

Java Projects

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Description: This document contains several Java projects, progressing from simple to difficult. All the projects were developed using the (free) Netbeans IDE and the (free) Java JDK. All the code is included, and users are encouraged to take each project (especially the later ones) and convert them into more elaborate applications of their own design.

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Java Project: GettingStarted1

Description: Some simple java exercises for getting accustomed to the Netbeans interface and simple java code.

Create a new Netbeans Project, name it **GettingStarted1**

Netbeans > file > new project > choose project: java application <next>
Project Name: GettingStarted <finish>

Your screen will now look something like:

```
/*
 * To change this license header, Project Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */
package gettingstarted1;

/**
 *
 * @author wwolf3
 */
public class GettingStarted1 {

    /**
     * @param args the command line arguments
     */
    public static void main(String[] args) {
        //Your java code goes here
    }
}
```

This code will be deleted and replaced with the code on the following page.

Delete all the above code, replace it with the follow code:

```
package gettingstarted1;
import java.util.Scanner;

public class GettingStarted1 {

    public static void main(String[] args) {
        System.out.println("Hello World");

        System.out.println("1 + 2 + 3");
        System.out.println(1 + 2 + 3);
        System.out.println("1" + 2 + 3);
        System.out.println(1 + "2" + 3);
        System.out.println(1 + 2 + "3");
        System.out.println(1 + 2 + 3);

        System.out.println("a" + "b" + "c");

        int a = 89;
        System.out.println(a + "b" + "c");

        Scanner input = new Scanner(System.in);
        System.out.println("Please enter the length:");
        int length = input.nextInt();
        System.out.println("length = " + length);
        System.out.println("max integer = " + Integer.MAX_VALUE);
        System.out.println("max double = " + Double.MAX_VALUE);

        String x = "hello";
        x = x + " there";
        System.out.println("x = " + x);

        char z = 10036;
        for (int i = 40; i < 128; i++) {
            System.out.println("z = " + (char) i);
        }
    }
}
```

After clicking the green “Run” arrow on the menu bar you should get an output that looks like the follow (the computer will prompt you to enter a length → try 10)

Sample Output:

The screenshot shows a Java IDE interface with three tabs at the top: "...age", "Output - GettingStarted (run)", and "abrogate.jpg". The central pane displays the following sample output from a Java application:

```
run:  
Hello World  
1 + 2 + 3  
6  
123  
123  
33  
6  
abc  
89bc  
Please enter the length:  
  
10  
length = 10  
max integer = 2147483647  
max double = 1.7976931348623157E308  
x = hello there  
z = {  
z = }  
z = *  
z = +  
z = ,  
z = -  
z = .  
z = /  
z = 0  
z = 1  
z = 2  
z = 3  
z = 4  
z = 5  
z = 6  
z = 7  
z = 8  
z = 9  
z = :  
z = ;  
z = <  
z = =  
z = >  
z = ?
```

Java Project: GettingStarted2

Description: Some simple exercises to get started in Java programming.

Create a new Netbeans Project, name it GettingStarted2

Netbeans > new > project > java application > GettingStarted2

Type in code:

```
/////////////////////////////
package gettingstarted2;

public class GettingStarted2 {

    public static void main(String[] args) {

        //A = pi r squared
        System.out.println("area = " + 3.14 * 5.0 * 5.0);
        double r = 5.0;
        double area = Math.PI * r * r;
        System.out.println("area = " + area);
        System.out.println("max integer = " + Integer.MAX_VALUE);
        System.out.println("max double = " + Double.MAX_VALUE);
    }
}
```

When it's typed in, click the “Run” arrow.

Sample Output:

```
area = 78.5
area = 78.53981633974483
max integer = 2147483647
max double = 1.7976931348623157E308
BUILD SUCCESSFUL (total time: 0 seconds)
```

Java Project: GettingStarted3

Description: GettingStarted3: This program prompts the user for a score (0 -100) and then presents the associated letter grade.

Create a new Netbeans Project, name it **GettingStarted3**

Netbeans > new > project > java application > GettingStarted3

Type in code:

```
package gettingstarted3;

import javax.swing.JOptionPane;

public class GettingStarted3 {

    public static void main(String[] args) {
        //yesNoExample();
        //dialogWithIf();
        //dialogCircleArea();
        convertScoreToLetter();
    }

    public static void yesNoExample() {
        JOptionPane.showMessageDialog(null, "OK to continue",
"Warning", JOptionPane.WARNING_MESSAGE);
    }

    private static void dialogWithIf() {
        String input = JOptionPane.showInputDialog("Type
Something");
        System.out.println("Input = " + input);
        int choice = JOptionPane.showConfirmDialog(null, "Make
your choice");
        System.out.println("choice = " + choice);
        if (choice == 0) {
            System.out.println("You chose \"Yes\"");
        }
        if (choice == 1) {
            System.out.println("You chose \"No\"");
        }
        if (choice == 2) {
            System.out.println("You chose \"Cancel\"");
        }
    }
}
```

```

        }
    }

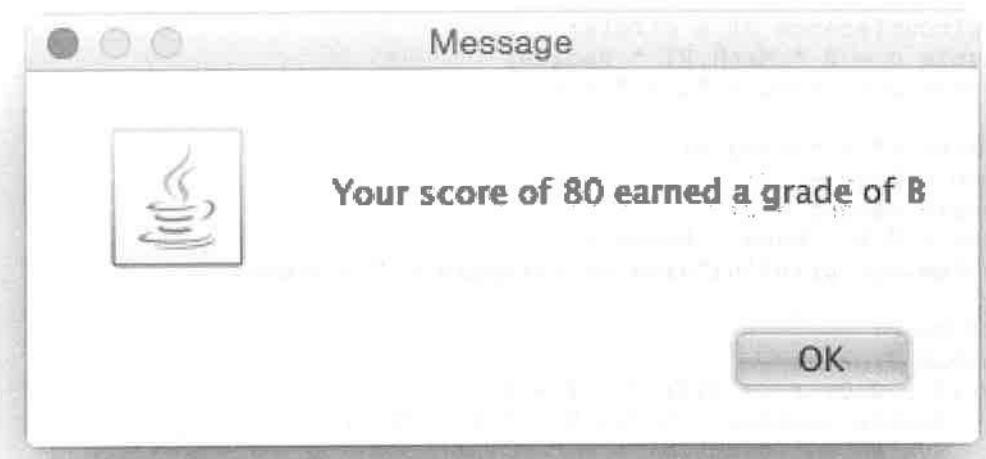
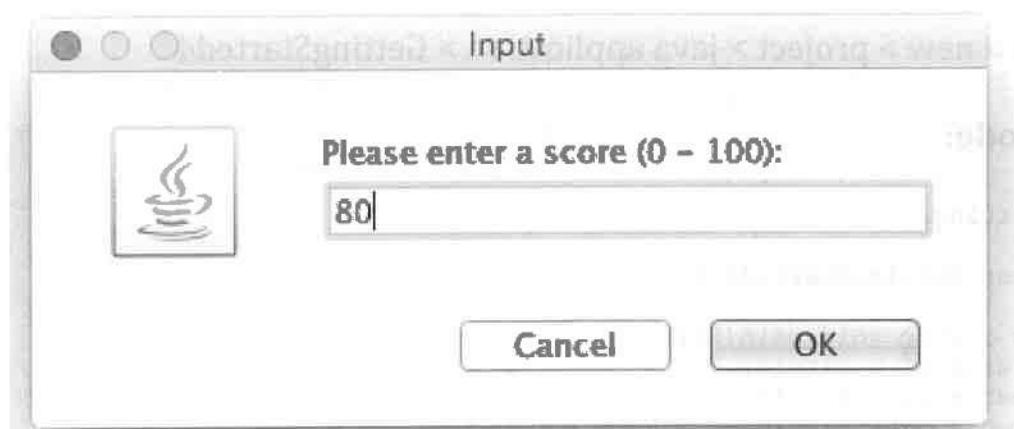
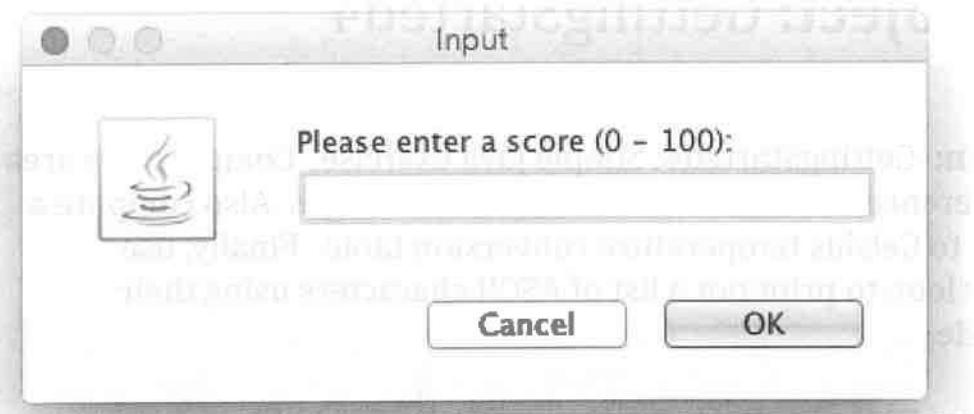
private static void dialogCircleArea() {
    String radius = JOptionPane.showInputDialog("Please enter
the circle radius:");
    double r = Double.parseDouble(radius);
    System.out.println("You entered a radius of: " + r);
    System.out.println("Area = " + Math.PI * Math.pow(r, 2));
}

private static void convertScoreToLetter() {
    int score =
Integer.parseInt(JOptionPane.showInputDialog("Please enter a
score (0 - 100):"));
    char letter;
    if (score >= 90 ) {
        letter = 'A';
    } else if ( score >= 80 ) {
        letter = 'B';
    } else if ( score >= 70 ) {
        letter = 'C';
    } else if ( score >= 60 ) {
        letter = 'D';
    } else {
        letter = 'F';
    }
    //System.out.println("Your score of " + score + " earned
a grade of " + letter);
    JOptionPane.showMessageDialog(null, "Your score of " +
score + " earned a grade of " + letter);
}

}
}

```

Sample Output:



Java Project: GettingStarted4

Description: GettingStarted4: Simple Java exercise. Compute the area and circumference of a circle and the area of a triangle. Also compute a Fahrenheit to Celsius temperature conversion table. Finally, use another for loop to print out a list of ASCII characters using their decimal code.

Create a new Netbeans Project, name it GettingStarted4

Netbeans > new > project > java application > GettingStarted4

Type in code:

```
package gettingstarted4;

public class GettingStarted4 {

    public static void main(String[] args) {
        //area of a circle:
        double radius = 10;
        double area = Math.PI * Math.pow(radius, 2);
        System.out.println("area = " + area);

        //circumference of a circle:
        double c = 2 * Math.PI * radius;
        System.out.println("c = " + c);

        //area of a triangle:
        double base = 10;
        double height = 3;
        area = 0.5 * base * height;
        System.out.println("area of triangle = " + area);

        //f to c:
        double f;
        for(f = 0.0; f <= 212; f = f + 1) {
            double celsius = 5.0/9.0 * ( f - 32 );
            System.out.println("f = " + (int)f + " c = " +
(int)celsius);
        }

        for(int i = 4000; i < 4128; i++) {
            System.out.println((char)i);
        }
    }
}
```

}

Sample output: (the output is very long, so here it is abbreviated):

```
area = 314.1592653589793
c = 62.83185307179586
area of triangle = 15.0
f = 0 c = -17
f = 1 c = -17
f = 2 c = -16
f = 3 c = -16
f = 4 c = -15
f = 5 c = -15
f = 6 c = -14
f = 7 c = -13
f = 8 c = -13
f = 9 c = -12
f = 10 c = -12
f = 11 c = -11
f = 12 c = -11
f = 13 c = -10
f = 14 c = -10
f = 15 c = -9
f = 16 c = -8
f = 17 c = -8
...
f = 204 c = 95
f = 205 c = 96
f = 206 c = 96
f = 207 c = 97
f = 208 c = 97
f = 209 c = 98
f = 210 c = 98
f = 211 c = 99
f = 212 c = 100
```

Q E F L C P F G E C T S R C T P F R A E Q D O Q H G C U L V C M C D C T S E C P F C L C Z

....

