



Manhattan Center for Science and Math High School

Mathematics Department Curriculum

Content/Discipline AP Computer Science Term 2

<http://MCompSciM.weebly.com/>

Marking Period 1

Topic and Essential Question

Lessons 33-35, Passing by value/reference, Matrices, Inheritance - (1) boolean type operators (2) if statement (3) switch statement & char

Lessons 36-37, Exceptions, Interfaces - (1) boolean type operators (2) if statement (3) switch statement & char

Lessons 38-39, Big-O analysis, Recursion - (1) boolean type operators (2) if statement (3) switch statement & char

Unit/Topics Lessons 33-35, Passing by value/reference, Matrices, Inheritance and Lessons 36-37, Exceptions, Interfaces and Lessons 38-39, Big-O analysis, Recursion

SWBAT/Objectives Content (“Know”):

Lessons 33-35, Passing by value/reference, Matrices, Inheritance 11 days

(1) Arrays, (2) primitives/value, (3) objects/reference, (4) 2D arrays, matrix, Arrays class, (5) Superclass, subclass, base class, derived class, abstract, final, overriding, shadowing, instanceof, Object, this, super

Lessons 36-37, Exceptions, Interfaces 6 days

(1) checked/unchecked exceptions, (2) try/catch/finally/throw/throws, (3) implementation/objective perspective, (4) instanceof, polymorphism, implements

Lessons 38-39, Big-O analysis, Recursion 8 days

(1) Sequential search, (2) binary search, (3) recursion, factorial, Fibonacci

Skills (“Do”):

Lessons 33-35, Passing by value/reference, Matrices, Inheritance 11 days

- (1) Students will be able to create and populate arrays.
- (2) SWBAT access and store data in matrices (2D arrays).
- (3) SWBAT design and implement a hierarchical class structure using inheritance.

Lessons 36-37, Exceptions, Interfaces 6 days

- (1) Students will be able to anticipate and handle runtime errors.
- (2) SWBAT exploit polymorphism in their programs.

Lessons 38-39, Big-O analysis, Recursion 8 days

- (1) Student will be able to perform Big-O analysis on various algorithms.
- (2) SWBAT design and implement recursive algorithms to generate factorial and Fibonacci sequences.

Vocabulary/Key Terms

Arrays, primitive types, objects, references, matrix, 2D array, superclass, subclass, base class, derived class, abstract, final, overriding, overloading, instanceof, this, super, checked, unchecked, try, catch, throw, implement, polymorphism, Big-O notation, sequential search, binary search, recursion, factorial, Fibonacci

Assessments:

- Unit Test / Quiz
- Classwork
- Lesson Summary
- Homework daily
- Warm-up (DO NOW) Quiz next day
- Tests
- At least one programming projects submitted for almost every lesson

Common Core Standards:

F.IF.7 , F.LE.1, F.LE.2, F.LE.3, F.LE.4, F.IF.8

Common Core Standards for Math Practices:

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics
- MP5: Use appropriate tools strategically
- MP6- Attend to precision
- MP7: Look for and make use of structure
- MP8- Look for and express regularity in repeated reasoning

Differentiated Instruction:

- Flexible grouping
- Cooperative Learning
- Visual Learning – SMART Board, White board
- Visual and interactive questions using the Smart board
- Students have an option to view additional videos, tutorials, interactive practice problems online through the class website, MCompSciM.weebly.com

ELLs:	<ul style="list-style-type: none"> • Students with ELL's will watch videos (the video has English and Spanish both versions) and additional tutorials about the lesson through the class website. • Students are allowed extra time for works and assessments
SWDs:	<ul style="list-style-type: none"> ▪ Preview the Key Terms to give students access to context. ▪ Assign chapter summary to give less proficient readers access to content.
High-Achievers:	<ul style="list-style-type: none"> ❖ Have gifted students assist students that are not as gifted. ❖ Ask students to take on leadership roles when working in groups.
Resources/Books	<ul style="list-style-type: none"> ✚ Lewis, Leftus, Cocking. “Java Software Solutions”. 2nd edition. Pearson, 2007 ✚ Multiple-Choice & Free-Response Questions in Barron's Review Book for AP Computer Science A, 7th Edition, 2015 by Teukolsky, M.S. ✚ Cook. “Blue Pelican Java”, Version 7.0.1A. Virtualbookworm.com Publishing, 2013. ✚ AP Central web site to find past free-response exams and AP Exam information. See www.apcentral.collegeboard.com.

