COURSE TITLE

Computer Programming 1

LENGTH

One Semester
Grades 9-12

DEPARTMENT

Computer Department
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SCHOOL

Rutherford High School

DATE

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COMPUTER PROGRAMMING 1

I. Introduction/Overview/Philosophy

Computer Programming 1 is designed for students who wish to gain an understanding of computer coding or who plan to further their knowledge of computer design and computer programming in upper level high school computer classes, college, business, or vocational schools. This course provides an introduction to the Python programming language. Students will learn the fundamental concepts of programming—concepts that can be applied in the study of any programming language. Students will also dive into specific features of the Python programming language. The course utilizes a blended classroom approach. The content is fully web-based, with students writing and running code in the browser. Teachers utilize tools and resources provided by CodeHS to leverage time in the classroom and give focused 1-on-1attention to students. This course will provide a foundation for more advanced computer programming languages and computer design techniques

II. Objectives

Course Outline

I. Getting Started with Python
   - A. Introduction to Python / Computer Science
   - B. Introduction to OOP (Object-Oriented Programming) with graphics
   - C. Introduction to use of basic commands

II. Basic Python and Console Interaction
   - A. Printing to the console
   - B. Learn debugging techniques
   - C. Declaration, initialization, and assignment of variables
   - D. Data types (int, double, string, boolean)
   - E. Translation of arithmetic expressions
   - F. Using and converting keyboard input

III. Control Flow
   - A. Use of comments for program understanding
   - B. Use of Decision Statements
     - 1. If statements
     - 2. Conditional operators
     - 3. Boolean values
   - C. Use of Iteration
     - 1. While loops
     - 2. For loops
     - 3. Nested loops
   - D. Introduction to Functions
     - 1. User defined functions
     - 2. Built-in functions
   - E. Exception handling and identification

IV. Strings
   - A. Manipulation of strings
   - B. Math operators on strings
   - C. Traverse through a string

If time allows and based upon student needs the following topics can/will be covered:

V. Data Structures
   - A. Tuples

B. Lists
C. Dictionaries
D. 2D Lists
E. List comprehensions
F. Packing and unpacking
G. Mutable vs. immutable
H. Equivalence vs. identity

VI. Classes and objects
A. Classes
B. Attributes
C. Class variables vs. instance variables
D. Methods
E. Built-in methods
F. Composition, inheritance and polymorphism
G. Private attributes

Student Outcomes:

Upon completion of the course, students will demonstrate the ability to:

- Code in the Python language fluently in a well-structured fashion
- Understand the concepts of object-oriented programming as used in Python including control statements, loops, functions, and lists.
- Develop an intuition for syntax in program creation
- Analyze and design strategies for solving basic programming problems by using logical reasoning

NEW JERSEY STUDENT LEARNING STANDARDS

CAREER READY PRACTICES

CRP1 Act as a responsible and contributing citizen and employee

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2 Apply appropriate academic and technical skills

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP4 Communicate clearly and effectively and with reason.

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP6 Demonstrate creativity and innovation

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP8 Utilize critical thinking to make sense of problems and persevere in solving them

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP11 Use technology to enhance productivity

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

TECHNOLOGY STANDARDS

STANDARD 8.1: EDUCATIONAL TECHNOLOGY: ALL STUDENTS WILL USE DIGITAL TOOLS TO ACCESS, MANAGE, EVALUATE, AND SYNTHESIZE INFORMATION IN ORDER TO SOLVE PROBLEMS INDIVIDUALLY AND COLLABORATE AND TO CREATE AND COMMUNICATE KNOWLEDGE.

8.1.12.B.2 - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
8.1.12.D.5 - Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.
8.1.12.F.1 - Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

STANDARD 8.2: TECHNOLOGY EDUCATION, ENGINEERING, DESIGN, AND COMPUTATIONAL THINKING – PROGRAMMING: ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE NATURE AND IMPACT OF TECHNOLOGY, ENGINEERING, TECHNOLOGICAL DESIGN, COMPUTATIONAL THINKING, AND THE DESIGNED WORLD AS THEY RELATE TO THE INDIVIDUAL, GLOBAL SOCIETY, AND THE ENVIRONMENT.

