# AP Computer Science - A Overview 

Content Area: Computer Science \& Business Course(s): Time Period: Length: Status:

## AP COMPUTER SCIENCE A

 180 Days Published
# EAST BRUNSWICK PUBLIC SCHOOLS <br> East Brunswick New Jersey 

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## COURSE DESCRIPTION

The Advanced Placement Computer Science course is a full year introductory course in college level Computer Science. Students taking the course are required to have taken The Introduction to Computer Science course and math courses at the Algebra II level. Students taking the course will prepare to take the Advanced Placement Test in Computer Science. Practice exercises and problems from old and sample AP tests will be included a part of the course. The course centers on the development of computer programs to solve problems. The course emphasizes the design issues that make programs understandable, adaptable and reusable. The course uses an "object oriented" design paradigm. Important concepts include the development and analysis of algorithms, the development and use of data structures, the study of standard algorithms and typical applications. In addition, an understanding of the basic hardware and software components of computer systems and the responsible use of these systems are part of the course.

## COURSE SCOPE AND SEQUENCE

| Sequential Unit Description | Associated CPI's to be Achieved | Marking Period Guide | Other Pacing Guide References | Proficiency (Summative) Assessments |
| :---: | :---: | :---: | :---: | :---: |
| Unit 1 - Introduction to Computers and Java Language |  |  |  |  |
| - Components of a computer system (hardware and software) | 8.1.12.D. 1 |  |  |  |
| - A brief history of computing | 8.1.12.D. 2 |  |  |  |
|  | 8.1.12.D.58.2.2.E. 1 |  |  | - History report |
| Object Oriented Programming AP Computer Science and Java (an overview) | 8.2.2.E. 2 | 1 | 6 days | - Vocabulary assignment |
|  | 8.2.8.E. 2 |  |  |  |
| 1. encapsulation |  |  |  |  |
| 2. inheritance |  |  |  |  |
| 3. polymorphism |  |  |  |  |
| Unit 2 - Introduction to Program Development and Object Oriented Design | N-Q (R) |  |  |  |
|  | A-SSE (D) |  |  |  |
|  | F-IF (D) |  |  |  |
| Simple class design |  |  |  |  |
|  | S-IC (R) |  |  |  |
| Introduction to standard Java classes (String class, Character class) |  |  |  | - Programming projects |
|  | 8.2.2.E. 1 | 1 | 25 days | - Online practice assignments |
| $\cdot$ Inputting data into a program(Scanner class) | 8.2.2.E. 2 |  |  | - Unit tests |
|  | 8.2.2.E. 3 |  |  |  |
|  | 8.2.2.E. 4 |  |  |  |

8.2.5.E. 2
8.2.5.E. 3
8.2.8.E. 3
8.2.12.E. 3

N-Q (M)
A-CED (M)

A-REI(M)

F-BF (D)
Use methods from the Integer and Double wrapper
classes to convert String input to primitive
numeric types

|  | $8.2 .5 . \mathrm{E} .1$ |
| :--- | :---: |
| Use the numeric operators and Math class <br> methods and constants to perform calculations <br> with numeric data | $8.2 .5 . \mathrm{E} .2$ |

- Programming projects

16 days

- Online practice assignments
- Unit tests

Use Math class random method to generate pseudo-random numeric values

Unit 4- Use List interface and ArrayLists Class to Create and Process Linear Data Structures
8.2.2.E. 1
8.2.2.E. 2

Perform the standard operations (traversals, insertions, and deletions) on ArrayLists
8.2.5.E. 3
8.2.8.E. 3

N-Q 2 (I)

A-SSE 3 (I)
Unit 5- Writing Classes Using Inheritance and F-BF 1 (R)
Interfaces.
Examine the use of inheritance in Java library classes.

Examine a group of classes to demonstrate the 8.2.2.E.2 concepts of inheritance.
8.2.2.E. 3

Have classes implement the Comparable interface to allow for comparisons of objects
8.2.5.E. 3
8.2.8.E. 3
8.2.12.E. 3

N-Q 1 (A)
$\mathrm{N}-\mathrm{Q} 2$ (A)

N-Q 3 (A)
Unit 6- Using 1 and 2 Dimensional Arrays to Manipulate Data in Java

N-VM 6 (D)

F-BF 2 (D)

F-BF 3 (D)

S-IC 2 (D)

Use 2-dimensional arrays to create tables/matrices
of data
8.2.2.E. 1

Perform the standard operations (traversals, insertions, and deletions) on one and two dimensional arrays.
efficiencies of algorithms
8.2.5.E. 3
8.2.8.E. 3
8.2.12.E. 3

A-SSE 1 (I)

A-SSE 4 (I)

F-BF 2 (I)
F-BF 3 (I)
8.2.2.E. 1
8.2.2.E. 2
8.2.2.E. 3

## - Programming projects

## 20 days

- Unit tests
- Programming projects
- Unit tests
- Programming projects
- Online practice assignments
8.2.2.E. 4
8.2.5.E. 3
8.2.8.E. 3
8.2.12.E. 3

S-MD 1 (R)
S-MD 5 (R)

S-MD 6 (R)

S-MD 7 (R)
Unit 8- A.P. Computer Science Labs

The Advanced Placement labs. The study will change over the years.
8.2.5.E. 3
8.2.8.E. 3
8.2.12.E. 3

A-REI 1 (M)

## - Programming projects

18 days

- Unit tests
8.2.2.E. 4

Unit 9 - Preparing for the Advanced Placement 8.2.2.E. 1
Computer Science test
8.2.2.E. 2
8.2.2.E. 3

