

Name:

### APCS 2-Dimensional Arrays Starter Programs

**Directions:** All of code for the assignment can be written in one main method. Please clearly indicate each question using comments.

1. Create a mxn array, with user inputted dimensions. Assign a random number between 1 and 100 to each element of the array.
2. Write code to print all the values.
3. Write code that searches this array for a value of 57. The loop should terminate at the first instance of a 57. Include an output statement to inform the user whether or not there is a 57 in the array.
4. Using for each loops, find the following for your double two-dimensional array. Print each value after the loop(s) execute(s).
  - a. The sum and average of the elements
  - b. The minimum value
  - c. The number of elements with a value greater than 25

5. **Matrix Application:** Bankruptcy Filings

The table shows the numbers of personal bankruptcy filings in three New York/New Jersey regions during various months of 2001-2002.

\*Use a two-dimensional array to represent the values in the table and use appropriate matrix algebra and for loops to complete each task. You may also use additional arrays to keep track of what is represented in each row and column.

	Jan 01	Apr	Jul	Oct	Jan 02
Manhattan	150	250	150	100	150
Brooklyn	300	400	300	200	250
Newark	250	400	250	200	200

- a. Determine the total number of bankruptcy filings in each of the given months.
- b. Determine the total number of bankruptcy filings in each of the given regions.
- c. Determine in which month the difference between the number of bankruptcy filings in Brooklyn and in Newark was greatest.
- d. Determine in which region the difference between the bankruptcy filings in April 2001 and January 2001 was greatest.

6. **Application:** Simulate the 3x3 magic square game. In this game, the player needs to place the numbers 1-9 in a 3x3 grid so that the vertical, horizontal and diagonal sums are all the same.
- a. Create a default 3x3 array.
  - b. Write code that prints the current array and allows the user to enter values in each of the nine elements. (You can do this in order, or if you want to be fancy, you can let the user enter the indices for each element. The latter will also allow the user to change values.) This should loop until the entire board is filled.
  - c. Write code to check whether or not the user has successfully completed the game, i.e. the vertical, horizontal and diagonal sums are all the same.
  - d. Inform the player whether or not they have won.

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## **AP Computer Science A Matrices Lab**

**Directions:** Your task is to create a program that performs matrix operations on two 2-dimensional arrays. All components of this lab should be in one class (methods should be static).

1. Main Class
  - a. Allow the user to create 2 two-dimensional arrays of double values with user specified dimensions and values.
  - b. Provide a menu of options to the user. The menu should include (1) scalar multiplication by a scalar, (2) adding the matrices, (3) subtracting the matrices, (4) multiplying the matrices, (5) finding the inverse of the matrices (only needs to work for a 2x2 matrix – condition can be tested within the method), and (6) exit/quit program.
  - c. After the user has chosen from the menu, include code to ensure that proper parameters are passed to the methods.
  - d. There should be a while loop that continues until the user chooses to exit/quit the program.
2. Scalar Multiplication Method
  - a. The method should take a double parameter as the scalar and one two dimensional array as the matrix.
  - b. The method should perform the scalar multiplication operations.
  - c. The method should return the answer matrix.
3. Adding the Matrices
  - a. The method should perform addition operations.
  - b. The method should return the answer matrix.
4. Subtracting the Matrices
  - a. The method should perform subtraction operations.
  - b. The method should return the answer matrix.
5. Multiplying the Matrices
  - a. The method should ensure that the dimensions of the matrices are multipliable.
  - b. The method should perform multiplication operations.
  - c. The method should return the answer matrix.
6. Inverse of the Matrix
  - a. The method should take one two dimensional array as the matrix.
  - b. The method should ensure that the dimensions of the matrix is 2x2.
  - c. The method should determine the inverse of the matrix.
  - d. The method should return the answer matrix.

## The Game of Tic-Tac-Toe

**Directions:** Write code to simulate a tic-tac-toe board. You have two options: (1) simulate a game between two human users or (2) simulate a game between one human user and the computer. Use a two-dimensional array to represent the game board.