

NJCCCS AREA: Mathematics

North Brunswick Township Public Schools

AP COMPUTER SCIENCE

Acknowledgements

Vivian Morris, Mathematics Teacher

Diane M. Galella, Supervisor of Mathematics

Date: New _____

Revision May 2012

Board Adoption _____

This curriculum is aligned with the Advanced Placement Computer Science syllabus submitted to and approved by the College Boards.

The major emphasis in *AP Computer Science* is on programming methodology, algorithms and data structures, and object-oriented programming. After completion of this course, the qualified student will be able to: design and implement computer-based solutions to problems in application areas, apply knowledge of well-known algorithms and data structures, identify major hardware and software components of the computer system, know the roles they play and their inter-relationships, recognize social and ethical implications of computer use. Due to the nature and increasing complexity of the course work, candidates for this program must have successfully completed or be enrolled in Precalculus or its equivalent. **A summer assignment is given.** It is expected that these students will take the “A” portion of the Advanced Placement Exam.

NJ Core Curriculum Standards that apply throughout the course are:

From the Math Standards	4.5.A1 & 2
	4.5.B1 – 4
	4.5.C3 & 4
	4.5.F1-6
From the Technology Standards	8.1A4 & D1
	8.2 A3
	8.2 B1,2,4

Standards unique to a particular concept are stated in the Course of Study.

New Jersey - Common Core State Standards for Mathematics

Note: Please see p 1 regarding NJ Core Curriculum Standards

Chapter or Unit: Introduction/Review, Files, RandomNumbers, Base Conversion

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Create a graphic using JCreator	Powerpoint presentation Computer	•	Programming Assignment/Activities Student Oral Response	3 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1
Create a program utilizing skills learned in Intro to Computer Science (2533)	Powerpoint presentation Worksheets Computer	• Create a program composed of methods and a menu that accesses each method depending on the users choice. Implement needed methods from the Math class	Programming Lab Student Oral Response	1 wk	8.2.A.3 8.2 B1,2,4
Read data from files into a program	Powerpoint presentation Worksheets Computer	• Using EasyReader, read a file of: same type data mixed type data	Programming Lab Student Oral Response	1 wk	
Implement and understand the difference between the Random Class and the Random method in the math class	Powerpoint presentation Worksheets Computer	• Use the java.lang.Math method random() in a program • Use various methods in the Random class	Programming Assignment/Activities Student Oral Response	1 wk	

Chapter or Unit: Introduction/Review, Files, RandomNumbers, Base Conversion (cont)

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Convert numbers from the decimal base to bases 2, 8, 16 (binary, octal, and hexadecimal) and visa versa Understand the use of this notation in the computer world.	Teacher Lecture	<ul style="list-style-type: none"> Discuss algorithms to convert from the decimal base to any other base and visa versa 	Student Oral Response Hwk Worksheet	2 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Apply knowledge of files, Random Class, methods in the Math class, and number conversion	Worksheets	<ul style="list-style-type: none"> Test 	Teacher made Test	1 day	

Chapter or Unit: Introduction to Objects and Classes

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand the concepts of classes and objects Realize the difference between objects and object references	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Construct and use objects • Using object variables (importing from other packages) 	Programming Assignment/Activities Student Oral Response	2 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Implement classes and simple methods within those classes Use and understand the use and purpose of constructors	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Define and test a class • Create constructor(s) in the class definition • Design & implement a public interface of a class 	Programming Assignment/Activities Student Oral Response	4 days	
Be able to access instance fields and local variables Appreciate the importance of documentation and comments	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Use an instance field • Understand the variable types • Create a method summary generated by javadoc 	Programming Assignment/Activities Student Oral Response	4 days	
Apply knowledge of Objects and Classes	Worksheet	<ul style="list-style-type: none"> • Lab • Test 	Programming Lab Teacher made Test	4 day	

Chapter or Unit: Data Types

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand how to work with static methods	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> Discuss/compare/contrast static methods with other methods 	Programming Assignment/Activities Student Oral Response	½ day	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Use the String class to define and manipulate character strings	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> Discuss what constitutes a string Discuss/list the methods in the string class with examples of the usage of each 	Programming Assignment/Activities Student Oral Response	3 days	
Understand the copy behavior of primitive types and object references	Powerpoint presentation Teacher Lecture Text/Worksheets Computer Computer	<ul style="list-style-type: none"> Review casting 	Programming Assignment/Activities Student Oral Response	2 days	
Implement static methods, the String class and the copy behavior of primitive types and object references	Worksheets	<ul style="list-style-type: none"> Lab Test 	Programming Lab Teacher made Test	4 days 1 day	