BUILD SUCCESSFUL (total time: 0 seconds)

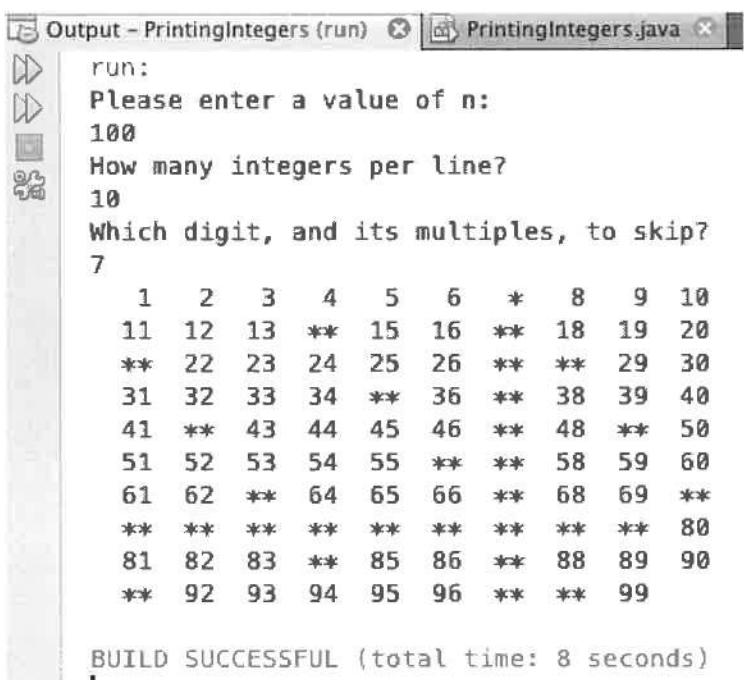
Java Project: PrintingIntegers

Create a new Netbeans Project, name it
PrintingIntegers

Netbeans > file > new project > project > java application <next> >
Project Name: PrintingIntegers > <finish>

Description: Print a list of integers in a rectangular layout, skipping those integers that contain, or are a multiple of, a specified digit. Uses a method (indexOf) to detect if a character is in a given string.

Sample Output:



```
Output - PrintingIntegers (run) × PrintingIntegers.java ×
run:
Please enter a value of n:
100
How many integers per line?
10
Which digit, and its multiples, to skip?
7
    1   2   3   4   5   6   *   8   9   10
    11  12  13  **  15  16  **  18  19  20
    **  22  23  24  25  26  **  **  29  30
    31  32  33  34  **  36  **  38  39  40
    41  **  43  44  45  46  **  48  **  50
    51  52  53  54  55  **  **  58  59  60
    61  62  **  64  65  66  **  68  69  **
    **  **  **  **  **  **  **  **  **  80
    81  82  83  **  85  86  **  88  89  90
    **  92  93  94  95  96  **  **  98
```

BUILD SUCCESSFUL (total time: 8 seconds)

```

package printingintegers;

import java.util.Scanner;

public class PrintingIntegers {

    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.println("Please enter a value of n:");
        int n = input.nextInt();
        String nString = "" + n; //length of n treated as string
        int maxDigits = nString.length();
        System.out.println("How many integers per line?");
        int p = input.nextInt();
        System.out.println("Which digit, and its multiples, to
skip?");

        int m = input.nextInt();
        for(int i = 1; i < n; i++) {
            if ( ((i%m) == 0 ) || hasM(i,m) ){
                int iLength = (" " + i).length();
                String stars = getStars(iLength);
                System.out.format("%" + (maxDigits + 1) + "s",
stars);
            } else {
                System.out.format("%" + (maxDigits + 1) + "d", i);
            }
            if( i % p == 0) {
                System.out.println("");
            }
        }
        System.out.println("");
        System.out.println("");
    }

    public static String getStars(int p) {
        String stars = "";
        for(int k = 0; k < p; k++) {
            stars += "*";
        }
        return stars;
    }

    public static boolean hasM(int i, int m) {
        char c = String.format("%s", m).charAt(0);
        String x = "" + i;
        return x.indexOf(c) >= 0;
    }
}

```

Java Project: Population

Description: Predicts the population based on assumptions about birth and death rate.

Sample Output:

run:

```
pop year 0 = 312032486
pop year 1 = 314812582
pop year 2 = 317592678
pop year 3 = 320372774
pop year 4 = 323152870
pop year 5 = 325932966
```

```
package population;

public class Population {

    public static void main(String[] args) {
        //Given: current pop, birth rate, death rate, immigr. rate
        //predict the population for 5 years
        //a birth every 7 seconds.
        //a death every 13 seconds.

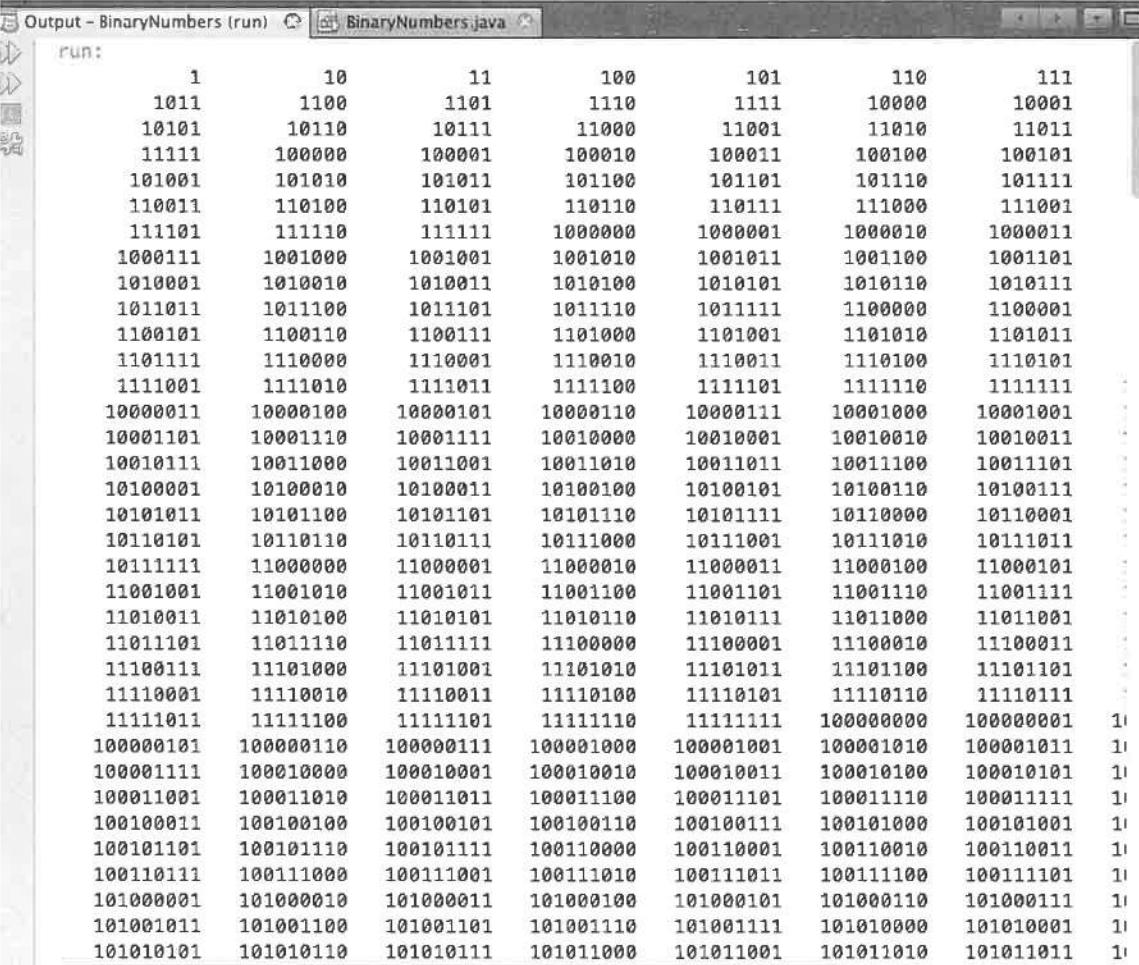
        //an immigrant every 45 seconds.
        int pop = 312032486;
        System.out.println("pop year 0 = " + pop);
        int n = 365 * 24 * 60 * 60;
        int births = n / 7;
        int deaths = n / 13;
        int immigrants = n / 45;
        int net = births + immigrants - deaths;
        int years = 5;
        for (int i = 1; i <= years; i = i + 1) {
            pop = pop + net;
            System.out.println("pop year " + i + " = " + pop);
        }
    }
}
```

Java Project: BinaryNumbers

Description: Print a list of binary numbers, in order. It uses a method to convert a decimal number to its binary equivalent.

Netbeans > file > new project > project > java application <next> > Project Name: BinaryNumbers > <finish>

Sample Output:



The screenshot shows the Netbeans IDE interface with the 'Output' window selected. The title bar reads 'Output - BinaryNumbers (run)'. The window displays a list of binary numbers, each consisting of eight digits. The numbers are listed in ascending order from top to bottom. The first few lines of the output are:

```
run:
      1       10      11      100     101      110      111
1011      1100     1101     1110     1111     10000    10001
10101     10110    10111    11000    11001    11010    11011
11111     100000   100001   100010   100011   100100   100101
101001    101010   101011   101100   101101   101110   101111
110011    110100   110101   110110   110111   111000   111001
111101    111110   111111   1000000  1000001  1000010  1000011
1000111   1001000  1001001  1001010  1001011  1001100  1001101
1010001   1010010  1010011  1010100  1010101  1010110  1010111
1011011   1011100  1011101  1011110  1011111  1100000  1100001
1100101   1100110  1100111  1101000  1101001  1101010  1101011
1101111   1110000  1110001  1110010  1110011  1110100  1110101
1111001   1111010  1111011  1111100  1111101  1111110  1111111
10000011  10000100 10000101 10000110 10000111 10001000 10001001
10001101  10001110 10001111 10010000 10010001 10010010 10010011
10010111  10011000 10011001 10011010 10011011 10011100 10011101
10100001  10100010 10100011 10100100 10100101 10100110 10100111
10101011  10101100 10101101 10101110 10101111 10110000 10110001
10110101  10110110 10110111 10111000 10111001 10111010 10111011
10111111  11000000 11000001 11000010 11000011 11000100 11000101
11001001  11001010 11001011 11001100 11001101 11001110 11001111
11010011  11010100 11010101 11010110 11010111 11011000 11011001
11011101  11011110 11011111 11100000 11100001 11100010 11100011
11100111  11101000 11101001 11101010 11101011 11101100 11101101
11110001  11110010 11110011 11110100 11110101 11110110 11110111
11111011  11111100 11111101 11111110 11111111 100000000 100000001
100000101 100000110 100000111 100001000 100001001 100001010 100001011
100001111 100010000 100010001 100010010 100010011 100010100 100010101
100011001 100011010 100011011 100011100 100011101 100011110 100011111
100100011 100100100 100100101 100100110 100100111 100101000 100101001
100101101 100101110 100101111 100110000 100110001 100110010 100110011
100111011 100111100 100111101 100111110 100111111 100111100 100111101
101000001 101000010 101000011 101000100 101000101 101000110 101000111
101001011 101001100 101001101 101001110 101001111 101001000 101001001
101010011 101010100 101010101 101010110 101010111 101010000 101010001
101010101 101010110 101010111 101011000 101011001 101011010 101011011
```

```

package binarynumbers;

public class BinaryNumbers {

    public static void main(String[] args) {
        int n = 2015;
        String nBinary = convertToBinary(n);
        int maxDigits = nBinary.length();
        int p = 10; // numbers per line
        for (int i = 1; i <= n; i++) {
            System.out.format("%" + (maxDigits + 1) + "s",
convertToBinary(i));
            if ((i % p) == 0) {
                System.out.println("");
            }
        }
    }

    public static String convertToBinary(int k) {
        String binary = "";
        while (k > 0) {
            if (k % 2 == 1) {
                binary = 1 + binary;
            } else {
                binary = 0 + binary;
            }
            k = k / 2;
        }
        return binary;
    }
}

```

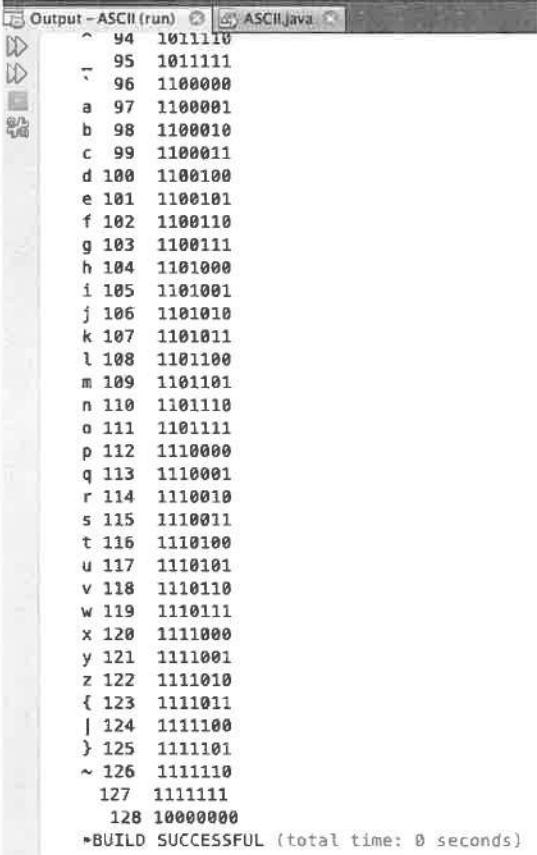
Java Project: ASCII

Description: Print a list of ASCII (or Unicode) characters with their decimal and binary representations.