8.2.12.E.3 - Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.12.E.4 - Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

STANDARD 9.3: CAREER AND TECHNICAL EDUCATION

PATHWAY: PROGRAMMING & SOFTWARE DEVELOPMENT (IT-PRG)

9.3.IT-PRG.6 Program a computer application using the appropriate programming language.

III. Proficiency Levels

This course is open to grades 9 -12.

IV. Methods of Assessment

Student Assessment

The teacher will provide a variety of assessments during the course of the year. Among these are: homework, laboratory exercises, weekly projects, teacher-made tests and quizzes, and long-term projects.

Curriculum/Teacher Assessment

The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

V. Grouping

There is no prerequisite for Computer Programming 1. Students completing this course will have sufficient knowledge and experience with data types and structures to be successful in advanced programming and design courses such as C++, Java, etc.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one semester and is offered to students in grades 9-12.

VII. Resources

CodeHS: Introduction to Computer Science in Python https://codehs.com/info/curriculum/intropython

How to Think Like a Computer Scientist: Interactive Edition
http://interactivepython.org/runestone/static/thinkcspy/index.html

Automate the Boring Stuff with Python https://automatetheboringstuff.com/

https://codeacademy.com - an online interactive platform that offers free coding classes

VIII. Suggested Activities

- Laboratory programming problems
- Game simulated programs
- Cooperative programming projects

IX. Methodologies

The course utilizes a blended classroom approach offered through CodeHS. The content is fully web-based, with students writing and running code in the browser. Teachers utilize tools and resources provided by CodeHS to leverage time in the classroom and give focused 1-on-1 attention to students. Each unit of the course is broken down into lessons. Lessons consist of video tutorials, short quizzes, example programs to explore, and written programming exercises, adding up to over 100 hours of hands-on programming practice in total. Each unit ends with a comprehensive unit test that assesses student's mastery of the material from that unit. Much of the class time is spent in lab work with required hands-on exercises to be completed.

X. Interdisciplinary Connections

Connections are made to mathematics by using a variety of arithmetic formulas, as well as higher mathematical concepts. Connections are also made to the disciplines of business, art and English, by means of incorporation of theses ideas into programming projects.

XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, and Gifted & Talented Students

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

Differentiation for Support (ELL, Special Education, Students at Risk)

- activity choice
- appeal to diverse learning styles
- choice to work with others or alone
- hands-on activities
- multimodal activities
- advance organizers
- pre-teaching vocabulary
- visual demonstrations, illustrations, and models
- work with checklists
- online video review
- peer teaching and support

Differentiation for Enrichment

- more complex tasks and problems
- higher expectations in assessment questioning
- independent extensions based on student interest, curiosity, and choice
- extended research and readings
- curriculum compacting
- more complex tasks and problems

XII. Professional Development

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

XIII. Curriculum Map/Pacing Guide

The course utilizes a blended classroom approach offered through CodeHS. The content is fully web-based.

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk of School Failure, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Unit 1: Introduction to Programming in Python with Tracy the Turtle • Commands • Colors • Loops • Functions	2 Weeks	*For Support:* • Choice to work alone or with another student • Hands-on activity • Pre-teaching vocabulary • Visual demonstrations, illustrations, and models • Online video review • Peer teaching and support *For Enhancement:* • More complex tasks & challenge problems • Independent extensions based on student interest, curiosity and choice • Higher expectations in assessment questioning	*Standards:* CRP1, CRP2, CRP4, CRP6, CRP8, 8.2.12.E.3, 8.2.12.E.4, 9.3.IT-PRG.6	*Formative Assessment:* • Do Now! Programs • Questioning • 9 total examples • 17 total exercises • Debugging programs • 1 Challenge Program • 4 end of lesson online quizzes *Summative Assessment:* • End of unit Test on commands, colors, loops and functions. • Tracy the Turtle Project requiring the students to use basic commands to draw their own name on the screen given set parameters