Chapter or Unit: One Dimensional Arrays and ArrayLists

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand and use one dimensional arrays	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss the use of arrays to handle collections of similar objects • Implement arrays, declaration and manipulation using loops, out of bounds error • Discuss/implement parallel arrays 	Programming Assignment/Activities Student Oral Response	4 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Understand when to choose array lists and arrays to store data Implementing partially filled arrays	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss usage/ease of using arraylist vs arrays and types of data used for each • Discuss flexibility in “growing” an array vs an arraylist 	Programming Assignment/Activities Student Oral Response	2 days	
Understand and use an arraylist	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss the use of array list to hand collections of objects • Discuss wrapper classes to make primitives appear as objects • Implement an array list, declaration and manipulation using loops, using array list methods, out of bounds error 	Programming Assignment/Activities Student Oral Response	2 days	
Apply objectives of arrays and arraylist	Worksheets	<ul style="list-style-type: none"> • Lab • Test 	Programming Lab Teacher made Test	4 days 1 day	

Chapter or Unit: Interfaces and Polymorphism

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Be able to define and implement an interface Be able to convert between supertype and subtype references	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss/code how to create an interface • Discuss common errors in working with interfaces • Revisiting casting to convert from an interface type to a class type 	Programming Assignment/Activities Student Oral Response	1 day	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Understand the concept of polymorphism	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Define/discuss the concept of polymorphism • Define/discuss the concepts of early and late binding 	Programming Assignment/Activities Student Oral Response	1 day	
Improve reusability by implementing helper classes as inner classes	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Defining classes within other classes 	Programming Assignment/Activities Student Oral Response	1 day	
Apply objectives on interfaces and polymorphism	Worksheets	<ul style="list-style-type: none"> • Lab • Test 	Programming Lab Teacher made test	3 days 1 day	

Chapter or Unit: Iterative Sorts and Searches

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Discuss the pros/cons of the various iterative sorts Analyze the algorithms	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss the bubble, insertion and selection sorts in terms of loop structure and best/worst case analysis • Implement the bubble sort algorithm and either the insertion or selection sort • Identify the “swap” method and its use 	Programming Assignment/Activities Student Oral Response Programming Lab	3 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Discuss the pros/cons of both the linear search and the binary search Analyze the algorithms	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss the linear search and binary search in terms of the loop/decision structure and the best/worst case analysis • Implement the binary search algorithm after one of the above searches has been completed to find an object 	Programming Assignment/Activities Student Oral Response Programming Lab	3 days	
Applying sorts and searches	Worksheets	<ul style="list-style-type: none"> • Lab • Test on both sorts and searches 	Programming Lab Teacher made test	5 days 1 day	

Chapter or Unit: Recursion

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand the concept of recursion as a repetitive process both from a math and computer perspective Emphasize the need for a terminating condition/base case	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> Discuss the math definition of writing the recursive rule of a sequence of numbers Discuss problems that are easier to solve by recursion than by iteration, discuss the relationship between recursion and iteration “Thinking recursively” 	Student Oral Response	1 day	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Investigate the “Towers of Hanoi” simulation and algorithm Apply the algorithms for factorial, pascals triangle, and Fibonacci numbers	Powerpoint presentation Teacher Lecture Text/Worksheets Computer Scissors	<ul style="list-style-type: none"> “Play” the Towers of Hanoi simulation with “disks” and paper cutting exercise, discuss code for moving disks discuss/code algorithm for factorial, pascals triangle and generating Fibonacci numbers 	Programming Activities Student Oral Response	2 days	4.5.C.1 & 3
Discuss/apply the merge sort algorithm	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> Analyze merge sort algorithm in terms of efficiency, time and memory, O notation Compare/contrast merge sort algorithm with iterative sort algorithms 	Programming Assignment/ Activities Student Oral Response	1 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Apply objective on recursion and merge sort	Worksheets	<ul style="list-style-type: none"> Lab Test 	Programming Lab Teacher made test	3 days 1 day	

