of techniques for students with individual learning styles.

Technology

The technology that students use in this unit prepares the students to become computer programmers. The creation of user defined functions enables students to experience how to view programs into small parts.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. The material is a great background for students to understand that they do not have to do everything in the main program, but rather call to different methods or functions that they have created.

Honors Computer Science IV - Unit 03

Arrays

Enduring Understandings:

Arrays are data structures that are used to represent data by using just one variable and subscripts. Arrays can be multi-dimensional.

Essential Questions:

How do you create a one dimensional array in C++?

How do you create a multi-dimensional array?

How do you use an initializer list to create an array?

Unit Goals:

1. Create arrays of primitive data as well as objects.

2. Create multi-dimensional arrays.

3. Design loops to print out data as well as populate data.

4. Create arrays that use initialized loops.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How do you declare and populate a one-dimensional array by using an initializer list, direct input or automatic generation?	Develop a program that will use one dimensional array for input and output.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs
How do you create a method to sort an array?	Develop a program that takes an array and sorts the array.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs
How are two dimensional arrays created, populated and printed?	Develop a program that will use two dimensional arrays for input and output.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Students can understand how to use multiple variables by using arrays. Individualized learning can take place by experiencing the value of arrays through lecture, assistance and programming.

Technology

The technology that students use in this unit prepares the students to become computer programmers. The value of arrays in programming allows the user to use many variables by one declaration.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. The use of variables is an important step in the development of computer programming because it allows the programmer to work with many values.

Honors Computer Science IV - Unit 04

Dynamic memory

Enduring Understandings:

Dynamic memory is memory that is allocated at runtime, rather than fixed, before the program is written.

Essential Questions:

What is a pointer?

How do you dereference a pointer?

How do you create a dynamic allocated array?

What are the big three when dealing with dynamic memory?

Why do you need to write your own code for the big three when using dynamic memory?

How do you write the copy constructor, assignment operator and destructor for an object that has dynamic memory?

Unit Goals:

1. Use pointers to access data.

2. Know how to deference pointers.

3. Create one dimensional and multi-dimensional arrays using pointers.

4. Write an assignment operator, copy constructor, and delete method when dynamic memory is used in an object.

5. Understand why you have to write the above code when dynamic memory is involved.

Recommended Duration: 3 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are pointers used to access and manipulate data?	Develop a program that utilizes pointers. Display the memory locations and what is contained in the memory locations by differencing the pointer.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs

		Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs
How are pointers used to declare and manipulate a multi-dimensional array?	Develop a program to create and use a multi-dimensional array by using dynamic memory (pointers).	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs
How and why are assignment operators, copy constructors and destructors used in classes that have dynamic memory (the big three)?	Develop a class that uses dynamic memory and demonstrate what happens when the big three are not written, as opposed to when the big three are written.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs

MA.9-12.N-Q.2   Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.

TEC.9-12.8.2.12   All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

TEC.9-12.8.2.12.B   Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Students learn about Dynamic Memory. Some students learn by lecture from the board and then it is reinforced by a program for different types of learners that display memory locations.

Technology

The technology that students use in this unit prepares the students to become computer programmers. It is important in C++ to show programmers who know other languages, how the memory of a computer works.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Learning about Dynamic Memory and pointers prepare programmers to understand memory problems in all computer languages.

Honors Computer Science IV - Unit 05

Files

Enduring Understandings:

Files need to be read and created in every computer science language.

Essential Questions:

How do you use the infile object to read a file?

How do you use the outfile object to create and output a file?

Unit Goal:

Students will perform file manipulation. They will read files and create files.

Recommended Duration: 3 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are files accessed in C++?	Develop a program that will use input file streams to access already created files.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Test and quizzes Graded programs

MA.9-12.F-BF.1.A   Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

TEC.9-12.8.2.12   All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

TEC.9-12.8.2.12.B   Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.
2. Manipulation of files is important for any large companies. Students of different learning styles can see the manipulation of the files on the computer for a better understanding of how they work.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Creating files and accessing files is essential for any large company.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. File creation and accessing is an important part of programming for large institutions.