Homework: Per Teacher



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Marking Period 2

Topic and Essential Question

Lessons 40, Sorting - (1) boolean type operators (2) if statement (3) switch statement & char

Lessons 41-44, List, ArrayList, Comparable - (1) boolean type operators (2) if statement (3) switch statement & char

Lessons 50, Binary search - (1) boolean type operators (2) if statement (3) switch statement & char

Golden Nuggets (AP Review) - (1) boolean type operators (2) if statement (3) switch statement & char

Unit/Topics

Lessons 40, Sorting and Lessons 41-44, List, ArrayList, Comparable and Lessons 50, Binary search and Golden Nuggets (AP Review)

SWBAT/Objectives

Content (“Know”):

Lessons 40, Sorting 7 days

(1) Selection sort, (2) Insertion sort, (3) Quick sort, (4) Merge sort, (5) Partition & Big-O chart

Lessons 41-44, List, ArrayList, Comparable 9 days

(1) ArrayList, LinkedList, Vector, (2) advantages & disadvantages, (3) Iterator, (4) Comparable interface

Lessons 50, Binary search 4 days

(1) Binary search of primitive arrays & object arrays, (2) Recursive search

Golden Nuggets (AP Review) 10 days

30 “lessons” – after-school needed

Skills (“Do”):

Lessons 40, Sorting 7 days

(1) Students will be perform any of the covered sorting algorithms by hand and by code.

(2) SWBAT analysis the relative strengths and weaknesses and choose the correct sorting algorithm for given criteria.

Lessons 41-44, List, ArrayList, Comparable 9 days

(1) Student will be able to use ArrayLists to store and retrieve data.

(2) SWBAT compare arrays with ArrayLists.

(3) SWBAT use iterators and interfaces to abstract coding.

Lessons 50, Binary search 4 days

(1) SWBAT implement binary and recursive searches on arrays.

Golden Nuggets (AP Review) 10 days

(1) Students will be able to pass the AP Computer Science A exam.

Vocabulary/Key Terms

Selection, insertion, quick, merge sorts; Big-O analysis, ArrayList, iterators, Comparable interface, binary search

Assessments:

- Unit Test / Quiz
- Classwork
- Lesson Summary
- Homework daily
- Warm-up (DO NOW) Quiz next day
- Tests
- At least one programming projects submitted for almost every lesson

Common Core Standards:

F.IF.7 , F.LE.1, F.LE.2, F.LE.3, F.LE.4, F.IF.8

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SWDs:

- Preview the Key Terms to give students access to context.
- Assign chapter summary to give less proficient readers access to content.

High-Achievers:

- ❖ Have gifted students assist students that are not as gifted.
- ❖ Ask students to take on leadership roles when working in groups.

Resources/Books

- ✚ Lewis, Leftus, Cocking. “**Java Software Solutions**”. 2nd edition. Pearson, 2007
- ✚ Multiple-Choice & Free-Response Questions in Barron's Review Book for AP Computer Science A, 7th Edition, 2015 by Teukolsky, M.S.
- ✚ Cook. “**Blue Pelican Java**”, Version 7.0.1A. Virtualbookworm.com Publishing, 2013.
- ✚ AP Central web site to find past free-response exams and AP Exam information. See www.apcentral.collegeboard.com.

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Marking Period 3

Topic and Essential Question

AP Computer Science A - (1) What did we learn from this class, academically and otherwise? (2) What and how can we communicate our lessons to future or prospective AP CS students?

Special Relativity - (1) What is special relativity? (2) What thought experiments can we conduct to test the predictions of special relativity? (3) What real-world phenomena can be explained by relativity?

Unit/Topics

AP Computer Science A – (1) Group Project – Video or poster-board presentation to future AP Computer Science Students, (2) Individual Project – Presentation on special relativity

1. Video/poster-board presentation to Future AP Computer Science A Students = 1 Test Grade

In September, we started out as individual bits and we've coded and compiled ourselves in the last nine months. It might not seem like it, but yes, we've made it! This is a time to take the last nine months and reflect on it to future students of AP Computer Science A. The following is a guideline on how you can convey your experiences. Be positive and have fun!

I. Starting Out

- Your initial expectations of the class
- What you had problems with/what did you excel at?
- What is one necessity that is required to get through this course? (ex: calculator, best friend, flash cards, etc.)
- Was it everything you expected? If not why?
- Did you have to put more effort than expected and/or have more work than expected?

II. I Am a Changed Woman/ Man

- What were you able to take out of AP Computer Science A?
- How did you tackle the AP exam with your fullest potential?
- In general, how did you change/improve (self wise, academically, etc) just by taking this course? (This is a very ambiguous question, feel free to be specific based on your personal experiences).
- Benefits of taking this course?

III. Time Machine

- What was the most memorable event in Mr. Lee's Computer Science A class?
- If you can go back in time, name one thing you would have done differently.

IV. Conclusion

- Leave a positive note: words of encouragement
- Any secret techniques that you can reward the reader for getting to the end of your essay

- Study tips for incoming students
Exceptional presentations will be posted on Mr. Lee's Summer CS Website!