Chapter or Unit: Designing Classes

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand the concepts of cohesion and coupling Minimize the use of side effects	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss/define/state useful criteria for analyze the quality in terms of cohesion and coupling of a public interface • Examine examples of side effects and how to minimize them 	Programming Assignment/Activities Student Oral Response Programming Lab	1day	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Understand the difference between instance methods and static methods Review the scope rules for local variables and instance fields	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Compare/contrast, discuss appropriate us of instance vs static methods • Review/discuss scope rules 	Programming Assignment/Activities Student Oral Response Programming Lab	1 day	
Work with/import packages	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss the use of packages, list some of the important packages in the java library and how to write code to import them 	Programming Assignment/Activities Student Oral Response Programming Lab	½ day	
Apply the objectives of class design	Worksheets	<ul style="list-style-type: none"> • Lab • Test 	Programming Lab Teacher made test	2 days 1 day	

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand how to inherit and override superclass methods Be able to invoke superclass constructors	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Define/discuss the concept of Inheritance, the concepts of Superclass and subclasses • How to invoke superclass constructors from a subclass • Discuss in relation to case study 	Programming Assignment/Activities Student Oral Response Programming Lab		4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Understand the common superclass Object and to override its toString, equals and clone methods	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Discuss usage and how to override the clone method • Using the toString methods • Discuss in relation to case study 	Programming Assignment/Activities Student Oral Response Programming Lab		

Chapter or Unit: Exception Handling

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Be able to “throw” exceptions Understand how to catch exceptions	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Implement the “throw” statement • Discuss the two types of exceptions • Write a method to handle a particular exception type 	Programming Assignment/Activities Student Oral Response	1 day	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Know when and where to catch an exception	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Implement the “finally” clause with a try block • Discuss exception handling in case study 	Programming Assignment/Activities Student Oral Response	2 days	

Chapter or Unit: Marine Biology Simulation Case Study

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Experimenting with the Marine Biology Simulation Program	Case study computer	<ul style="list-style-type: none"> • Load case study, all classes and files into students own directory – be able to get swimming fish!! • Read/Discuss text of Unit 1 of the case study • Design a test/debug plan 	Analysis Questions Student Responses Exercise Sets Programming Lab	3 days	4.3.A.1, C.1 4.4.A.2 & 3 4.4.B.3
Implementation of the Marine Biology Simulation	Case study computer	<ul style="list-style-type: none"> • Discuss the objects of the core classes, the: Simulation, Environment and Fish class • Design a test/debug plan 	Analysis Questions Student Responses Exercise Sets Programming Lab	3 wks	4.3.A.1, C.1 4.4.A.2 & 3 4.4.B.3
Creating a dynamic population	Case Study computer	<ul style="list-style-type: none"> • Designing code to modify the behavior of a fish to breed, move or die based on probabilities • Design a test/debug plan • 	Analysis Questions Student Responses Exercise Sets Programming Lab	2 wks	4.3.A.1, C.1 4.4.A.2 & 3 4.4.B.3
Creating specialized fish	Case Study computer	<ul style="list-style-type: none"> • Designing the “darter fish” and the “slow fish” based on a set of attributes • Design a test/debug plan 	Analysis Questions Student Responses Exercise Sets Programming Lab	3 wks	4.3.A.1, C.1 4.4.A.2 & 3 4.4.B.3
Apply objectives of the Marine Biology Case study	Worksheet	<ul style="list-style-type: none"> • Test • Create a “circle fish” as a subclass of fish – define how to make a circle on a grid – (partner activity) 	Teacher made test Presentation of all “circle fish” and discussion of code	1 day 2 days	4.3.A.1, C.1 4.4.A.2 & 3 4.4.B.3

Chapter or Unit: Preparation for AP Exam

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Review for AP Exam	AP Review Books Worksheets	<ul style="list-style-type: none"> • Discuss sample test questions • Discuss grading of open ended questions • Complete open ended questions 	Standardized AP Exam	1 wk to 10 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4

Chapter or Unit: Two Dimensional Arrays

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Understand and use two dimensional arrays	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> • Manipulating a two dimensional arrays using loops, accessing a row or column or a single cell • Summing rows/columns • Apply methods for two dimensional arrays 	Programming Assignment/Activities Student Oral Response Programming Lab Teacher made Test	3 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Applying two dimensional arrays	Worksheets	<ul style="list-style-type: none"> • Lab • Test 	Programming Lab Teacher made test	5 days 1 day	

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Chapter or Unit: Linked Lists