Netbeans > file > new project > project > java application <next> > Project Name: ASCII > <finish>

Sample Output:

1. with start = 0 and stop = 128



```
Output - ASCII (run)  ASCII.java
^ 94 1011110
~ 95 1011111
` 96 1100000
a 97 1100001
b 98 1100010
c 99 1100011
d 100 1100100
e 101 1100101
f 102 1100110
g 103 1100111
h 104 1101000
i 105 1101001
j 106 1101010
k 107 1101011
l 108 1101100
m 109 1101101
n 110 1101110
o 111 1101111
p 112 1110000
q 113 1110001
r 114 1110010
s 115 1110011
t 116 1110100
u 117 1110101
v 118 1110110
w 119 1110111
x 120 1111000
y 121 1111001
z 122 1111010
{ 123 1111011
| 124 1111100
} 125 1111101
~ 126 1111110
127 1111111
128 10000000
BUILD SUCCESSFUL (total time: 0 seconds)
```

2. with: start = 9728 and stop = 9839;

```
Output - ASCII (run) ASCII.java
↳ 9805 10011001001101
↳ 9806 10011001001110
↳ 9807 10011001001111
↳ 9808 10011001010000
↳ 9809 10011001010001
↳ 9810 10011001010010
↳ 9811 10011001010011
↳ 9812 10011001010100
↳ 9813 10011001010101
↳ 9814 10011001010110
↳ 9815 10011001010111
↳ 9816 10011001011000
↳ 9817 10011001011001
↳ 9818 10011001011010
↳ 9819 10011001011011
↳ 9820 10011001011100
↳ 9821 10011001011101
↳ 9822 10011001011110
↳ 9823 10011001011111
↳ 9824 10011001100000
↳ 9825 10011001100001
↳ 9826 10011001100010
↳ 9827 10011001100011
↳ 9828 10011001100100
↳ 9829 10011001100101
↳ 9830 10011001100110
↳ 9831 10011001100111
↳ 9832 10011001101000
↳ 9833 10011001101001
↳ 9834 10011001101010
↳ 9835 10011001101011
↳ 9836 10011001101100
↳ 9837 10011001101101
↳ 9838 10011001101110
↳ 9839 10011001101111
↳ *BUILD SUCCESSFUL (total time: 0 seconds)
```

```
package ascii;
public class ASCII {
    public static void main(String[] args) {
        //note: Greek upper case: 913 --> 937
        // Greek lower case: 945 --> 969
        int start = 9728;
        int stop = 9839;
        int maxDigits = (""+ stop).length() + 1;
        int maxBinaryDigits = convertToBinary(stop).length() + 1;
        for(int i = start; i <= stop; i++) {
            System.out.format("%3s", (char)i);
            System.out.format("%" + maxDigits + "s", i);
            System.out.format("%" + maxBinaryDigits + "s",
convertToBinary(i));
            System.out.println("");
        }
        System.out.format("%3s", (char)9728);
    }
    public static String convertToBinary(int k) {
        String binary = "";
        while (k > 0) {
            if (k % 2 == 1) {
                binary = 1 + binary;
            } else {
                binary = 0 + binary;
            }
            k = k / 2;
        }
        return binary;
    }
}
```

Java Project: Factorial

Description: Computes the factorial of a given integer in two ways: iterative (with a loop) and recursively (self-referencing method).

Sample Output:

run:

**10 factorial (iterative) = 3628800
10 factorial (recursive) = 3628800
BUILD SUCCESSFUL (total time: 0 seconds)**

```
package factorial;

public class Factorial {

    public static void main(String[] args) {
        int n = 10;
        int factorial = 1;

        //first way (without recursion)
        for (int i = 1; i <= n; i++) {
            factorial = i * factorial;
        }

        System.out.println(n + " factorial (iterative) = " +
factorial);

        //second way (with recursion)
        factorial = getFactorial(n);

        System.out.println(n + " factorial (recursive) = " +
factorial);
    }

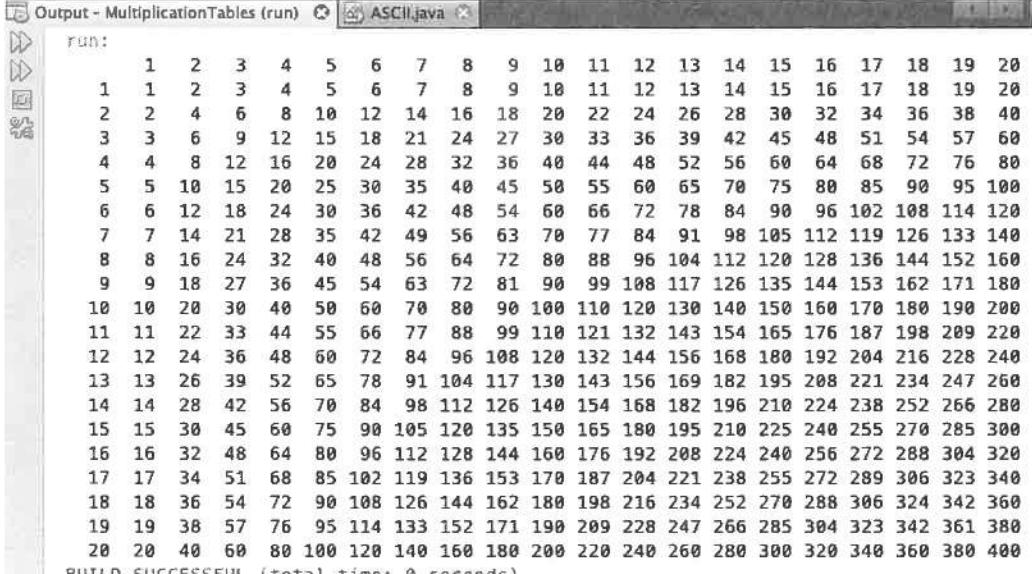
    public static int getFactorial(int n) {
        if (n == 0) {
            return 1;
        }
        return n * getFactorial(n - 1);
    }
}
```

Java Project: MultiplicationTables

Description: Print a multiplication table for a given integer size.

Netbeans > file > new project > project > java application <next> > Project Name: MultiplicationTables > <finish>

Sample Output: n = 20



The screenshot shows the NetBeans IDE interface with the 'Output' window selected. The title bar reads 'Output - MultiplicationTables (run) ASCII.java'. The output pane displays a 20x20 multiplication table. Below the table, the message 'BUILD SUCCESSFUL (total time: 0 seconds)' is shown. The code editor pane contains the Java source code for 'MultiplicationTables.java'.

```
package multiplicationtables;
public class MultiplicationTables {

    public static void main(String[] args) {
        int n = 20;
        int maxDigits = (""+n*n).length();
        System.out.format("%" + (maxDigits + 1) + "s", " ");
        for (int i = 1; i <= n; i++) {
            System.out.format("%" + (maxDigits + 1) + "d", i);
        }
        System.out.println("");
        for (int j = 1; j <= n; j++) {
            System.out.format("%" + (maxDigits + 1) + "d", j);
            for (int i = 1; i <= n; i++) {
                System.out.format("%" + (maxDigits + 1) + "d", i*j);
            }
            System.out.println("");
        }
    }
}
```

Java Project: PrimeNumbers

Description: Print out the prime numbers up to some maximum value.

Netbeans > file > new project > project > java application <next> > Project Name: PrimeNumbers > <finish>

Sample Output: n = 10000

The screenshot shows the NetBeans IDE interface. On the left, the Project Explorer displays a single project named 'PrimeNumbers'. In the center, the code editor shows the 'PrimeNumbers.java' file with the provided Java code. On the right, the Output window shows the command-line interface with the build log and the generated prime numbers from 2 to 349. The output ends with 'BUILD SUCCESSFUL, (total time: 8 seconds)'.

```
> 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349
```

BUILD SUCCESSFUL, (total time: 8 seconds)

```
package primenumbers;
public class PrimeNumbers {
    public static void main(String[] args) {
        int n = 10000;
        int maxDigits = (""+n).length();
        int p = 10;
        for (int i = 1; i <= n; i++) {
            if (isPrime(i)) {
                System.out.format("%" + (maxDigits + 1) + "d", i);
            } else {
                System.out.format("%" + (maxDigits + 1) + "s", "*");
            }
            if ((i % p) == 0) System.out.println("");
        }
    }
    public static boolean isPrime(int p) {
        boolean value = true;
        if (p == 1) return false;
        for (int i = 2; i <= p / 2; i++) {
            if (p % i == 0) {
                value = false;
            }
        }
        return value;
    }
}
```

Java Project: RandomCharacters

Description: Print random characters of all sorts.

Netbeans > file > new project > project > java application <next> >
Project Name: RandomCharacters > <finish>

Sample Output:

```
Output - RandomCharacters (run) PrimeNumbers.java RandomCharacters.java
run:
  245  451  746  891  403   86   78   390  535  245
  704   24  573  110  978  836  870  983   55  874
  211  995  191  777   69  416   64  261  675  540
  378  356  799  320  712   10  838   85  126  972
  681  731  747  305  436  921   52  725  187  990
  306  303  988  750  786  434  597  360   32  825
  227  628  567  835  364  746  478  727  122  837
  370  609  956  847  772  769  386  966  615  669
  117     4   17  125  560  660  323  484  103  936
  503  406  907  224  365  981  991  405   34  654

0110110001
1001010001
1001010010
0111111011
1000000001
1101010111
1100101000
1110011010
1011001001
1000100101

Jc4Xq7Sf6Vn80x0Ao7Lw0Vg4Mh00u1
Ky0Ck2Br8Yn8Kn1Qq3Lr7Sj6Jc8Iy4
Js1Lg4Aq2Hn4Cp6Uj3Kl2Vs2Md80n8
Tv1Rl0Mh5Xx1To0Kc8Io5Bh4Tg7Sa2
Ww4Fi6Jd4Ug2Sb2Lu0Yl5Lm4To6St4
Ev8Jt30e6Qp0Si0Ur5Up3Gy4Ys8Bt6
Ey2Yh4Lg2Kp2Fg5Gs20t2Ht20r3Jk1
Tn6Fg4Ki3Ae5Tm2Hq4Qu4Iv4Jx3Hr3
Hp2Dy3Lm0Km3Vm3Ge4Rs0Mq4Eu8Jo1
Lw6Io7Mh2Dd6Js2Wt7Ea8Pp8Hi5Fr8

BUILD SUCCESSFUL (total time: 0 seconds)
```

```

package randomcharacters;
import java.util.Random;
public class RandomCharacters {

    public static void main(String[] args) {
        Random r = new Random();
        int n = 10;
        int p = 1000;
        int maxDigits = (" " + p).length();
        //print an nxn block of random integers
        for (int j = 1; j <= n; j++) {
            for (int i = 1; i <= n; i++) {
                System.out.format("%" + (maxDigits + 1) + "d",
r.nextInt(p));
            }
            System.out.println("");
        }
        System.out.println("");

        int out;

        //print an nxn block of binary bits
        for (int j = 1; j <= n; j++) {
            for (int i = 1; i <= n; i++) {
                if (r.nextBoolean()) {
                    out = 1;
                } else {
                    out = 0;
                }
                System.out.format("%d", out);
            }
            System.out.println("");
        }
        System.out.println("");

        //print an nxn block of random letters and digits
        for (int j = 1; j <= n; j++) {
            for (int i = 1; i <= n; i++) {
                System.out.format("%c", getRandomChar(r, 'A', 'Z'));
                System.out.format("%c", getRandomChar(r, 'a', 'z'));
                System.out.format("%c", getRandomChar(r, '0', '9'));
            }
            System.out.println("");
        }
        System.out.println("");
    }

    public static char getRandomChar(Random r, char from, char to) {
        int k = r.nextInt((int)to - (int)from);
        char c = (char) (k + from);
        return c;
    }
}

```

Java Project: GCD

Description: Calculate and print the greatest common divisor of a pair of numbers.