Honors Computer Science IV - Unit 06

User Defined Classes and inheritance

Enduring Understandings:

Creating objects and using inheritance for organizing and creating hierarchies of classes is a crucial part of object oriented programming in C++.

Essential Questions:

What is an object?

What is a class?

What is polymorphism?

How do you create a class in C++?

How do you create a child of a class in C++?

Unit Goals:

Students will create classes and hierarchies of classes that will demonstrate polymorphism and inheritance.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are classes created in C++?	Develop a program that consists of a class and a driver. Create and manipulate objects of the class and also create an array of objects in the driver.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Tests and quizzes Graded programs
How are children of classes created in C++ to demonstrate inheritance?	Develop a program that is a child of the previous class and demonstrate how polymorphism and inheritance is used.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Tests and quizzes Graded programs

		Computers	Lecture and	Tests and quizzes
How are operators re-defined for the particular object that was created?	Develop greater than and other operators for the previous programs.	Notes Reference books C++ programming language	class discussion	Graded programs
How are newly defined operators created, and what is there purpose?	Develop a program that uses the greater than operator for the particular classes above, to demonstrate how to sort the previously defined objects.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Tests and quizzes Graded programs

MA.9-12.F-BF.1.A   Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive
                         process, or steps for calculation from a context.
TEC.9-12.8.1.12   All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems
                         individually and collaboratively and to create and communicate knowledge.
TEC.9-12.8.1.12.B   Creativity and Innovation

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Classes are the main structure of object-oriented programming. Students of different learning styles will see the objects create both using lecture and on the computer. They will experience firsthand what an object is by developing their own object methods. Other students will assist them if they are having trouble with the concept.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Classes
and object-oriented programming are essential in any high level language in industry and college.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Understanding classes is the first step toward inheritance.

Honors Computer Science IV - Unit 07

Template functions

Enduring Understandings:

A template function is a function that can be used for any type of data including primitive types and objects.

Essential Questions:

What is the heading of each template functions?

Why are template functions useful?

How do you create and use a template function?

What are the similarities between template functions in C++ and static generic methods in Java?

Unit Goals:

Students will create template functions that can be used to perform the same operation on any type of data that has the proper operators that are defined.

Recommended Duration: 3 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are template functions created?	Develop a simple template function and use it in several different programs or with several different types of data.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Tests and quizzes Graded programs
How are template functions created that utilize re-defined operators?	Develop a program that utilizes a template function for a class that has a re-defined operator.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Tests and quizzes Graded programs
How are template functions used to perform operations on many types of data?	Develop a program that uses a template function to sort any type of data.	Computers Notes Reference books C++ programming language	Lecture and class discussion	Tests and quizzes Graded programs

MA.9-12.F-BF.1.A	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Template functions allow students to understand that you can write one function for many different data types. Students of individual learning styles can see by writing one function, it can use many different types. This starts to give all types of students the power of high level programming.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Template functions allow programmers to write one function for many data types.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Programmers need to know how to write a function that can be used as a resource for many data types.

Honors Computer Science IV - Unit 08

Template Classes

Enduring Understandings:

A template class is a class that can be designed for any type of data.

Essential Questions:

What is a template class?

What is the syntax for a template class?

What are the similarities between a template class in C++ and a generic class in Java?

Unit Goals:

Students will develop a template class consisting of a linked list that can be used as a data structure for any class.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are template classes developed?	Develop a simple template class and implement it in a driver.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs
How do you develop a template class for a linked list?	Develop a template class for a linked list.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs
How do you use a class with the template linked list class?	Develop a program that utilizes the template class for the linked list with any object or class.	Computers Notes Reference books C++ programming language	Lecture and class discussions	Tests and quizzes Graded programs

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-

one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Template classes give a programmer the ability to write classes for different data types. This demonstrates to all

learners the power of programming.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Using template classes allows us to use one class to perform operations for several objects.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Using template classes in the workplace is a necessary and useful tool in advanced programming.