OBJECTIVES	MATERIALS/ MANIPULATIVES	SUGGESTED STRATEGIES	ASSESSMENT State, Teacher made, District	PACING	NJ CORE CURRICULUM STANDARD
Use the linked list definition provided for in the library	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> Discuss the difference between linked lists and arrays or array lists – pros/cons Importing and using the Linked list definition 	Programming Assignment/Activities Student Oral Response	2 days	4.5.A1 & 2 4.5.B1 – 4 4.5.C3 & 4 4.5.F1 – 6 8.1.A.4 & D.1 8.2.A.3 8.2 B1,2,4
Use iterators to traverse a linked list to be able to insert and delete a node	Powerpoint presentation Teacher Lecture Text/Worksheets Computer	<ul style="list-style-type: none"> Use the list iterator to access elements inside a linked list Add and delete a node at the front of a linked list, in the middle and at the end 	Programming Assignment/Activities Student Oral Response	2 days	
Applying Linked lists	Worksheets	<ul style="list-style-type: none"> Lab Test 	Programming Lab Teacher made test	4 days 1 day	

BIBLIOGRAPHY

Texts

Lambert & Osborne, Fundamentals of JAVA. Massachusetts: Thompson Learning Inc., 2003

Horstmann, Cay, Computing Concepts with Java Essentials. New York: John Wiley & Sons, 2003

Horowitz, Susan, Review for the AP Computer Science Exam in Java. New York: Addison Wesley, 2004

Trees, Fran, Computing Concepts with Java Essentials – Workbook. New York: John Wiley & Sons, 2003

Teukolsky, Roselyn, Barron's How to prepare for the AP Computer Science Advanced Placement Examination Java Version.
New York: Barrons Educational Series Inc., 2003

Software

Java SDK from Sun: J2EE1.4.2 windows 2000 & XP platforms and Documentation

JCreatorLE v 3.1

Easyreader from skylit.com

BlueJ (Optional)

Case Study

The College Board AP Marine Biology Simulation Case Study

NORTH BRUNSWICK TOWNSHIP HIGH SCHOOL

(2525) Advanced Placement Computer Science Using Java

Grades: 11,12

5 Credits - 1 Year

Pre-requisite: Successful completion of Intro to Computer Science (2533)

Co-requisite: Precalculus

This course emphasizes the design issues that make programs understandable, adaptable, and, when appropriate, reusable as well as solving a given problem. The development of useful computer programs and classes are used as a context for introducing the study, development and analysis of algorithms, and the use of fundamental data structures.

Computer science is not just programming. Through programming, the student will experience the disciplines that compose the field of computer science. The use of Java provides a mechanism for doing this.

The course outline as described in the AP Course Description Booklet will be used as a guideline in this course to prepare the students for success on the AP exam. This may result in the student receiving credit for a one semester introductory course in programming (A exam).

At the completion of this course, the student will be able to:

- Specify and design a program that is understandable, can be adapted to changing circumstances, and has the potential to be reused in whole or in part.
- Apply the AP subsets
- Analyze and test programs to determine whether they correctly meet their specifications
- Analyze programs or algorithms so as to understand their time and space requirements when applied to different data sets.
- Apply data structures
- Apply standard algorithms
- Know the major hardware and software components of computer systems
- Know the importance of considering the ethical and social implications of computing systems.
- Investigate case studies, particularly “GridWorld Case Study” (introduced for the 2008 AP exam in C++ and has been adapted to JAVA).

Course Requirements:

- Students will be expected to bring to class daily those items used for the days lesson, such as disks, text, notebooks etc.
- Students will be expected to complete all assignments, both programming and non-programming, on time.
- Students will be expected to successfully complete all tests, quizzes, and projects on time
- Students who are absent are expected to arrange with the teacher times for making up assignments, labs, and tests.
- Students are expected to keep the computer lab tidy - PLEASE RECYCLE!!! THERE WILL BE NO FOOD OR DRINK IN THE LAB!!!!
- Students may share ideas, however each program must contain some originality. Students who are found “sharing the work” will result in a zero grade for both students.
- Any student found to be mistreating the equipment, tampering with software or using the equipment in a non-educational fashion will face disciplinary actions
- You will be assigned your own account. As a member of this class you have special privileges which are only to be used in completing work for this class in room 615.

Marking period grades will be determined by:

Assessments	45%
Programs/Projects	35%
Homework/Classwork	20%