Sample Output:

```
Output - GCD.java
GCD.java

public class GCD {
    public static void main(String[] args) {
        int a = 100;
        int b = 75;
        System.out.println("GCD of " + a + " and " + b + " is " + gcd(a, b));
    }

    public static int gcd(int a, int b) {
        if (b == 0)
            return a;
        else
            return gcd(b, a % b);
    }
}
```

```

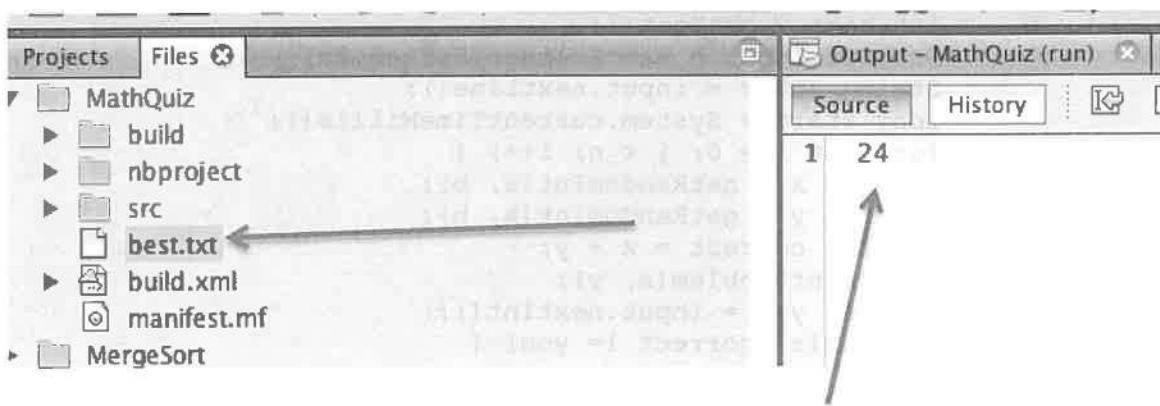
package gcd;
public class GCD {
    public static void main(String[] args) {
        int n = 300;
        int maxDigits = (""
            + n).length();
        System.out.format("%" + (maxDigits + 1) + "s", " ");
        for (int i = 1; i <= n; i++) {
            System.out.format("%" + (maxDigits + 1) + "d", i);
        }
        System.out.println("");
        for (int j = 1; j <= n; j++) {
            System.out.format("%" + (maxDigits + 1) + "d", j);
            for (int i = 1; i <= n; i++) {
                int thisGCD = gcd(i, j);
                if(thisGCD == 1) {
                    System.out.format("%" + (maxDigits + 1) + "s",
                    "*");
                } else {
                    System.out.format("%" + (maxDigits + 1) + "d",
                    gcd(i, j));
                }
            }
            System.out.println("");
        }
    }
    public static int gcd(int a, int b) {
        if (a == 0) return b;
        if (b == 0) return a;
        if (a > b) return gcd(b, a % b);
        return gcd(a, b % a);
    }
}

```

Java Project: MathQuiz

Description: Solve arithmetic problems as fast as you can.

Besides the java file, the code uses a file called best.txt. There is only one number in best.txt, the fewest seconds that the user has taken to solve the randomly generated set of arithmetic problems.



best.txt has only one number in it, the best time (seconds) that the quiz has been completed in so far.

Sample Output:

```
Output - MathQuiz (run) | MathQuiz.java |
PLAY
best = 24 seconds
Solve the following problems as quick as you can.
Hit enter to start the problems and the timer

    849
+924
---
    1773
    252
+882
---
    1134
    929
+644
---
    1573
    920
+477
---
    1397
    354
+803
---
    1157
Seconds = 46
wrong = 0
BUILD SUCCESSFUL (total time: 1 minute 4 seconds)
```

```

package mathquiz;
import java.io.File;
import java.io.FileNotFoundException;
import java.io.PrintWriter;
import java.util.Scanner;
public class MathQuiz {
    public static void main(String[] args) throws
FileNotFoundException {
        int n = 5; //number of problems to solve
        int m = 3; //number of digits in the numbers
        int a = (int) Math.pow(10, m - 1);
        int b = (int) Math.pow(10, m) - 1;
        int n_wrong = 0;
        int best = getBest();
        Scanner input = new Scanner(System.in);
        String enter = input.nextLine();
        long start = System.currentTimeMillis();
        for (int i = 0; i < n; i++) {
            int x = getRandomInt(a, b);
            int y = getRandomInt(a, b);
            int correct = x + y;
            printProblem(x, y);
            int you = input.nextInt();
            while (correct != you) {
                n_wrong++;
                System.out.println("incorrect, try again:");
                printProblem(x, y);
                you = input.nextInt();
            }
        }
        finish(start, best, n_wrong);
    }

    public static void finish(long start, int best, int n_wrong )
throws FileNotFoundException{
        long t = System.currentTimeMillis() - start;
        long yourTime = t / 1000;
        System.out.println("Seconds = " + yourTime);
        System.out.println("wrong = " + n_wrong);
        if (yourTime < best) {
            System.out.println("New best time: " + yourTime);
            File bestFile = new File("best.txt");
            PrintWriter output = new PrintWriter(bestFile);
            output.print(yourTime);
            output.close();
        }
    }

    public static int getBest() throws FileNotFoundException {
        File file = new File("best.txt");
        Scanner getBest = new Scanner(file);
        int best = getBest.nextInt();
        System.out.println("best = " + best + " seconds");
    }
}

```

```
        System.out.println("Solve the following problems as quick as
you can.");
        System.out.println("Hit enter to start the problems and the
timer");
        return best;
    }

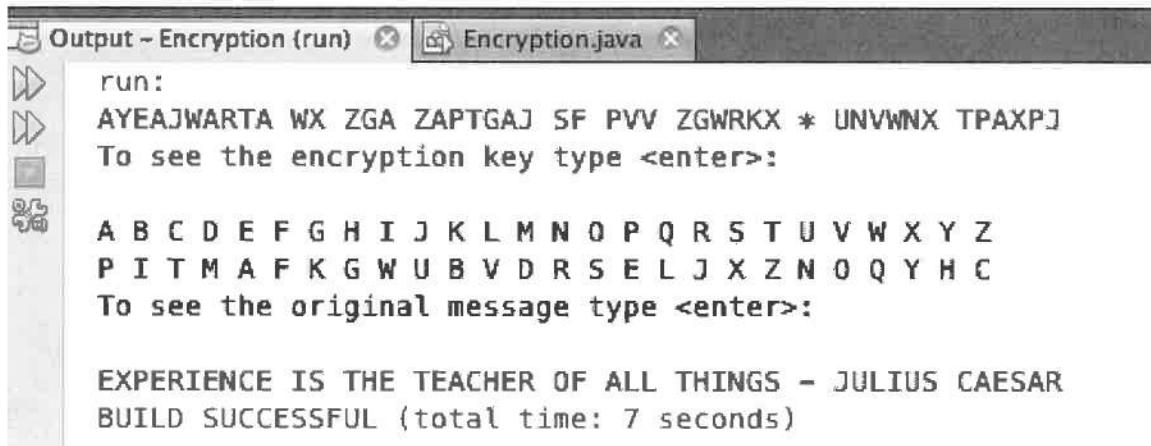
    public static void printProblem(int x, int y) {
        int length = (" " + x).length();
        System.out.println(" " + x);
        System.out.println(" +" + y);
        System.out.print(" ");
        for (int j = 0; j < length; j++) {
            System.out.print("-");
        }
        System.out.println("");
    }

    public static int getRandomInt(int a, int b) {
        return (int) ((b + 1 - a) * Math.random() + a);
    }
}
```

Java Project: Encryption

Description: Encode a message with an encryption cipher and then decode it. The cipher is a randomized, shuffled, alphabetic list.

Sample Output:



```
Output - Encryption (run)  Encryption.java
run:
AYEAJWARTA WX ZGA ZAPTGAJ SF PVV ZGWRKX * UNVWNX TPAXP]
To see the encryption key type <enter>:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
P I T M A F K G W U B V D R S E L J X Z N O Q Y H C
To see the original message type <enter>:

EXPERIENCE IS THE TEACHER OF ALL THINGS - JULIUS CAESAR
BUILD SUCCESSFUL (total time: 7 seconds)
```

```
package encryption;
import java.util.Random;
import java.util.Scanner;
public class Encryption {

    public static void main(String[] args) {
        int n = 26;
        char[] alphabet = new char[n];
        char[] key = new char[n];
        for (int i = 0; i < n; i++) {
            alphabet[i] = (char) (i + 65);
            key[i] = alphabet[i];
        }
        key = createRandomKey(key);

        String input = "Experience is the teacher of all things -
Julius Caesar";
        input = input.toUpperCase();

        String output = encrypt(input, key);
        System.out.println(output);

        Scanner scanner = new Scanner(System.in);
        System.out.println("To see the encryption key type
<enter>:");
        String getEnter1 = scanner.nextLine();
```

```

        for (int i = 0; i < n; i++) {
            System.out.print(alphabet[i] + " ");
        }
        System.out.println("");
        for (int i = 0; i < n; i++) {
            System.out.print(key[i] + " ");
        }
        System.out.println("");
        System.out.println("To see the original message type
<enter>:");
        String getEnter2 = scanner.nextLine();
        System.out.println(input);
    }

    public static char[] createRandomKey(char[] key) {
        int n = key.length;
        int m = n * n;
        Random r = new Random();
        for (int p = 0; p < m; p++) {
            int swap1 = r.nextInt(n);
            int swap2 = r.nextInt(n);
            char temp = key[swap1];
            key[swap1] = key[swap2];
            key[swap2] = temp;
        }
        return key;
    }
    public static String encrypt(String input, char[] key) {
        String output = "";

        for (int k = 0; k < input.length(); k++) {
            char thisChar = input.charAt(k);
            if (thisChar == ' ') {
                output += ' ';
            } else if((int)thisChar > 91 || (int)thisChar < 65) {
                output += '*';
            } else {
                int index = (int) input.charAt(k) - 65;
                output += key[index];
            }
        }
        return output;
    }
}

```

Java Project: InsertionSort

Description: Sorts a random array of integers, using the method called "insertion sort".

Sample Output:

run:

Original array:

a[0] = 8
a[1] = 16
a[2] = 91
a[3] = 40
a[4] = 50
a[5] = 29
a[6] = 53
a[7] = 28
a[8] = 87
a[9] = 86

Sorted array:

a[0] = 8
a[1] = 16
a[2] = 28
a[3] = 29
a[4] = 40
a[5] = 50
a[6] = 53
a[7] = 86
a[8] = 87
a[9] = 91

BUILD SUCCESSFUL (total time: 0 seconds)

```

/*
 * Insertion sort -- ref: Algorithms Text, Cormen
 */
package insertionsort;

import java.util.Arrays;

public class InsertionSort {

    public static void main(String[] args) {
        //initialize an array of integers:
        final int N = 10;
        int[] array = new int[N];

        //generate random integers from 0 to 99:
        for (int i = 0; i < array.length; i++) {
            array[i] = (int)(100 * Math.random());
        }

        //print the random array:
        System.out.println("Original array:");
        printArray(array);

        insertionSort(array);
        //Java has a sort function: Arrays.sort(array);

        //print the sorted array
        System.out.println("Sorted array:");
        printArray(array);
    }

    private static void printArray(int[] a) {
        for(int i = 0; i < a.length; i++) {
            System.out.println("a[" + i + "] = " + a[i]);
        }
    }

    private static void insertionSort(int[] a) {
        for(int j = 1; j < a.length; j++) {
            int key = a[j];
            int i = j - 1;
            while( i >= 0 && a[i] > key) {
                a[i+1] = a[i];
                i = i - 1;
            }
            a[i+1] = key;
        }
    }
}

```

Java Project: CardGame

Description: This program “deals” a poker hand, and checks for pairs, three of kind, and four of a kind. Just the beginning of what could be a fund poker playing game.