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk of School Failure, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Unit 2: Basic Python and Console Interaction • Printing • Debugging • Variables • Types • Arithmetic expressions • User input • Converting input from a string	3 Weeks	*For Support:* • Choice to work alone or with another student • Hands-on activity • Pre-teaching vocabulary • Visual demonstrations, illustrations, and models • Online video review • Peer teaching and support *For Enhancement:* • More complex tasks and challenge problems • Independent extensions based on student interest, curiosity and choice • Higher expectations in assessment questioning	*Standards:* CRP1, CRP2, CRP4, CRP6, CRP8, CRP11 8.2.12.E.3, 8.2.12.E.4, 9.3.IT-PRG.6	*Formative Assessment:* • Do Now! Programs • Questioning • 12 total examples • 8 total exercises • 3 Fix This Programs • Debugging programs • 4 end of lesson online quizzes *Summative Assessment:* • End of unit Test on Printing, debugging, variables and types, mathematical operators, user input

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk of School Failure, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Unit 3: Control Flow • Comments • If statements • Boolean values • Logical operators • Comparison operators • Truth tables • De Morgan's Laws • Short-circuit evaluation • Floating point numbers and "equality" • While loops • For loops • Nested control structures • Functions • Exceptions	8 weeks	*For Support:* • Choice to work alone or with another student • Hands-on activity • Pre-teaching vocabulary • Visual demonstrations, illustrations, and models • Online video review • Peer teaching and support *For Enhancement:* • More complex tasks and challenge problems • Independent extensions based on student interest, curiosity and choice • Higher expectations in assessment questioning	*Standards:* CRP1, CRP2, CRP4, CRP6, CRP8, 8.1.12.B.2, 8.1.12.D.5, 8.1.12.F.1, 8.2.12.E.3, 8.2.12.E.4, 9.3.IT-PRG.6	*Formative Assessment:* • Do Now! Programs • Questioning • 40 total examples • 30 total exercises • 2 Fix This Programs • 1 Challenge Program • Debugging programs • 16 end of lesson online quizzes *Summative Assessment:* • Benchmark Project creating a multiple choice trivia game • End of unit Test on comments, if statements, logical and comparison operators, while loops, for loops, nested loops, functions, and exceptions.

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk of School Failure, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Unit 4: Strings • Indexing and slicing • Immutability • Slicing and Concatenation • Strings and For Loops • For loops over a string • The "in" keyword • String methods	4 weeks	*For Support:* • Choice to work alone or with another student • Hands-on activity • Pre-teaching vocabulary • Visual demonstrations, illustrations, and models • Online video review • Peer teaching and support *For Enhancement:* • More complex tasks and challenge problems • Independent extensions based on student interest, curiosity and choice • Higher expectations in assessment questioning	*Standards:* CRP1, CRP2, CRP4, CRP6, CRP8, 8.1.12.B.2, 8.1.12.D.5, 8.1.12.F.1, 8.2.12.E.3, 8.2.12.E.4, 9.3.IT-PRG.6	*Formative Assessment:* • Do Now! Programs • Questioning • 14 total examples • 12 total exercises • Debugging programs • 6 end of lesson online quizzes *Summative Assessment:* • End of unit Test on Indexing, slicing, immutability, concatenation, strings, strings and for loops, the "in" keyword, and string methods

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk of School Failure, English Language Learners, & Gifted & Talented Students	Standards	Assessments
Unit 5: Data Structures • Tuples • Lists • List Methods ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ Topics listed below are for students that excel: • Dictionaries • 2D lists • List comprehensions • Packing and unpacking • Mutable vs. immutable • Equivalence vs. identity	3 weeks	*For Support:* • Choice to work alone or with another student • Hands-on activity • Pre-teaching vocabulary • Visual demonstrations, illustrations, and models • Online video review • Peer teaching and support *For Enhancement:* • More complex tasks and challenge problems • Independent extensions based on student interest, curiosity and choice • Higher expectations in assessment questioning	*Standards:* CRP1, CRP2, CRP4, CRP6, CRP8, 8.1.12.B.2, 8.1.12.D.5, 8.1.12.F.1, 8.2.12.E.3, 8.2.12.E.4, 9.3.IT-PRG.6	*Formative Assessment:* • Do Now! Programs • Questioning • 33 total examples • 21 total exercises • 4 Challenge Program • Debugging programs • 8 end of lesson online quizzes • Current event on ethical matters in Computer Science *Summative Assessment:* • End of unit Test on Tuples, Lists, List Methods, Dictionaries, 2D lists, packing & unpacking, mutable vs. immutable, and equivalence vs. identity • Written Benchmark Test covering Units 3.10 – 5.3.