# TEACHER’S GUIDE

# Two-Dimensional Arrays

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**OBJECTIVES:** The student will use 2-D arrays in programs.

The student will pass two-dimensional arrays to methods.

The student will code algorithms to solve two-dimensional array problems.

**ACTIVITIES/TIME:** Two Weeks

**MATERIALS:** Student Lesson AB23: *Two-Dimensional Arrays*

Worksheet AB23.1, *Magic Square*

Worksheet AB23.2, *Two-Dimensional Arrays*

Lab Assignment AB23.1, *Life*

Lab Assignment AB23.1, Data File*, life100.txt*

Lab Assignment AB23.2, *Knight's Tour 1*

Lab Assignment AB23.3, *Knight's Tour 2*

Lab Assignment AB23.3, Data File, *access.txt*

Teacher’s Guide, Lesson AB23: *Two-Dimensional Arrays*

Worksheet AB23.1 – *Answer Sheet*

Worksheet AB23.2 – *Answer Sheet*

Lab Assignment AB23.1 - Answers, *Life.java*

Lab Assignment AB23.1 – Supplementary Code, *MakeLife.java*

Lab Assignment AB23.2 - Answers, *KnightsTour1.java*

Lab Assignment AB23.3 - Answers, *KnightsTour2.java*

Quiz AB23

Quiz AB23 - *Answer Sheet*

**REFERENCES:** **The Wonders of Math: The Game of Life**  
<http://www.math.com/students/wonders/life/life.html>

This site provides a detailed description of the Game of Life, and an interactive applet to 'play' the game.

**INSTRUCTOR**

**NOTES:** Two-dimensional array problem solving is a very important and relevant topic. Many data processing problems involve rows and columns of data. The student lesson focuses on the Java syntax of the two-dimensional array class and related algorithms. It centers on a small table-like grid consisting of three rows and four columns. This example grid will be used to illustrate the important features of two-dimensional arrays.

Lab Assignment AB23.1, *Life* involves a simulation of bacterial growth that requires the creation of a data file by the teacher. The program, *MakeLife.java*, has been provided to create this data file. It is suggested that the teacher create a data file with 100 bacteria locations.

(Please note: As an alternative, a teacher may use the prepared data file (*life100.txt*) that gives the starting locations of living bacteria in a 20 x 20 grid.) If this file is used and run through five generations, the final answers will show how many bacteria are still alive:

Number in Row 10 ---> 8

Number in Column 10 ---> 5

Number of living organisms ---> 88

The two Knight's Tour Lab Assignments (AB23.2 and AB23.3) are also fabulous problems that should challenge both teacher and student. If time is short, the teacher may elect to complete only one or two of the lab assignments with students.

**WORKSHEET**

**NOTES:** Worksheet AB23.1, *Magic Square* and Worksheet AB23.2, *Two-Dimensional Arrays* provide practice working with the cells of two-dimensional arrays. The first worksheet has students writing a few methods to solve a Magic Square. This worksheet may be too advanced for some students. In the second worksheet, the first question asks students to change all even cells to zero. This sounds easy, but many new programmers get lost in the complexity of the array. Question # 2 gives extra practice working with the cells and encourages students to work with diagonal positions - calling them northwest, northeast, southwest and southeast. This provides a useful reference to the Marine Biology Simulation Case Study that has fish moving in these and other directions.