Sample Output:

4♣ 4♦ 9♥ 9♣ T♦
Has a pair of 4's
BUILD SUCCESSFUL (total time: 0 seconds)

```
package cardgame;

import java.util.Scanner;

public class CardGame {

    public static int[] hand = new int[5];
    public static int[] deck = new int[52];

    public static void main(String[] args) {
        //lab4_exercise_1();
        lab4_exercise_4();
    }

    private static int randomInteger(int a, int b) {
        return (int) ((b - a) * Math.random() + a);
    }

    private static void lab4_exercise_1() {
        //generate two integers
        //for timing:
        long start, stop;
        start = System.currentTimeMillis();
        System.out.println("start time = " + start);
        int n1, n2;
        int n_digits = 2;
        int a = (int) Math.pow(10, n_digits - 1);
        int b = (int) Math.pow(10, n_digits);
        n1 = randomInteger(a, b);
        n2 = randomInteger(a, b);
        System.out.println(" " + n1);
        System.out.println(" " + n2);
        System.out.println("+___");
        int correct = n1 + n2;
        Scanner input = new Scanner(System.in);
        int answer = input.nextInt();
```

```

        while (answer != correct) {
            System.out.println("Wrong, try again:");
            answer = input.nextInt();
        }
        System.out.println("Got it");
        stop = System.currentTimeMillis();
        System.out.println("It took you " + (stop - start) / 1000.0
+ " seconds.");
    }

    private static void lab4_exercise_4() {
        // choose a random card
        // model the deck as: 52 cards, indexed from 0 to 51.
        // print the whole deck:
        //printDeck();
        initializeDeck();
        shuffleDeck();
        dealPokerHand();
        sortHand();
        displayPokerHand();
        if (hasPair() >= 0) {
            System.out.println("Has a pair of " + getRank(hasPair()
% 13) + "'s");
        }

        if (hasThree() >= 0) {
            System.out.println("Has three " + getRank(hasThree() %
13) + "'s");
        }
    }

    private static int getSuit(int suit) {

        switch (suit) {
            case 0:
                return 9829; //hearts
            case 1:
                return 9830; //diamonds
            case 2:
                return 9824; //spades
            case 3:
                return 9827; //clubs
            default:
                return 9837; //flat
        }
    }

    private static char getRank(int rank) {
        if (rank > 0 && rank < 9) {
            return (char) (49 + rank);
        }
        switch (rank) {

```

```

        case 0:
            return 'A';
        case 9:
            return 'T';
        case 10:
            return 'J';
        case 11:
            return 'Q';
        case 12:
            return 'K';
    }
    return (char) rank;
}

private static void printDeck() {
    for (int i = 0; i < 52; i++) {
        int rank = i % 13;
        int suit = i / 13;
        System.out.println(getRank(rank) + " " + (char)
getSuit(suit));
    }
}

private static void initializeDeck() {
    for(int i = 0; i < 52; i++) {
        deck[i] = i;
    }
}

private static void shuffleDeck () {

    for(int i = 0; i < 10000; i++) {
        int card1 = randomInteger(0, 52);
        int card2 = randomInteger(0, 52);
        //swap card1 with card2
        int temp = deck[card1];
        deck[card1] = deck[card2];
        deck[card2] = temp;

    }
}

private static void dealPokerHand() {
    for (int i = 0; i < 5; i++) {
        //hand[i] = randomInteger(0, 52);
        hand[i] = deck[i];
    }
}

private static void displayPokerHand() {

    for (int i = 0; i < 5; i++) {

```

```

        char cardRank = getRank(hand[i] % 13);
        char cardSuit = (char) getSuit(hand[i] / 13);
        System.out.print(cardRank + "" + cardSuit);
        System.out.print(" ");
    }
    System.out.println("");
}

private static int hasPair() {
    for (int i = 0; i < 4; i++) {
        for (int j = i + 1; j > i && j < 5; j++) {
            if (hand[i] % 13 == hand[j] % 13) {
                return hand[i];
            }
        }
    }
    return -1;
}

private static int hasThree() {
    //assumes the hand is sorted by rank
    int[] rank = new int[5];
    for (int i = 0; i < 5; i++) {
        rank[i] = hand[i] % 13;
    }
    for (int i = 0; i < 3; i++) {
        if (rank[i] == rank[i+1] && rank[i] == rank[i+2]) {
            return hand[i];
        }
    }
    return -1;
}

private static void sortHand() {
    int[] rank = new int[5];
    for (int i = 0; i < 5; i++) {
        rank[i] = hand[i] % 13;
    }
    boolean flag = true;
    while (flag) {
        flag = false;
        for (int i = 0; i < 4; i++) {
            if (rank[i] > rank[i + 1]) {
                int temp = rank[i];
                rank[i] = rank[i + 1];
                rank[i + 1] = temp;
                int temp2 = hand[i];
                hand[i] = hand[i + 1];
                hand[i + 1] = temp2;
                flag = true;
            }
        }
    }
}

```

```
    }  
}  
}
```

Java Project: QuadraticEquations

Description: This program solves randomly generated quadratic equations $\rightarrow a x^2 + b x + c = 0$. Where a, b and c are integers between 0 and 10. This range can be easily changed in the program to solve other equations.

Sample Output:

```
run:  
a = 5  
b = 9  
c = 3  
The quadratic equation:  
5x^2 + 9x + 3 = 0  
Has solutions:  
Real solutions:  
x1 = -0.44174243050441603  
x2 = -1.3582575694955838  
BUILD SUCCESSFUL (total time: 0 seconds)
```

```
package quadraticequations;  
  
public class QuadraticEquations {  
  
    public static void main(String[] args) {  
        //quadratic equation  
        // x = (- b +- sqrt( b squared - 4 a c) )/2a  
        //note: can't take sqrt of a negative number  
  
        int a = randomInteger(0, 10);  
        int b = randomInteger(0, 10);  
        int c = randomInteger(0, 10);  
  
        System.out.println("a = " + a);  
        System.out.println("b = " + b);  
        System.out.println("c = " + c);  
    }  
}
```

```

        System.out.println("The quadratic equation:");
        System.out.println(a + "x^2 + " + b + "x + " + c + " = 0 ");
        System.out.println("Has solutions:");

        if (a == 0) {
            System.out.println("x = " + -c / b);
            System.exit(1);
        }
        double discriminant = Math.pow(b, 2) - 4 * a * c;
        if (discriminant >= 0) {
            double x1 = (-b + Math.sqrt(discriminant))/(2 * a);
            double x2 = (-b - Math.sqrt(discriminant))/(2 * a);
            System.out.println("Real solutions:");
            System.out.println("x1 = " + x1);
            System.out.println("x2 = " + x2);
        } else {
            double c1_real = -b / (2 * a);
            double c2_real = -b / (2 * a);
            double c1_imaginary=Math.sqrt(-discriminant)/(2* a);
            double c2_imaginary=-Math.sqrt(-discriminant)/(2* a);
            System.out.println("Complex solutions:");
            System.out.println("c1_real = " + c1_real);
            System.out.println("c1_imaginary = "+ c1_imaginary);
            System.out.println("c2_real = " + c2_real);
            System.out.println("c2_imaginary = "+ c2_imaginary);
        }
    }

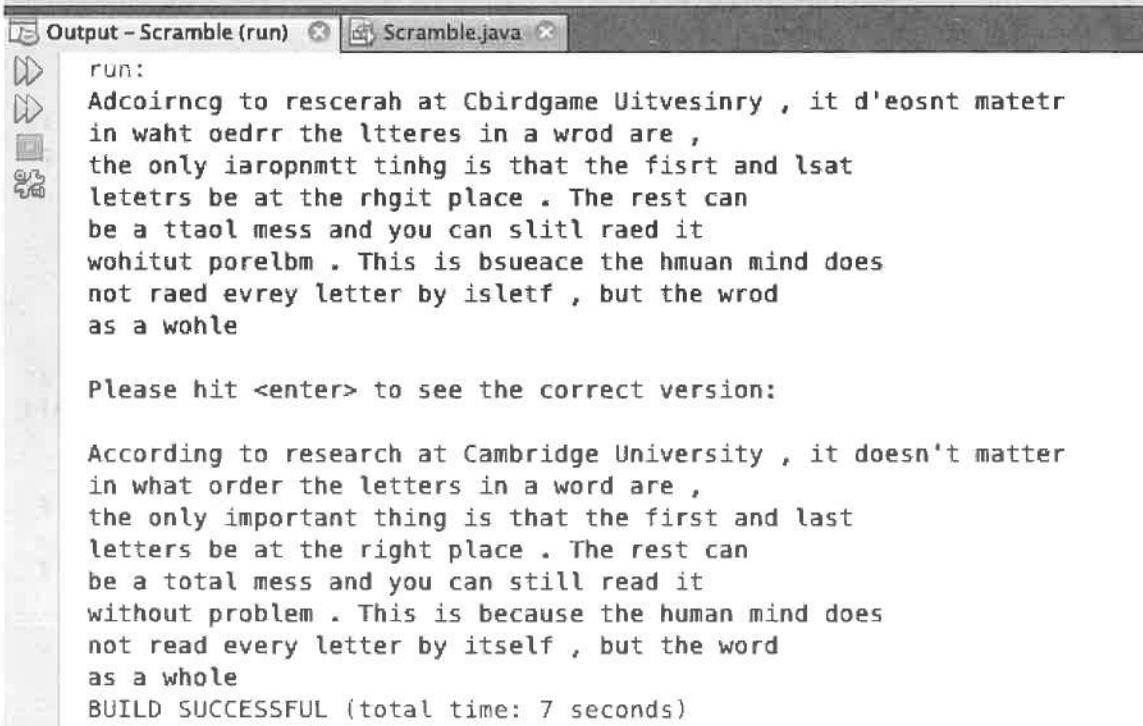
    private static int randomInteger(int a, int b) {
        return (int) ((b - a) * Math.random() + a);
    }
}

```

Java Project: Scramble

Description: Scramble the words in a paragraph by shuffling the internal letters of each word, keeping the first and last letters in place.

Sample Output:



```
Output - Scramble (run) Scramble.java
run:
Adcoirncg to rescerah at Cbirdgame Uitvesinry , it d'eosnt matetr
in waht oedrr the ltteres in a wrod are ,
the only iaropnmtt tinhg is that the fisrt and lsat
letetrs be at the rhgit place . The rest can
be a ttaol mess and you can slitl raed it
wohitut porelbm . This is bsueace the hmuian mind does
not raed evrey letter by isletf , but the wrod
as a wohle

Please hit <enter> to see the correct version:

According to research at Cambridge University , it doesn't matter
in what order the letters in a word are ,
the only important thing is that the first and last
letters be at the right place . The rest can
be a total mess and you can still read it
without problem . This is because the human mind does
not read every letter by itself , but the word
as a whole
BUILD SUCCESSFUL (total time: 7 seconds)
```

```
package scramble;

import java.util.Random;
import java.util.Scanner;

public class Scramble {

    public static void main(String[] args) {
        String sentence = "According to research at Cambridge
University , it doesn't matter \nin what order the letters in a word
are , \nthe only important thing is that the first and last
\nletters be at the right place . The rest can\nbe a total mess and
you can still read it \nwithout problem . This is because the human
mind does \nnot read every letter by itself , but the word\nas a
whole";

        String out = "";
        Scanner scanner = new Scanner(sentence);
```

```

        int count = 0;
        while (scanner.hasNext()) {
            String word = scanner.next();
            count++;
            out += innerScramble(word) + " ";
            if ((count % 10 ) == 0) out += "\n";
        }
        System.out.println(out);
        Scanner consoleInput = new Scanner(System.in);
        System.out.println("");
        System.out.println("Please hit <enter> to see the correct
version:");
        consoleInput.nextLine();
        System.out.println(sentence);

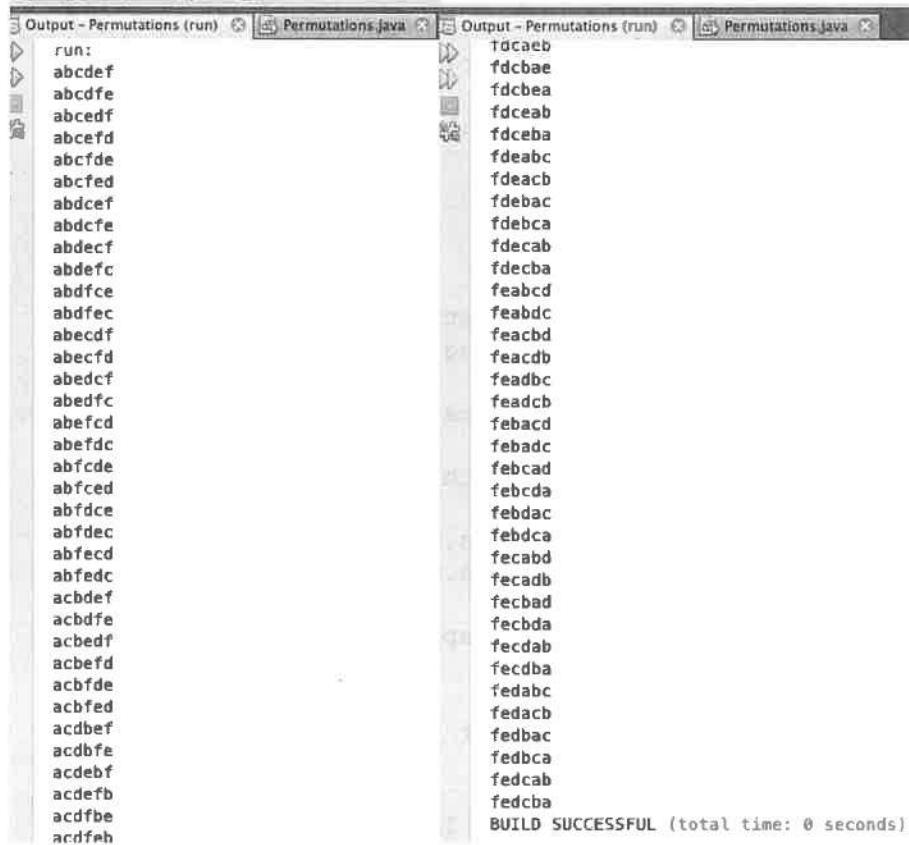
    }
    //getScramble scrambles the entire input string
    public static String getScramble(String input) {
        String output = input;
        char[] outChars = output.toCharArray();
        Random r = new Random();
        for (int i = 0; i < outChars.length * outChars.length; i++)
        {
            int swap1 = r.nextInt(outChars.length);
            int swap2 = r.nextInt(outChars.length);
            char temp = outChars[swap1];
            outChars[swap1] = outChars[swap2];
            outChars[swap2] = temp;
        }
        output = String.valueOf(outChars);
        return output;
    }
    //innerScramble leaves the first and last letters in place.
    public static String innerScramble(String input) {
        String output = input;
        char[] outChars = output.toCharArray();
        if (outChars.length > 3) {
            Random r = new Random();
            for (int i = 0; i < outChars.length * outChars.length;
i++) {
                int swap1 = r.nextInt(outChars.length - 2) + 1;
                int swap2 = r.nextInt(outChars.length - 2) + 1;
                char temp = outChars[swap1];
                outChars[swap1] = outChars[swap2];
                outChars[swap2] = temp;
            }
        }
        output = String.valueOf(outChars);
        return output;
    }
}

```

Java Project: Permutations

Description: Print out all the permutations of a given string of letters.

