SCHOOL DISTRICT OF THE CHATHAMS

Programming in Java
Grades 9 - 12
Semester

Course Overview

Programming in Java provides an introduction to the Java programming language and can be used as a prerequisite for AP Computer Science A or AP Computer Science Principles. This course will cover the basics of the Java programming language as well as covers general material on the discipline of computer science. Topics include computing devices (hardware and software), the software development process, structured programming, top-down design and programming language features. These features include identifiers, data types, input/output commands, control flow statements, classes, and user-defined methods.

New Jersey Student Learning Standards
The New Jersey Student Learning Standards (NJSLS) can be located at www.nj.gov/education/cccs/2020/.

Algorithms & Programming
8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables.
8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify tradeoffs to justify the choice.
8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.

Engineering Design
8.2.12.ED.1: Use research to create a product or system that addresses a problem and make modifications based on input from potential consumers.

Technology Standards
9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.

21st Century Integration | NJSLS 9
9.3.IT-PRG.6 Program a computer application using the appropriate programming language.

Career Ready Practices

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Interdisciplinary Connections

Comprehensive Health & Physical Education
- 2.2.12.LF.4: Exhibit responsible social behavior by including and cooperating with classmates of all skill levels, assisting when needed and collaborating respectfully to solve problems in groups, teams and in pairs.

Units of Study

Unit 1: Computer Architecture and Java with Eclipse (~6 days)
- What are the hardware components of a computer and their functions?
- What are the software components of a computer and their functions?
- How do analog and digital compare?
- What are number systems? (Binary)
- What are networks?
- What is the internet?
- How does Java work (review of identifiers, errors)
- What is the difference between a compiler and interpreter?
- What is ASCII? (How do we print to the console)

Unit 2: Outputting to the console, Variables, Data Types, Expressions and Data Conversions (~24 days)
- How do we invoke print() and println()
- How does concatenation work?
- What are escape sequences?
- What are primitive data types?
- What are variables and constants?
- How do we assign a value?
- How do we implement the scanner class?
- What are the arithmetic expressions? (introducing mod)
- What is operator precedence?
- How do we implement increment, decrement and assignment operators?
- What does strongly typed mean?
- How do we convert data from one type to another by assignment, arithmetic or casting?

Unit 3: Objects and the String Class (~20 days)
- How do we instantiate an object and where does it reside in memory? (stack vs heap)
- What is an alias?
- What is garbage collection?
- What is a null reference?
- What is the dot operator?
- How do we invoke methods in the string class, accounting for return type and passing parameters?

Unit 4: Flow of Control (~12 days)

Revision Date: *November 2021*

- If and While revisited
- What are the equality/relational operators?
- What are the logical operators?
- What is short-circuiting?
- How do we use logical operators in conjunction with conditionals to alter flow of control?
- Nesting revisited
- What are the issues with dealing with doubles in java?
- How do we create a tolerance?
- How do we compare char vs comparing Strings?

Unit 5: Error Handling and File Manipulation (~12 days)
- How does a Do statement differ from a While and how do we implement one?
- How do we implement a For statement?
- How do we trace nested For loops?
- How do we determine what kind of loop is most appropriate to use?
- What is the purpose of a Try and how do we implement it?
- How do we access data from a txt file?
- What is PrintWriter and how do we write to a text file?
- What is the meaning of Throws?

Unit 6: Arrays (~4 days)
- What is an array and how do we create one?
- What are elements and how do we use an index to access them?
- How can we populate an array?
- How can we make use of For loops to work with arrays?
- What are two dimensional arrays?
- What are the limitations of arrays?

Learning Objectives/Discipline Standards of Practice

Learning Objectives:
- Understand the structure of a Library.
- Understand the function of the Scanner class and methods available.
- Understand the function of the Random class and methods available.
- Understand the function of the Math class and methods available.
- Distinguish between static and non-static methods.
- Understand the function of the DecimalFormat class and methods available.
- Write programs which implement the aforementioned classes.
- Revisit the concept of If and While, singularly and nested.
- Understand the various equality, relational and logical operators.
- Understand what short-circuiting is and how to apply it.
- Understanding how to alter flow of control.
- Revisit comparisons and issues (binary representation and comparing doubles in java, comparing char vs Strings).
- Understand how a switch statement functions.
- Recognizing key words 'break' and 'default'
- Write programs implementing boolean logic and switch statements.
- Understand the difference between a While, Do and For loop.
- Understand the structure of a For loop.

Revision Date: *November 2021*

- Navigate the flow of nested For loops.
- Understand the purpose and function of Try/Catch
- Introduce reading from and writing to a text file
- Introduce the concept of Throws
- Write programs implementing For loops, reading to and writing from text files.
- Understand the difference between a While, Do and For loop.
- Understand the structure of a For loop.
- Navigate the flow of nested For loops.
- Understand the purpose and function of Try/Catch
- Introduce reading from and writing to a text file
- Introduce the concept of Throws
- Write programs implementing For loops, reading to and writing from text files.
- Design and implement a java application referencing the techniques learned.
- Work in a team to develop a console (or other) application to solve a real world problem.

Discipline Standards of Practice:
- Computing Systems
  - People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.
- Networks and the Internet
  - Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world.
- Impacts of Computing
  - Computing affects many aspects of the world in both positive and negative ways at local, national, and global levels. Individuals and communities influence computing through their behaviors and cultural and social interactions, and, in turn, computing influences new cultural practices.
- Data & Analysis
  - Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.
- Algorithms & Programming
  - An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems.
- Engineering Design
  - People design for enjoyment and to solve problems, extend human capabilities, satisfy needs and wants, and improve the human condition. Engineering Design, a systematic approach to creating solutions to technological problems and finding ways to meet people's needs and desires, allows for the effective and efficient development of products and systems.

- Interaction of Technology and Humans

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- - Societies influence technological development. Societies are characterized by common elements such as shared values, differentiated roles, and cultural norms, as well as by entities such as community institutions, organizations, and businesses. Interaction of Technology and Humans concerns the ways society drives the improvement and creation of new technologies, and how technologies both serve and change society.
- Nature of Technology
  - Human population, patterns and movement focus on the size, composition, distribution, and movement of human populations and how they are fundamental and active features on Earth's surface. This includes understanding that the expansion and redistribution of the human population affects patterns of settlement, environmental changes, and resource use. Patterns and movements of population also relate to physical phenomena including climate variability, landforms, and locations of various natural hazards and their effects on population size, composition, and distribution.
- Effects of Technology on the Natural World
  - Many of engineering and technology's impacts on society and the environment are widely regarded as desirable. However, other impacts are regarded as less desirable. Effects of Technology on the Natural World concerns the positive and negative ways that technologies affect the natural world.
- Ethics & Culture
  - Ethics and Culture concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions.

Instructional Resources and Materials
Whole class resources have been identified with an asterisk.

Resources
- *Java Software Solutions, foundations of program design*, 6th Edition, by John Lewis, William Loftus, and Cara Cocking, Addison Wesley.

Materials
- Online documentation for the Java programming language
- Online documentation for the Eclipse IDE
- Teacher Generated Materials

Assessment Strategies
Assessment is designed to measure a student's mastery of a course standard and learning objective. Assessment can be used for both instructional purposes (formative assessment) and for evaluative purposes (summative assessment).

The following is a general list of the many forms assessment may take in learning.
- Peer Feedback
- Self-Reflection
- Reflective Exit Tickets/Slips

Course Specific Assessments Include:
- Tests
- Quizzes
- Programming projects

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