Unit 10: Recursion

Content Area: **Computer Science**
Course(s):
Time Period: **Marking Period 4**
Length: **1-2 Weeks**
Status: **Published**

Summary

Sometimes a problem can be solved by solving smaller or simpler versions of the same problem rather than attempting an iterative solution. This is called recursion, and it is a powerful math and computer science idea. In this unit, students will revisit how control is passed when methods are called, which is necessary knowledge when working with recursion. Tracing skills introduced in Unit 2 are helpful for determining the purpose or output of a recursive method. In this unit, students will learn how to write simple recursive methods and determine the purpose or output of a recursive method by tracing.

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1	Make sense of problems and persevere in solving them
L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
F.BF.A.1.a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
L.KL.11–12.2	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
9.4.12.CT	Critical Thinking and Problem-solving
8	Look for and express regularity in repeated reasoning
F.IF.A	Understand the concept of a function and use function notation
F.IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
8.1.12.DA.2	Describe the trade-offs in how and where data is organized and stored.
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 trade-offs to justify the choice.
8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

Essential Questions & Essential Understanding

- What is recursion?

- What real world processses do you follow that are recursive in nature?
- Why do programmers sometimes prefer using recursive solutions when sorting data?

Objectives

Students Will Know

- how to evaluate a recursive function call.
- how to recursively sort or search a collection of data.

Students Will Be Skilled At

- recognizing base cases of recursive calls.
- solving basic problems using recursion, and determining the efficiency of the code.

Learning Plan

Pseudocode exercises as a class to introduce the idea of recursion - Fibbonacci's sequence is the most famous.

Recognizing patterns - given recursive methods understanding the pattern in which the method is traced (stacking) to determine final output/return

Pair programming examples to trace recursive calls for printing and for returning values.

Codinbat - few methods to write (first 3-5). cannot use multiplication or loops.

Assessments

Assessments

- Formative: Daily assessments using examples from class notes and CodeHS.com, AP Classroom/Albert Checks for Understanding
- Summative: Teacher-created assessments/projects and CodeHS Computer Science Projects, AP Classroom/Albert Unit Assessments
- Benchmark: Check for understanding benchmark assessments on CodeHS, AP Classroom/Albert/Khan Academy Diagnostics
- Alternative Assessments: Student-centered activities such as a doorbell coding project, game design projects, and other activities involving real world applications

complete performance tasks:

- Students will be able to design programs using recursion to solve a problem without a loop.

complete quizzes/tests:

- tracing a recursive call

Materials

Core instructional materials: Computing Concepts with Java

Supplemental instructional materials:

Java Concepts for AP Computer Science Study Guide
CollegeBoard AP Classroom Website
CollegeBoard AP Computer Science A Website

Integrated Accomodations & Modifications

Possible accommodations/modification for AP Computer Science A