Sample Output:



```
Output - Permutations (run)  Permutations.java  Output - Permutations (run)  Permutations.java
run:
abcdef
abcdfe
abcedf
abcefdf
abcfdde
abcfde
abcfed
abdcfe
abdcft
abdcfe
abdecf
abdefc
abdfce
abdfec
abecdf
abecfd
abedcf
abedfc
abefcd
abefdc
abfcde
abfcfd
abfcde
abfced
abfdec
abfecd
abfedc
acbdfe
acbedf
acbfde
acbdef
acbfde
acbfed
acdbfe
acdebf
acdefb
acdfbe
acdfbh
```

```
tdcaeb
fdcbae
fdcbea
fdceab
fdceba
fdeabc
fdeacb
fdebac
fdebc
fdecab
fdecba
feabcd
feabdc
feacbd
feacdb
feadbc
feadcb
febacd
febadc
febcad
febca
febdac
febdc
fecabd
fecadb
fecabd
fecbda
fecdab
fecdba
fecdb
fedabc
fedacb
fedbac
fedbac
fedcba
fedcab
fedcba
fedcba
fedcba
BUILDSUCCESSFUL (total time: 0 seconds)
```

```
package permutations;
public class Permutations {
    public static void main(String[] args) {
        permutation("", "abcdef");
    }
    private static void permutation(String prefix, String str) {
        int n = str.length();
        if (n == 0) {
            System.out.println(prefix);
        } else {
            for (int i = 0; i < n; i++) {
                permutation(prefix + str.charAt(i), str.substring(0,
i) + str.substring(i + 1, n));
            }
        }
    }
}
```

Java Project: Number Guessing Game

Description: Guess a hidden number between 1 and 1000. The program uses a do while loop to keep the iteration going until the user gets the correct number. The program gives the user a "higher/lower" hint after each guess.

Sample Output:

```
run:  
Enter a guess (1-1000): 500  
Your guess is greater than the secret number.  
Enter a guess (1-1000): 250  
Your guess is smaller than the secret number.  
Enter a guess (1-1000): 325  
Your guess is smaller than the secret number.  
Enter a guess (1-1000): 400  
Your guess is smaller than the secret number.  
Enter a guess (1-1000): 450  
Your guess is smaller than the secret number.  
Enter a guess (1-1000): 475  
Your guess is greater than the secret number.  
Enter a guess (1-1000): 457  
Your guess is greater than the secret number.  
Enter a guess (1-1000): 453  
Your guess is smaller than the secret number.  
Enter a guess (1-1000): 455  
Your guess is smaller than the secret number.  
Enter a guess (1-1000): 456  
Your guess is correct. Congratulations!  
BUILD SUCCESSFUL (total time: 1 minute 1 second)
```

```
package numberguessinggame;

import java.util.Scanner;

public class NumberGuessingGame {

    public static void main(String[] args) {

        int secretNumber;
        secretNumber = (int) (Math.random() * 999 + 1);
        Scanner keyboard = new Scanner(System.in);
        int guess;
        do {
            System.out.print("Enter a guess (1-1000): ");
            guess = keyboard.nextInt();
            if (guess == secretNumber)
                System.out.println("Your guess is correct.
Congratulations!");
            else if (guess < secretNumber)
                System.out.println("Your guess is smaller
than the secret number.");
            else if (guess > secretNumber)
                System.out.println("Your guess is greater
than the secret number.");
        } while (guess != secretNumber);

    }
}
```

Java Project: ComputeGrades

Description: Help a teacher grade the students. The user enters the students' names and scores and the program computes their letter grades and other statistics.

Sample Output:

```
Output - ComputeGrades (run) × ComputeGrades.java ×
run:
How many students?
3
Please enter their names:
Name: 1: john jones
Name: 2: mary mack
Name: 3: peter paul
Now, please enter their scores:
john jones's score: 45
mary mack's score: 90
peter paul's score: 32
Average score: 55.67
Hightest score: mary mack: 90
Lowest score: peter paul: 32
Names:      Grades:
john jones: F
mary mack: A
peter paul: F
BUILD SUCCESSFUL (total time: 16 seconds)
```

```
package computegrades;

import java.util.Scanner;

public class ComputeGrades {

    public static void main(String[] args) {
        String[] names = getNames();
        int[] scores = getscores(names);
        double average = computeAverage(scores);
        int highestIndex = getHighest(scores);
        int lowestIndex = getLowest(scores);
        System.out.format("Average score: %3.2f\n", average);
        System.out.println("Hightest score: " + names[highestIndex]
+ ":" + scores[highestIndex]);
        System.out.println("Lowest score: " + names[lowestIndex] +
": " + scores[lowestIndex]);
        System.out.println("Names:      Grades:    ");
    }
}
```

```

        System.out.print("");
        printLetterGrades(names, scores);
    }

    public static void printLetterGrades(String[] names, int[]
scores) {
        for (int i = 0; i < names.length; i++) {
            if (scores[i] >= 90) {
                System.out.println(names[i] + ": A");
            } else if (scores[i] >= 80) {
                System.out.println(names[i] + ": B");
            } else if (scores[i] >= 70) {
                System.out.println(names[i] + ": C");
            } else if (scores[i] >= 60) {
                System.out.println(names[i] + ": D");
            } else {
                System.out.println(names[i] + ": F");
            }
        }
    }

    public static String[] getNames() {
        Scanner input = new Scanner(System.in);
        System.out.println("How many students?");
        int n = input.nextInt();
        System.out.println("Please enter their names:");
        String[] names = new String[n];
        for (int i = 0; i < names.length; i++) {
            System.out.print("Name: " + (i + 1) + ": ");
            names[i] = input.next() + " " + input.next();
        }

        return names;
    }

    public static int[] getscores(String[] names) {
        System.out.println("Now, please enter their scores:");
        Scanner input = new Scanner(System.in);
        int[] scores = new int[names.length];
        for (int i = 0; i < names.length; i++) {
            System.out.print(names[i] + "'s ");
            System.out.print("score: ");
            while (!input.hasNextInt()) {
                input.next();
                System.out.println("Please enter an integer for the
score.");
            }
            scores[i] = input.nextInt();
        }
        return scores;
    }

    public static double computeAverage(int[] scores) {

```

```

        double sum = 0;
        for (int i = 0; i < scores.length; i++) {
            sum += scores[i];
        }
        return sum / scores.length;
    }

    public static int getHighest(int[] scores) {
        int highestIndex = Integer.MIN_VALUE;
        int highestScore = Integer.MIN_VALUE;
        for (int i = 0; i < scores.length; i++) {
            if (scores[i] > highestScore)
            {
                highestScore = scores[i];
                highestIndex = i;
            }
        }
        return highestIndex;
    }

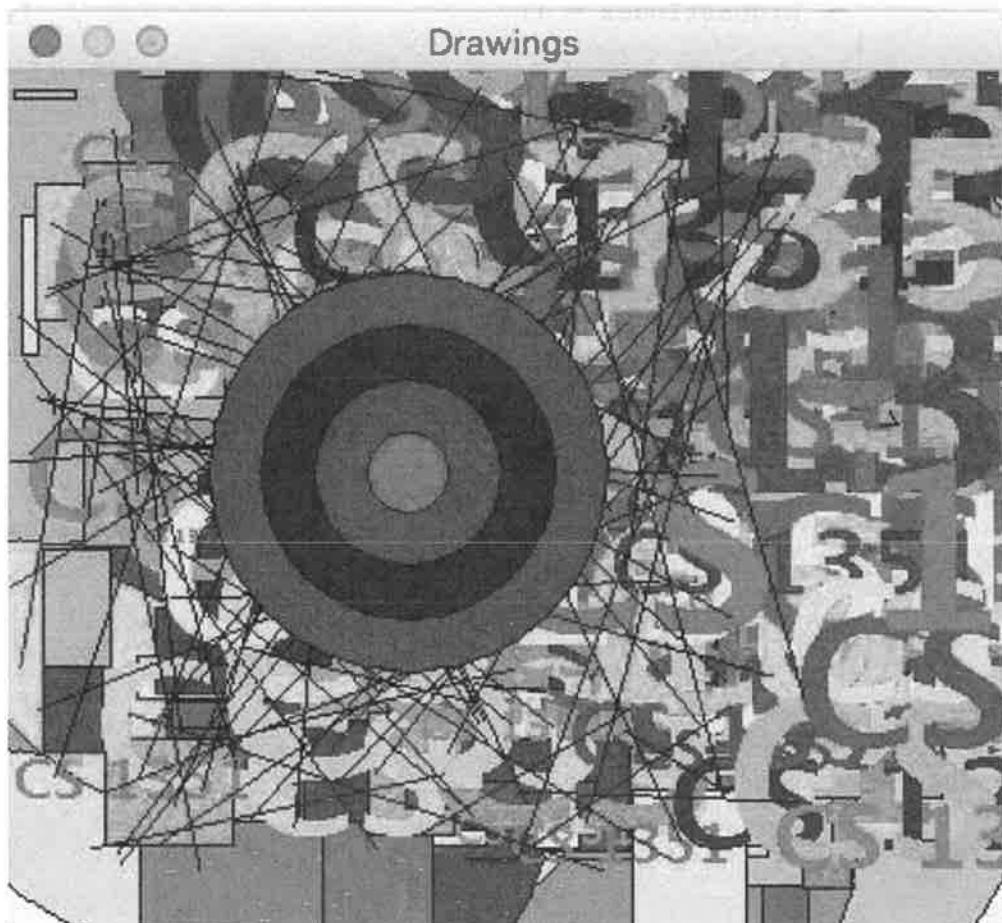
    public static int getLowest(int[] scores) {
        int lowestIndex = Integer.MAX_VALUE;
        int lowestScore = Integer.MAX_VALUE;
        for (int i = 0; i < scores.length; i++) {
            if (scores[i] < lowestScore) {
                lowestScore = scores[i];
                lowestIndex = i;
            }
        }
        return lowestIndex;
    }
}

```

Java Project: RandomDrawings

Description: Draw a variety of objects to a drawing panel. This program is a demonstration of how to use Java to draw Characters, Lines, Rectangles and circles.

