Multi-Dimensional Arrays I

- Write a program which constructs an 8 x 8 integer matrix of random values 0...9.

```java
public static int[][] random (int len)
{
    int i, j, a[][] = new int[len][len];
    for (int i = 0; i < len; i++)
        for (int j = 0; j < len; j++)
            a[i][j] = (int) (Math.random() * 10.0);
    return a;
}
```

Multi-Dimensional Arrays II

- Extend the program to print out the matrix.

```java
public static void print (int a[][], int len)
{
    for (int i = 0; i < len; i++)
        System.out.println(a[i][0] + "","", a[i][1] + "","", a[i][2] + "","", a[i][3], "\n");
}
```

Multi-Dimensional Arrays III

- Extend the program to also transpose the matrix, i.e., rows and columns are interchanged.

```java
public static int[][] transpose (int a[][], int len)
{
    int b[][] = new int[len][len];
    for (int i = 0; i < len; i++)
        for (int j = 0; j < len; j++)
            b[j][i] = a[i][j];
    return b;
}
```

Tutorial #9

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Class CharDisplay

```java
class CharDisplay {
    public final static int LEFT = 0;
    public final static int CENTER = 2;
    public final static int RIGHT = 1;

    public CharDisplay(int max, int maxCol) {
        // Initialize character display image
        for (int i = 0; i < max; i++)
            for (int j = 0; j < maxCol; j++)
                // Set default character
                charDisplay[i][j] = ' '; // ' ' represents no character
    }

    public void write(int row, int col, char value) {
        // Write character at specified position
        charDisplay[row][col] = value;
    }

    public void write(int row, int col, String s) {
        // Write string at specified position
        for (int i = 0; i < s.length(); i++)
            write(row, col + i, s.charAt(i));
    }

    public void flush() {
        // Flush the display to the screen
        // Implementation details...
    }
}
```

Class CharDisplay II

```java
class CharDisplayII {
    public static void main(String[] args) {
        // Initialize character display
        CharDisplay d = new CharDisplay(10, 60);

        // Use CharDisplay methods to draw stars
        for (int i = 0; i < 60; i++)
            d.write(i, (int)Math.round(Math.sqrt(d.HEIGHT)));

        // Flush the display
        d.flush();
    }
}
```
Class CharDisplay III

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Class CharDisplay III

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Class CharDisplay III

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Class CharDisplay III

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- Extend the Sqrt class to also print out the X- and Y-axes.

```java
class Sqrt {
    public static void main (String args[]) {
        char[][] display = new char[16][16];
        int d = 0;
        for(int i = 0; i < 16; i++)
            for(int j = 0; j < 16; j++)
                display[i][j] = (d < 16) ? '1' : '0';
        for(int i = 0; i < 16; i++)
            for(int j = 0; j < 16; j++)
                if(display[i][j] == '1')
                    System.out.print(display[i][j]);
    }
}
```

- What is the output of the program below?

```java
class Fib {
    public static int F (int n) {
        int a[] = new int[n+1];
        a[0] = a[1] = 1;
        for(int i = 2; i <= n; i++)
            a[i] = a[i-1] + a[i-2];
        return a[n];
    }
    public static void main (String args[]) {
        System.out.println(F(10));
    }
}
```

- What is the output of the program below?

```java
java Sqrt
```

Fib
Write a program that prints out the flight of stairs below:

```
class Stair {
    static final int NumberofSteps = 5;
    static final int StepHeight = 4;
    static final int StepLength = 6;

    public static void main (String args[]) {
        for(int i = 0; i<NumberofSteps; i++)
            for(int h=0; h<StepHeight; h++) {
                for(int s=0; s<(StepLength*(i+1)); s++)
                    System.out.print("\n");
                System.out.println();
            }
    }
}
```

Find all errors in the program below:

```
class Err {
    public static void F (int n) {
        int a = new int[n];
        ^ Should return an int.
        a[0] = a[1] = 1;
        ^ Missing brackets.
        for(int i = 2; i < n; i++)
            a[i] += a[i-1];
        ^ Missing semicolon
            return a[n];
            ^ Only a[0]...a[n-1] are valid array elements.
    }

    public static void main (String args[]) {
        System.out.println(F(1.0));
        ^ Can’t pass a double to an int.
    }
}
```
Fill II

Write a program that fills a 5 x 10 array with the number 0...4 and the points out the array. Use div () and mod () to calculate the position of each entry!

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Method Call I

What's the output of the program below?

```
class Call {
  public static int F (int x) {
    int y = 1;
    for(int i = 0; i < x; i++)
      y = y * x;
    return y; }
  public static int G (String x) {
    int y = 1;
    for(int i = 0; i < x.length(); i++)
      y += H(i);
    return y; }
  public static int H (int x) {
    int y = 1;
    while(x > 0) {
      y = x * 2; x--;
    }
    return y; }
  public static void main (String args[]) {
    System.out.println(F(3) + G("Bye")); }
}
```

Method Call II

```
F(3) = 1 * 3 * 3 * 3
     = 27
G("Bye") = 1 + H(0) + H(1) + H(2)
           = 1 + 1 + 2 + 2
           = 6
H(0) = 1
H(1) = 1 * 2
H(2) = 1 * 2 * 1
F(3) + G("Bye") = 27 + 6 = 33
```