Honors Computer Science IV - Unit 09

Introduction to Databases

Enduring Understandings:

Relational databases are sophisticated data structures that are used to access and categorize data.

Essential Questions:

What is a database?

What is referential integrity?

What is a primary key and a foreign key?

What does one to many, one to one, and many to many indicate?

Unit Goals:

Students will examine and understand previously constructed databases.

Students will examine the relationships and structures in a database.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How do you recognize referential integrity?	Examine databases where referential integrity is in effect.	Computers Notes Reference books Access Previously written databases	Examine databases and answers questions at the end of the chapter	Tests and quizzes
How are primary keys and foreign related?	Look at the relationship window to identify primary keys and foreign keys.	Computers Notes Reference books Access Previously written databases	Examine databases and answers questions at the end of the chapter	Tests and quizzes
How are the relationships such as one to many recognized?	Look at the relationship window to identify specific relationships.	Computers Notes Reference books Access Previously written databases	Examine databases and answers questions at the end of the chapter	Tests and quizzes

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Students with individual learning styles can visually see the relationships between fields and tables in the Access Programming Language.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Database programming provides students with the ability to further their programming abilities.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Database programming provides programmers with an option of pursuing an Information Technology career.

Honors Computer Science IV - Unit 10

Query by Example (QBE)

Enduring Understandings:

You can query an Access Database by example called QBE.

 Essential Questions:

What does QBE indicate?

How do you create a query by example?

How do you set the conditions for a query?

Where do you find the automatically created SQL?

How do you join tables in a QBE?

How do you group fields in a QBE?

 Unit Goals:

Students will query a database in a graphical setting by choosing the tables of interest and placing conditions on the fields.

Students will query a database and create computed fields.

Students will perform queries on grouped data and joined tables.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are queries created by QBE?	Students will perform QBE queries on previously constructed databases.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and demonstrations of the queries
How are computed fields created in a QBE query?	Students will perform QBE queries on previously constructed databases.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and demonstrations of the queries
How are fields grouped together in a QBE query?	Students will perform QBE queries on previously constructed databases.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and demonstrations of the queries

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Students with individual learning styles can visualize and create queries visually by using Query by Example.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Learning how to create queries by QBE gives the students an easy way to create queries.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Sometimes queries need to be created in a hurry and using QBE enables students to provide the function quickly.

Honors Computer Science IV - Unit 11

SQL (Structured Query Language)

Enduring Understandings:

Queries are usually written by a programmer using Structured Query Language.

Essential Questions:

What is SQL?

Why is it better to write your own SQL statements rather then having them generated by Access?

How do you join tables in SQL statements?

How do you create tables in SQL?

How do you create computer fields in SQL?

Unit Goals:

Students will write their own queries using SQL.

Students will create tables with SQL.

Students will join tables and query data on two or more tables using SQL.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How is a simple query written to obtain all of the data in a table?	Develop simple queries using SQL to access data that satisfy certain conditions.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and demonstrations
How are queries written to create a table?	Develop queries that can create tables.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and demonstrations

How are queries written to get data from two tables by creating a join?	Develop queries that access data from two tables through the use of a join.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and demonstrations

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.A	Nature of Technology: Creativity and Innovation
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, collaborations with other students, and use of visual and auditory teaching methods.

2. Students of individualized leaning styles can learn how to create queries from QBE in the previous unit and then see how the same query is created using SQL (Structured Query Language).

Technology

The technology that students use in this unit prepares the students to become computer programmers. Students understanding SQL can pursue a career in Information Technology.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Students using SQL can create or use databases in the work place adding another dimension to their value.

Honors Computer Science IV - Unit 12

Normalization

Enduring Understandings:

The normalization of a database enables the programmer to identify the existence of potential problems usually called update anomalies.

Essential Questions:

What is a functional dependency?

What is first normal form and how do you put your database into first normal form?

What is second normal form and how do you convert your database to second normal form?

What is third normal form and how do you convert your database to third normal form?

What is fourth normal form and how do you convert your database to fourth normal form?