Sample Output:



```

package randomdrawings;

import java.awt.Color;
import java.awt.Font;
import java.awt.Graphics;
import javax.swing.JFrame;
import javax.swing.JPanel;

public class RandomDrawings extends JFrame {

    public static int W = 300;
    public static int H = 300;

    public RandomDrawings() {
        DrawingPanel drawingPanel = new DrawingPanel();
        this.add(drawingPanel);

    }

    static class DrawingPanel extends JPanel {

        public static double radius;
        public static double x;
        public static double y;
        public static Color color;

        public DrawingPanel() {
            radius = W / 8;
            x = W / 2;
            y = H / 2;
            color = new Color(100, 250, 10);

        }

        @Override
        protected void paintComponent(Graphics g) {
            super.paintComponent(g);
            drawCircles(g);
            drawRectangels(g);
            drawLetters(g);
            drawLines(g);
            drawConcentricCircles(g);
            //drawGrid(g);
        }

        public void drawGrid(Graphics g) {
            int cellW = 100;
            int cellH = 100;
            for(int i = 0; i < H/cellH; i++){
                for(int j = 0; j < W/cellW; j++) {
                    color = getRandomColor();
                    g.setColor(color);
                    g.fillRect(j*cellW, i*cellH, cellW, cellH);
                    g.setColor(Color.black);
                }
            }
        }
    }
}

```

```

        g.drawRect(j*cellW, i*cellH, cellW, cellH);
    }
}
}

public void drawConcentricCircles(Graphics g) {
    int minRadius = 0;
    int maxRadius = W/4;
    int centerX = W/2;
    int centerY = H/2;
    int delta = 20;
    for(int radius = maxRadius; radius > minRadius ; radius
-- delta) {
        color = getRandomColor();
        g.setColor(color);
        g.fillOval(
            centerX - radius,
            centerY - radius,
            2*radius,
            2*radius
        );
        g.setColor(Color.black);
        g.drawOval(
            centerX - radius,
            centerY - radius,
            2*radius,
            2*radius
        );
    }
}

public Color getRandomColor() {
    return color = new Color(
        (int) (256 * Math.random()),
        (int) (256 * Math.random()),
        (int) (256 * Math.random())
    );
}

public void drawLines(Graphics g) {
    int n = 100;
    int x1, y1, x2, y2;
    for (int i = 0; i < n; i++) {
        color = getRandomColor();
        //g.setColor(color);
        x1 = (int) (Math.random() * W);
        y1 = (int) (Math.random() * H);
        x2 = (int) (Math.random() * W);
        y2 = (int) (Math.random() * H);
        g.drawLine(x1, y1, x2, y2);
        g.setColor(Color.black);
    }
}

```

```

}

public void drawLetters(Graphics g) {

    int maxFontSize = 100;
    int n = 100;
    for (int i = 0; i < n; i++) {
        int fontSize = (int) (maxFontSize * Math.random());
        Font font = new Font("New Courier", Font.BOLD,
fontSize);

        g.setFont(font);
        String text = "CS 1351";
        getRandomColor();

        g.setColor(color);
        x = (int) (W * Math.random());
        y = (int) (H * Math.random());
        g.drawString(text, (int) x, (int) y);

    }
}

public void drawRectangels(Graphics g) {
    int maxRectWidth = W / 4;
    int maxRectHeight = H / 4;
    int n = 100;
    for (int i = 0; i < n; i++) {
        int rectWidth = (int) (maxRectWidth *
Math.random());
        int rectHeight = (int) (maxRectHeight *
Math.random());
        getRandomColor();
        x = (int) (W * Math.random());
        y = (int) (H * Math.random());
        g.setColor(color);
        g.fillRect((int) x, (int) y, rectWidth, rectHeight);
        g.setColor(Color.black);
        g.drawRect((int) x, (int) y, rectWidth, rectHeight);
    }
}

public void drawCircles(Graphics g) {
    int maxRadius = W / 4;

    int n = 50;
    for (int i = 0; i < n; i++) {
        radius = W / 2 * Math.random();
        getRandomColor();
        x = (int) (W * Math.random());
        y = (int) (H * Math.random());
        g.setColor(color);
        g.fillOval(

```

```
        (int) (x - radius),
        (int) (y - radius),
        (int) (2 * radius),
        (int) (2 * radius)
    );
    g.setColor(Color.black);
    g.drawOval(
        (int) (x - radius),
        (int) (y - radius),
        (int) (2 * radius),
        (int) (2 * radius)
    );
}

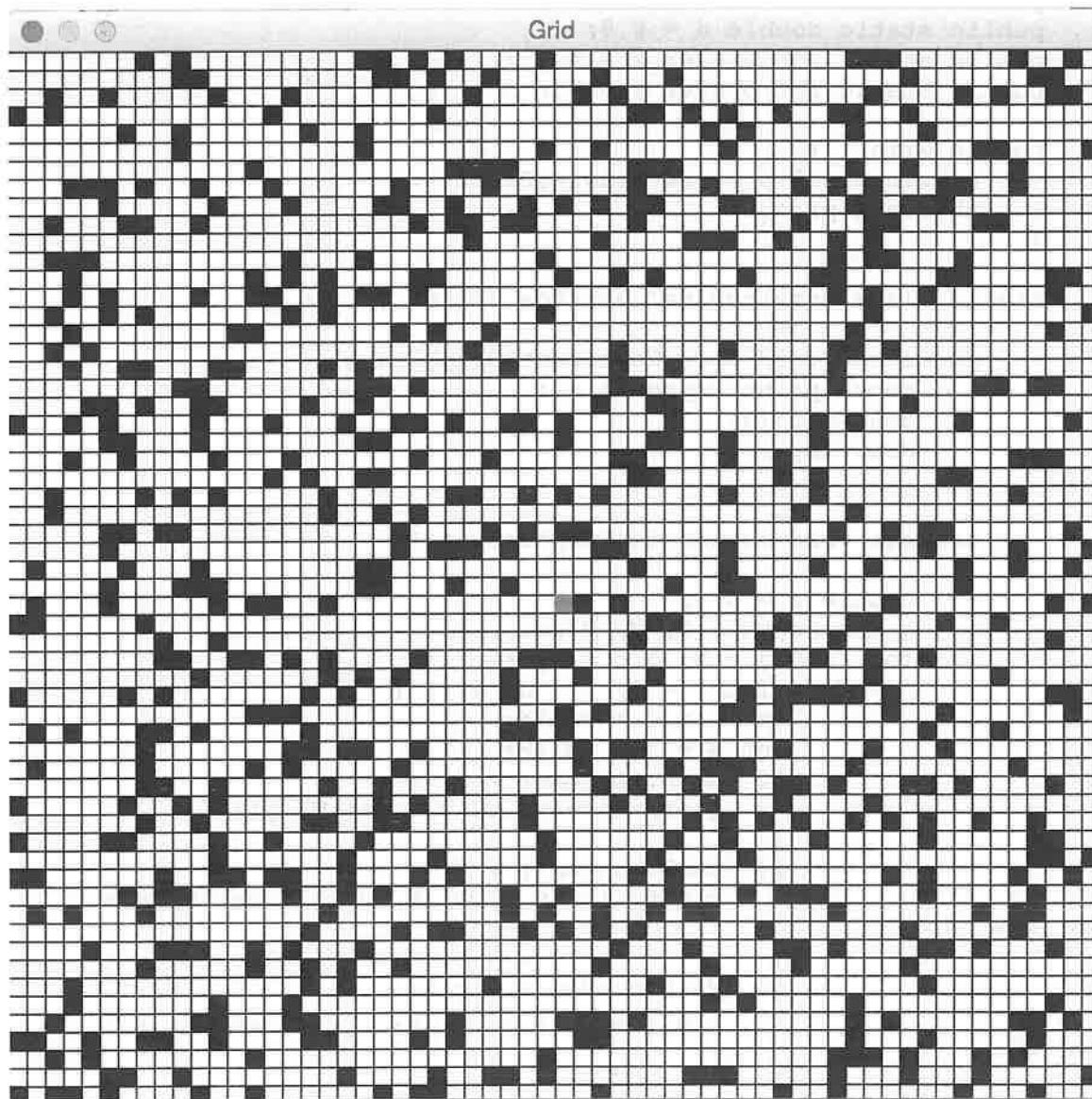
}

public static void main(String[] args) {
    RandomDrawings frame = new RandomDrawings();
    frame.setTitle("Drawings");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(W, H);
    frame.setVisible(true);
}
}
```

Java Project: Grid

Description: Draw a grid of boxes/cells that are filled, or not filled, depending on a random variable. Make one red cell to be the “player”. There is no game play in this project but it is easy to imagine the red cell as a player moving around the grid (maybe with enemies moving around as well).

Sample Output:



```

package grid;

import java.awt.Color;
import java.awt.Graphics;
import javax.swing.JFrame;
import javax.swing.JPanel;

public class Grid extends JFrame {

    public static int W = 600;
    public static int H = 600;
    public static int cellW = 10;
    public static int cellH = 10;
    public static int n = W / cellW;
    public static int m = H / cellH;
    public static double d = 0.8;
    public static int player_x = W / 2;
    public static int player_y = H / 2;

    public Grid() {
        DrawingPanel p = new DrawingPanel();
        this.add(p);
    }

    static class DrawingPanel extends JPanel {

        protected void paintComponent(Graphics g) {
            super.paintComponent(g);
            drawGrid3(g);
            drawPlayer(g);
        }

        private void drawGrid1(Graphics g) {

            double d = 0.8;
            g.drawRect(0, 0, W, H);
            for (int j = 0; j < m; j++) {
                for (int i = 0; i < n; i++) {
                    int x = i * cellW;
                    int y = j * cellH;
                    if (Math.random() > d) {
                        g.drawLine(x, y, x + cellW, y);
                    }
                    if (Math.random() > d) {
                        g.drawLine(x + cellW, y, x + cellW, y +
cellH);
                    }
                    if (Math.random() > d) {
                        g.drawLine(x + cellW, y + cellH, x, y +
cellW);
                    }
                    if (Math.random() > d) {
                        g.drawLine(x, y + cellW, x, y);
                    }
                }
            }
        }
    }
}

```

```

        }
    }
}

private void drawGrid2(Graphics g) {

    g.drawRect(0, 0, W, H);
    for (int j = 0; j < m; j++) {
        for (int i = 0; i < n; i++) {
            int x = i * cellW;
            int y = j * cellH;
            //g.drawRect(x, y, cellW, cellH);
            if (Math.random() > d) {
                g.drawLine(x, y, x + cellW, y);
            }
            if (Math.random() > d) {
                g.drawLine(x, y + cellW, x, y);
            }
        }
    }
}

private void drawGrid3(Graphics g) {
    g.setColor(Color.black);
    g.drawRect(0, 0, W, H);
    for (int j = 0; j < m; j++) {
        for (int i = 0; i < n; i++) {
            int x = i * cellW;
            int y = j * cellH;
            g.drawRect(x, y, cellW, cellH);
            if (Math.random() > d) {
                g.fillRect(x, y, cellW, cellH);
            }
        }
    }
}

public static void drawPlayer(Graphics g) {
    g.setColor(Color.red);
    g.fillRect(player_x, player_y, cellW, cellH);
}

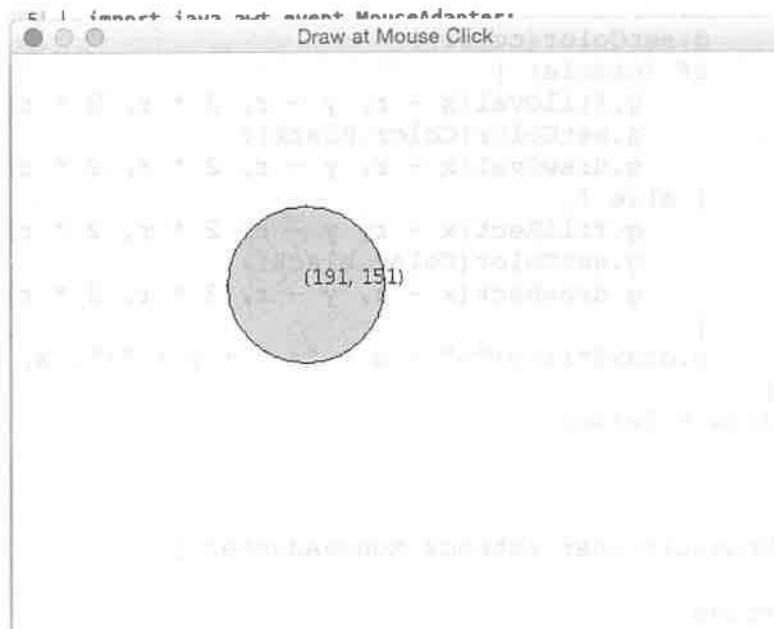
public static void main(String[] args) {
    Grid frame = new Grid();
    frame.setTitle("Grid");
    frame.setSize(W, H);
    frame.setLocationRelativeTo(null);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setVisible(true);
}
}

```

Java Project: MouseClickDraw

Description: Interactive circle/square drawing program. When the user clicks (left) in the drawing window a circle is drawn of random radius and color. If the user right-clicks the circle changes to another random color. A middle-click turns the circle into a square.