2. Individual Project - PowerPoint = 1 Test Grade

1. On your Individual Project - you are creating your own non-PowerPoint presentation to discuss what you learned about special relativity, your questions or ideas.
2. You MUST be well-prepared for your presentation on Friday. Your presentation must be 3-4 minutes. You only have one chance to make it perfect. You must include the following aspects to receive a high grade: a) Creativity! b) Four perspectives (see above). c) BE SURE TO CHOSE YOUR QUESTION WISELY!
3. Exceptional presentations will be posted on Mr. Lee's Website!
4. Check your rubric and make sure your cover everything.
5. Presentation (Individual Project) = 1 TEST GRADE

SWBAT/Objectives

Content ("Know"):

Chapter 1 – Introduction

(1) Computer processing & Software categories, (2) Binary, (3) Computer architecture & I/O devices, (4) Memory & CPU, (5) Network connections, (6) Internet & the web, (7) Programming language levels, compilers, interpreters, (8) Syntax & semantics, (9) Types of errors, (10) Java syntax, (11) Computer shopping assignment, (12) Review and retest

Chapter 2 – Java syntax

(1) Hello World, (2) Variable types, (3) Simple String operation

Lessons 4-7 – Values

(1) Assignment, Order of operations, Operators, (2) constants, mixed arithmetics, casting, (3) Math class methods(), (4) Input from the keyboard, Scanner class, methods

Lessons 8-10 – Flow of Control

(1) boolean values and type, precedence, (2) if statement, equals(), (3) switch statement, default, break, char

Lessons 11-14, Loops - (1) for loop (2) while loop, do-while loop (3) ASCII table (4) Base conversions

Lessons 15-16 – Classes & Objects

(1) Classes, (2) methods, (3) Objects, (4) states and behaviors

Lessons 17-19 – String methods & Arrays

(1) Declaring and initializing, length, parallel arrays, (2) Passing array to a method, Array of objects, (3) NullPointerException, sort, search, equals, (4) for-each loop

Lessons 20-22, State methods & variables, Wrapper classes

(1) Class methods and variables, static constants, static imports

Lessons 33-35, Passing by value/reference, Matrices, Inheritance

(1) Arrays, (2) primitives/value, (3) objects/reference, (4) 2D arrays, matrix, Arrays class, (5) Superclass, subclass, base class, derived class, abstract, final, overriding, shadowing, instanceof, Object, this, super

Lessons 36-37, Exceptions, Interfaces

(1) checked/unchecked exceptions, (2) try/catch/finally/throw/throws, (3) implementation/objective perspective, (4) instanceof, polymorphism, implements

Lessons 38-39, Big-O analysis, Recursion

(1) Sequential search, (2) binary search, (3) recursion, factorial, Fibonacci

Skills (“Do”):

Chapter 1 – Introduction

(1) Students will be able to explain basic architecture and components of digital computers and networks, and basic programming language features.

Chapter 2 – Java syntax

(1) Student will be able to write basic Java programs to output messages.

(2) Students will be able to store and concatenate simple values.

Lessons 4-7 – Values

(1) Students will be able to store and manipulate numerical values, and perform calculations.

(2) SWBAT apply the differences between integer and floating point numbers, and convert (cast) between types.

Lessons 8-10 – Flow of Control

(1) Student will be able to perform logic operations and complete truth tables.

(2) SWBAT draw flowcharts of flow of control with if statements, and write code from flowcharts.

(3) SWBAT rewrite switch statements as if-else statements.

(4) SWBAT differentiate between char and String.

Lessons 11-14 – Loops

-
- (1) Students will be write programs using loops to repeat actions.
 - (2) SWBAT convert between different loop types.
 - (3) SWBAT operate on char values and variables.
 - (4) SWBAT convert between different number systems (bases).

Lessons 15-16 – Classes & Objects

- (1) Students will be able to write programs that use classes to create and interact with objects.

Lessons 17-19 – String methods & Arrays

- (1) Students will be able to perform advanced operations on Strings.
- (2) SWBAT instantiate and manipulate arrays of primitive types.
- (3) SWBAT manipulate arrays of objects.

Lessons 20-22, State methods & variables, Wrapper classes

- (1) Students will be able to simplify objects with common traits with class methods and variables.
- (2) SWBAT use static constants.
- (3) SWBAT convert between primitive types and corresponding objects.

Lessons 33-35, Passing by value/reference, Matrices, Inheritance

- (1) Students will be able to create and populate arrays.
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Golden Nuggets (AP Review)

(1) Students will be able to pass the AP Computer Science A exam.

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Selection, insertion, quick, merge sorts; Big-O analysis, ArrayList, iterators, Comparable interface, binary search

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