Unit Goals:

Students will recognize the problems with constructions of databases and understand how to normalize the database to the correct form.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
When is a database not in first normal form and how is it converted to first normal form?	Recognize problems with databases and convert databases to first normal form.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and quizzes
When is a database not in second normal form and how is it converted to second normal form?	Recognize problems with databases and convert databases to second normal form.	Computers Notes Multimedia presentation Reference book Access Previously constructed databases	Multimedia Presentation Working with the exercises and the databases that are provided with the book	Tests and quizzes

		Computers Notes Multimedia presentation Reference book	Multimedia Presentation	
When is a database not in third or fourth normal form and how is it converted to third or fourth normal form?	Recognize problems with databases and convert databases to third and fourth normal form.	Access Previously constructed databases	Working with the exercises and the databases that are provided with the book	Tests and quizzes

MA.9-12.N-Q.2   Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.

TEC.9-12.8.2.12   All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

TEC.9-12.8.2.12.B   Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, student collaboration, additional testing time, and use of visual and auditory teaching methods.

2. Students can learn how to normalize a database with visual learning styles by creating and defining functional dependencies and demonstrating it graphically.

Technology

The technology that students use in this unit prepares the students to become computer programmers. Understanding functional dependencies is crucial to properly create a database.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Students that understand functional dependencies and relationships have an excellent background to pursue an Information Technology career.

Honors Computer Science IV - Unit 13

Database Creation

Enduring Understandings:

Creating a database is essential in the business world either on a large scale or small scale.

Essential Questions:

How do you create a database?

How do you create relationships in a database?

How do you normalize your database?

Unit Goals:

Students will create a database with a significant number of relationships and normalize the database.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How are databases created with relationships such as one to many?	Develop a database with a significant amount of relationships such as one to many.	Computers Access Notes Reference books	Class discussion on how to proceed to the whole class and individually	Demonstration of the database and its queries
How are databases normalized?	Recognize if the database is not normalized and make the conversion.	Computers Access Notes Reference books	Class discussion on how to proceed to the whole class and individually	Demonstration of the database and its queries
How is referential integrity used?	Use referential integrity in the database and perform queries to demonstrate that the database is working properly.	Computers Access Notes Reference books	Class discussion on how to proceed to the whole class and individually	Demonstration of the database and its queries

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, student collaboration, additional testing time, and use of visual and auditory teaching methods.

2. A wide variety of learning styles are applied to students learning. These include how to program a database, including visual aids, diagrams, and teacher support and student assistance.

Technology

The technology that students use in this unit prepares the students to become computer programmers and possibly Information Technology experts such as creating and maintaining a database.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. Students will have a great idea as to what part of computer science that they want to pursue.

Honors Computer Science IV - Unit 14

Senior Project

Enduring Understandings:

Researching an advanced computer science topic is a culmination of the material that was learned in the Computer Science Academy.

Essential Questions:

What have we studied in the Computer Science Academy?

What are some of the topics that you are interested in Computer Science?

What algorithms or topics would be great ideas for your Senior Project?

What platforms and Computer Languages are available to you?

Unit Goals:

Students will research an advanced topic in computer science and present their findings to the class.

Recommended Duration: 3 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What are your areas of interest?	Research an advanced topic in computer science and present it in class.	Internet Books Computer Science courses	Discuss topics of advanced computer science	Presentation

MA.9-12.N-Q.2	Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
MA.9-12.F-BF.1.A	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making
TEC.9-12.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Differentiation

1. Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, student collaboration, additional testing time, and use of visual and auditory teaching methods.
2. Students can pursue their own project in computer science which enables them to choose the learning style that they are most comfortable with.

Technology

The technology that students use in this unit prepares the students to become computer programmers or enter the many different worlds of computer science.

College and Workplace Readiness

The material in this unit provides a great background for students to major in Computer Science and pursue Computer Programming and related fields as a profession. The students prepare themselves by choosing a project which interests them the most. This will aid them in choosing the correct path that they want to take in computer science.