SUGGESTED SKILLS

1.B

Determine code that would be used to complete code segments.

1.C

Determine code that would be used to interact with completed program code.

3.E

Write program code to create, traverse, and manipulate elements in 2D array objects.

AVAILABLE LABS

- Classroom Resources >
  - AP Computer Science A: Picture Lab
  - AP Computer Science A: Steganography Lab

AVAILABLE RESOURCES

- Runestone Academy: AP CSA—Java Review: 10—Two-dimensional Arrays
- Practice-It!: BJP4 Chapter 7: Arrays—Self-Check 7.31–7.35
- Classroom Resources > GridWorld Resources: A Curriculum Module for AP Computer Science

TOPIC 8.1
2D Arrays

Required Course Content

ENDURING UNDERSTANDING

VAR-2

To manage large amounts of data or complex relationships in data, programmers write code that groups the data together into a single data structure without creating individual variables for each value.

LEARNING OBJECTIVE

VAR-2.F

Represent collections of related primitive or object reference data using two-dimensional (2D) array objects.

ESSENTIAL KNOWLEDGE

VAR-2.F.1

2D arrays are stored as arrays of arrays. Therefore, the way 2D arrays are created and indexed is similar to 1D array objects.

EXCLUSION STATEMENT—(EK VAR-2.F.1): 2D array objects that are not rectangular are outside the scope of the course and AP Exam.

VAR-2.F.2

For the purposes of the exam, when accessing the element at `arr[first][second]`, the first index is used for rows, the second index is used for columns.

VAR-2.F.3

The initializer list used to create and initialize a 2D array consists of initializer lists that represent 1D arrays.

VAR-2.F.4

The square brackets `[row][col]` are used to access and modify an element in a 2D array.

VAR-2.F.5

"Row-major order" refers to an ordering of 2D array elements where traversal occurs across each row, while "column-major order" traversal occurs down each column.

TOPIC 8.2
Traversing 2D Arrays

Required Course Content

ENDURING UNDERSTANDING

VAR-2

To manage large amounts of data or complex relationships in data, programmers write code that groups the data together into a single data structure without creating individual variables for each value.

LEARNING OBJECTIVE

VAR-2.G

For 2D array objects:

a. Traverse using nested `for` loops.

b. Traverse using nested enhanced `for` loops.

ESSENTIAL KNOWLEDGE

VAR-2.G.1

Nested iteration statements are used to traverse and access all elements in a 2D array. Since 2D arrays are stored as arrays of arrays, the way 2D arrays are traversed using `for` loops and enhanced `for` loops is similar to 1D array objects.

VAR-2.G.2

Nested iteration statements can be written to traverse the 2D array in "row-major order" or "column-major order."

VAR-2.G.3

The outer loop of a nested enhanced `for` loop used to traverse a 2D array traverses the rows. Therefore, the enhanced `for` loop variable must be the type of each row, which is a 1D array. The inner loop traverses a single row. Therefore, the inner enhanced `for` loop variable must be the same type as the elements stored in the 1D array.

SUGGESTED SKILLS

2.B

Determine the result or output based on statement execution order in a code segment without method calls (other than output).

2.D

Determine the number of times a code segment will execute.

3.E

Write program code to create, traverse, and manipulate elements in 2D array objects.

4.A

Use test-cases to find errors or validate results.

AVAILABLE LABS

- Classroom Resources >
  - AP Computer Science A: Picture Lab
  - AP Computer Science A: Steganography Lab

AVAILABLE RESOURCES

- Runestone Academy: AP CSA—Java Review: 10.7—Looping through a 2D Array
- Practice-It!: BJP4 Chapter 7: Arrays—Exercises 7.19–7.19
- The Exam >
  - 2017 AP Computer Science A Exam Free-Response Question #4 (Position)
  - 2018 AP Computer Science A Exam Free-Response Question #4 (ArrayTester)
  - Past AP Exam Questions on 2D Arrays on AP Question Bank

2D Array

ENDURING UNDERSTANDING

CON-2

Programmers incorporate iteration and selection into code as a way of providing instructions for the computer to process each of the many possible input values.

LEARNING OBJECTIVE

CON-2.N

For algorithms in the context of a particular specification that requires the use of 2D array traversals:

a. Identify standard algorithms.

b. Modify standard algorithms.

c. Develop an algorithm.

ESSENTIAL KNOWLEDGE

CON-2.N.1

When applying sequential/linear search algorithms to 2D arrays, each row must be accessed then sequential/linear search applied to each row of a 2D array.

CON-2.N.2

All standard 1D array algorithms can be applied to 2D array objects.