Reviewing old AP Free response questions
Reviewing available sample multiple choice questions
8.2.2.E. 4
8.2.5.E. 1
8.2.5.E. 2
8.2.5.E. 3

A-SSE 1 (I)
A-SSE 4 (I)
F-BF 2 (I)

F-BF 3 (I)
Unit 10 - Advanced Topics- (for after the AP Exam)

- Online practice assignments


## CONTENT FOCUS AREA AND COURSE NAME

Course Name: Advanced Placement Computer Science \#1456

| Course <br> Number | School <br> Numbers | Course Level | Grads(s) | Credits | Min. <br> Per <br> Week | Elective/Requir | Initial <br> Course <br> Adopted |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1456 | 050 | AP | 10-12 | 5.00 | 210 | E |  |

## Textbooks and Other Resources

## COURSE RESOURCES

Java an Introduction to Computer Science and Programming(Walter Savitch) Second Edition Prentice Hall APCS Case Study and other materials posted on the AP website and other websites.

Be Prepared for the AP Computer Science Exam in Java (Maria Litvin) SkyLight Publishing
APCS review tests and test questions released from past years tests

## Standards

| MA.N-Q.A. 1 | Use units as a way to understand problems and to guide the solution of multi-step <br> problems; choose and interpret units consistently in formulas; choose and interpret the <br> scale and the origin in graphs and data displays. |
| :--- | :--- |
| MA.N-Q.A. 2 | Define appropriate quantities for the purpose of descriptive modeling. <br> MA.N-Q.A. 3 |
| Choose a level of accuracy appropriate to limitations on measurement when reporting |  |
| quantities. |  |


| MA.F-BF.A.1a | Determine an explicit expression, a recursive process, or steps for calculation from a context. |
| :---: | :---: |
| MA.F-BF.A.1b | Combine standard function types using arithmetic operations. |
| MA.F-BF.A.1c | Compose functions. |
| MA.F-IF.A. 1 | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$. The graph of $f$ is the graph of the equation $y=f(x)$. |
| MA.F-IF.A. 2 | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. |
| MA.F-IF.A. 3 | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. |
| MA.F-IF.C. 8 | Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. |
| MA.N-VM.C. 6 | Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. |
| MA.S-IC.A. 1 | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. |
| MA.S-IC.A. 2 | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. |
| MA.S-IC.B. 3 | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. |
| MA.S-IC.B. 4 | Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. |
| MA.A-CED.A. 1 | Create equations and inequalities in one variable and use them to solve problems. |
| MA.A-CED.A. 3 | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. |
| MA.A-CED.A. 4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. |
| MA.A-REI.A. 1 | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. |
| MA.A-SSE.A. 1 | Interpret expressions that represent a quantity in terms of its context. |
| MA.A-SSE.A. 2 | Use the structure of an expression to identify ways to rewrite it. For example, see $x^{4}-y^{4}$ as $\left(x^{2}\right)^{2}-\left(y^{2}\right)^{2}$, thus recognizing it as a difference of squares that can be factored as $\left(x^{2}-\right.$ $\left.y^{2}\right)\left(x^{2}+y^{2}\right)$. |
| MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. |
| MA.A-SSE.A.1b | Interpret complicated expressions by viewing one or more of their parts as a single entity. |
| MA.A-SSE.B. 3 | Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. |
| MA.A-SSE.B. 4 | Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1 ), and use the formula to solve problems. |
| MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. |
| MA.A-SSE.B.3b | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. |
| MA.A-SSE.B.3c | Use the properties of exponents to transform expressions for exponential functions. |

TECH.8.1.12.D. 1

TECH.8.1.12.D. 2

TECH.8.1.12.D. 3
TECH.8.1.12.D. 4
TECH.8.1.12.D. 5

TECH.8.1.12.E. 1

TECH.8.1.12.E. 2

TECH.8.1.12.E.CS1
TECH.8.1.12.E.CS2

TECH.8.1.12.E.CS3

TECH.8.1.12.E.CS4

Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.

Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.

Compare and contrast policies on filtering and censorship both locally and globally.
Research and understand the positive and negative impact of one's digital footprint.
Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.

Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.

Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.
Plan strategies to guide inquiry.
Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.

Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.

Process data and report results.

## Grading and Evaluation Guidelines

## GRADING PROCEDURES

In terms of proficiency level the East Brunswick grades equate to:
A Excellent - Advanced Proficient
B Good Above Average - Proficient
C Fair-Proficient
D Poor - Minimally proficient
F Failing - Partially Proficient

## COURSE EVALUATION

Each quarter students will be evaluated with tests and programming assignments using a total point basis to determine the quarter average. The semester average will be a weighted average of the 2 quarter averages ( $40 \%$ each) and a midterm exam ( $20 \%$ ). The final average will be weighted of 4 quarters averages ( $20 \%$ each ) the midterm ( $10 \%$ ) and the final exam ( $10 \%$ )

Course achievement will be evaluated based on the percent of all pupils who achieve the minimum level of proficiency (final average grade) in the course. Student achievement levels above minimum proficiency will also be reported. Final grades, and where relevant mid-term and final exams, will be analyzed by staff for the total cohort and for sub-groups of students to determine course areas requiring greater support or modification.)

## Other Details

## 10157 AP Computer Science A

Following the College Board's suggested curriculum designed to mirror college-level computer science courses, AP Computer Science A courses provide students with the logical, mathematical, and problemsolving skills needed to design structured, well-documented computer programs that provide solutions to realworld problems. These courses cover such topics as programming methodology, features, and procedures; algorithms; data structures; computer systems; and programmer responsibilities.