Sample Output:



```
package mouseclickdraw;

import java.awt.Color;
import java.awt.Graphics;
import java.awt.event.MouseAdapter;
import java.awt.event.MouseEvent;
import java.util.Random;
import javax.swing.JFrame;
import javax.swing.JPanel;

public class MouseClickDraw extends JFrame {

    public boolean draw = false;
    public int x;
    public int y;
    public int r;
    public Color color;
```

```

public boolean circle = true;

public MouseClickDraw() {
    JPanel panel = new DrawingPanel();
    panel.addMouseListener(new myMouseListener());
    panel.setFocusable(true);
    add(panel);
}

public class DrawingPanel extends JPanel {

    protected void paintComponent(Graphics g) {
        super.paintComponent(g);

        if (draw) {
            g.setColor(color);
            if (circle) {
                g.fillOval(x - r, y - r, 2 * r, 2 * r);
                g.setColor(Color.black);
                g.drawOval(x - r, y - r, 2 * r, 2 * r);
            } else {
                g.fillRect(x - r, y - r, 2 * r, 2 * r);
                g.setColor(Color.black);
                g.drawRect(x - r, y - r, 2 * r, 2 * r);
            }
            g.drawString("(" + x + ", " + y + ")", x, y);
        }
        draw = false;
    }
}

class myMouseListener extends MouseAdapter {

    @Override
    public void mouseClicked(MouseEvent e) {

        if (e.getButton() == e.BUTTON1) {
            draw = true;
            x = e.getX();
            y = e.getY();
            r = (int) (100 * Math.random());
            repaint();
        }

        if (e.getButton() == e.BUTTON2) {
            draw = true;
            if (circle) {
                circle = false;
            } else {
                circle = true;
            }
            repaint();
        }
    }
}

```

```
        if (e.getButton() == e.BUTTON3) {
            draw = true;
            color = getRandomColor();
            repaint();
        }
    }

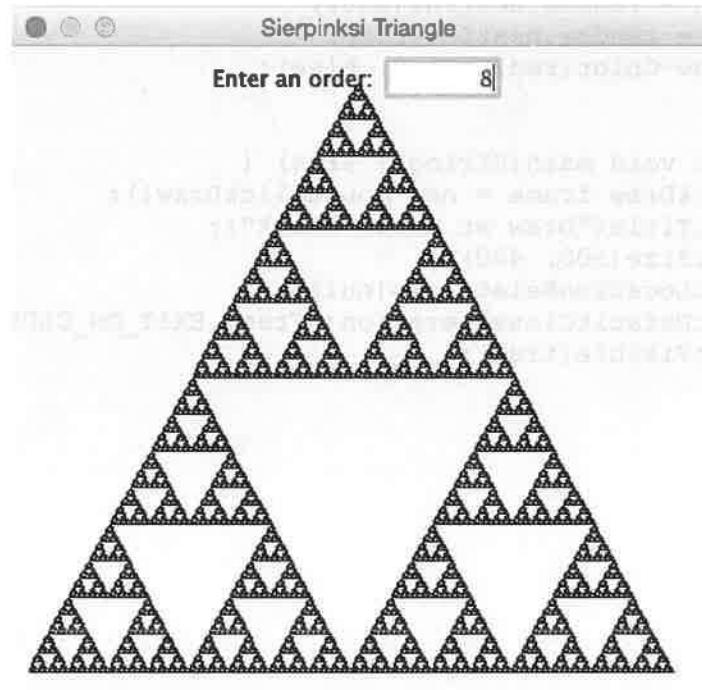
public Color getRandomColor() {
    Random random = new Random();
    int red = random.nextInt(256);
    int green = random.nextInt(256);
    int blue = random.nextInt(256);
    return new Color(red, green, blue);
}

public static void main(String[] args) {
    MouseClickDraw frame = new MouseClickDraw();
    frame.setTitle("Draw at Mouse Click");
    frame.setSize(500, 400);
    frame.setLocationRelativeTo(null);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setVisible(true);
}
}
```

Java Project: Sierpinski

Description: Draw a triangle-fractal by sequentially drawing triangles based on the halfway point on the sides of a give triangle.

Sample Output:



```

package sierpinski;

import java.awt.BorderLayout;
import java.awt.Graphics;
import java.awt.Point;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JPanel;
import javax.swing.JTextField;
import javax.swing.SwingConstants;

public class Sierpinski extends JFrame {

    public Sierpinski() {
        JPanel panel = new SierpinskiPanel();
        add(panel, new BorderLayout().CENTER);
    }

    static class SierpinskiPanel extends JPanel {

        public static int order = 0;
        private JTextField orderField = new JTextField("0", 5);

        SierpinskiPanel() {
            add(new JLabel("Enter an order:"));
            add(orderField);
            orderField.setHorizontalAlignment(SwingConstants.RIGHT);

            orderField.addActionListener(new ActionListener() {
                public void actionPerformed(ActionEvent e) {
                    setOrder(Integer.parseInt(orderField.getText()));
                }
            });
        }

        public void setOrder(int order) {
            this.order = order;
            repaint();
        }

        protected void paintComponent(Graphics g) {
            super.paintComponents(g);
            //the "20" is a padding so the drawing deosnt go to the
            edge of the window
            Point p1 = new Point(getWidth() / 2, 20);
            Point p2 = new Point(10, getHeight() - 20);
            Point p3 = new Point(getWidth() - 20, getHeight() - 20);
            displayTriangles(g, order, p1, p2, p3);
        }
    }
}

```

```

        private static void displayTriangles(Graphics g, int order,
Point p1, Point p2, Point p3) {
    if (order == 0) {
        g.drawLine(p1.x, p1.y, p2.x, p2.y);
        g.drawLine(p2.x, p2.y, p3.x, p3.y);
        g.drawLine(p3.x, p3.y, p1.x, p1.y);
    } else {
        Point p12 = midpoint(p1, p2);
        Point p13 = midpoint(p1, p3);
        Point p23 = midpoint(p2, p3);
        displayTriangles(g, order - 1, p1, p12, p13);
        displayTriangles(g, order - 1, p2, p12, p23);
        displayTriangles(g, order - 1, p3, p13, p23);
    }
}

public static Point midpoint(Point p1, Point p2) {
    return new Point((p1.x + p2.x) / 2, (p1.y + p2.y) / 2);
}

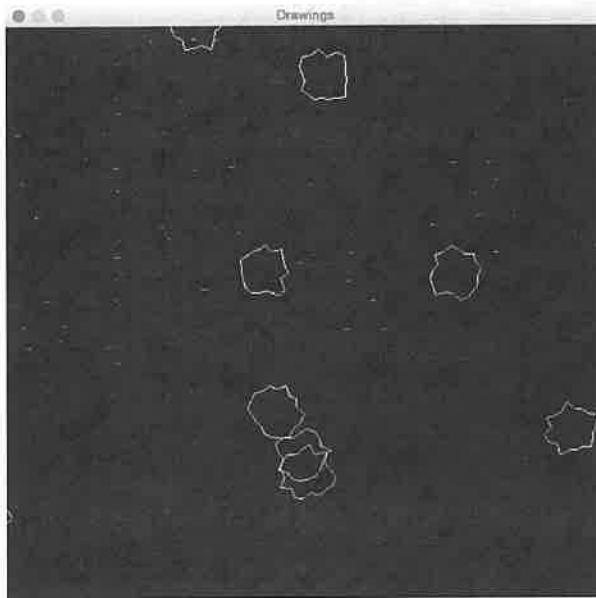
public static void main(String[] args) {
    Sierpinski sierpinski = new Sierpinski();
    sierpinski.setSize(400, 400);
    sierpinski.setTitle("Sierpinski Triangle");
    sierpinski.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    sierpinski.setLocationRelativeTo(null);
    sierpinski.setVisible(true);
}
}

```

Java Project: Asteroids

Description: Creates black/white asteroid environment. Great start for a shooting game similar to the original asteroids game.

Sample Output:



```
package asteroids;

import java.awt.Color;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.Timer;

public class Asteroids extends JFrame {

    public static int W = 600;
    public static int H = 600;

    public Asteroids() {
        DrawingPanel drawingPanel = new DrawingPanel();
        drawingPanel.setBackground(Color.black);
        this.add(drawingPanel);
    }

    static class DrawingPanel extends JPanel {
```

```

private Timer timer = new Timer(30, new TimerListener());
int m = 20; //points per poly
int n = 10; // number of polys
double[][] x = new double[n][m];
double[][] y = new double[n][m];
double[] dx = new double[n];
double[] dy = new double[n];
double[] speed = new double[n];
double maxRadius = 30;
double minRadius = 20;
double[] xCenter = new double[n];
double[] yCenter = new double[n];
public Color[] color = new Color[n];
public double maxSpeed = 5;

public DrawingPanel() {
    initializePolygons();
    timer.start();
}

private void initializePolygons() {
    double theta;
    for (int i = 0; i < n; i++) {
        color[i] = randomColor();
        xCenter[i] = Math.random() * W;
        yCenter[i] = Math.random() * H;
        for (int k = 0; k < m; k++) {
            theta = k * 2.0 * Math.PI / m;
            double r = minRadius + (maxRadius - minRadius) *
Math.random();
            //use this line if you want regular polygons:
            //double r = maxRadius;
            x[i][k] = r * Math.cos(theta);
            y[i][k] = r * Math.sin(theta);
        }
        speed[i] = maxSpeed;
        dx[i] = 2 * speed[i] * Math.random() - speed[i];
        dy[i] = 2 * speed[i] * Math.random() - speed[i];
    }
}

protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    updatePositions();
    checkBoundary();
    drawPolygons(g);
}

public void checkBoundary() {
    for (int i = 0; i < n; i++) {
        if (xCenter[i] + maxRadius < 0) {
            xCenter[i] = getWidth() + maxRadius;
        }
    }
}

```

```

        //dx[i] = Math.abs(dx[i]);
    }
    if (xCenter[i] - maxRadius > getWidth()) {
        xCenter[i] = -maxRadius;
        //dx[i] = -Math.abs(dx[i]);
    }
    if (yCenter[i] + maxRadius < 0) {
        yCenter[i] = getHeight() + maxRadius;
        //dy[i] = Math.abs(dy[i]);
    }
    if (yCenter[i] - maxRadius > getHeight()) {
        yCenter[i] = -maxRadius;
        //dy[i] = -Math.abs(dy[i]);
    }
}

private void updatePositions() {
    double alpha = 0.1;
    for (int i = 0; i < n; i++) {
        for (int k = 0; k < m; k++) {

            double newX = (x[i][k]) * Math.cos(alpha) +
(y[i][k]) * Math.sin(alpha);
            double newY = -(x[i][k]) * Math.sin(alpha) +
(y[i][k]) * Math.cos(alpha);

            x[i][k] = newX;
            y[i][k] = newY;
        }
        xCenter[i] += dx[i];
        yCenter[i] += dy[i];
    }
}

class TimerListener implements ActionListener {

    public void actionPerformed(ActionEvent e) {
        repaint();
    }
}

private void drawPolygons(Graphics g) {
    for (int i = 0; i < n; i++) {
        int[] polyX = new int[m];
        int[] polyY = new int[m];
        //Color color = randomColor();
        g.setColor(color[i]);
        for (int k = 0; k < m; k++) {
            polyX[k] = (int) (x[i][k] + xCenter[i]);
            polyY[k] = (int) (y[i][k] + yCenter[i]);
        }
    }
}

```

```
        //g.fillPolygon(polyX, polyY, m);
        g.setColor(Color.white);
        g.drawPolygon(polyX, polyY, m);
    }
}

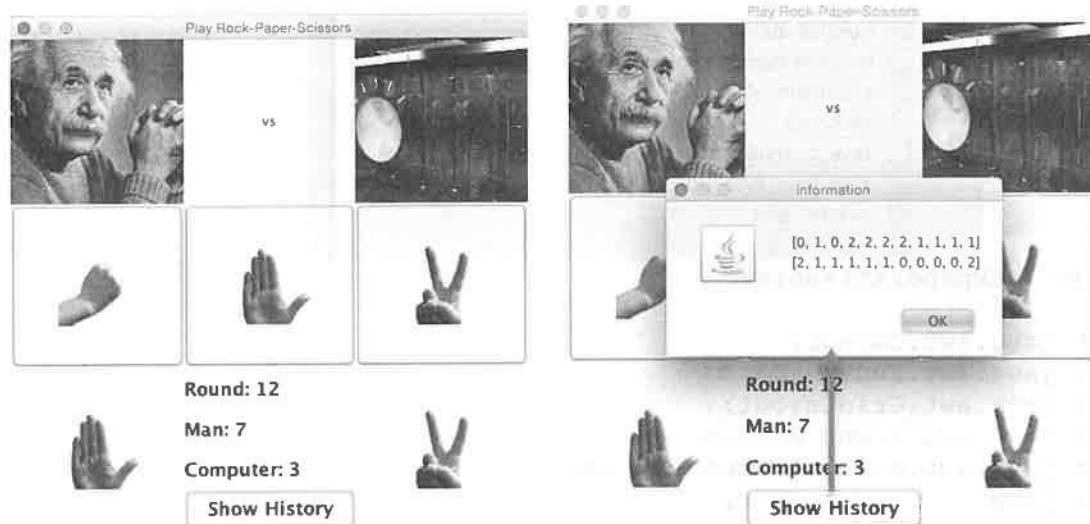
private Color randomColor() {
    Color color = new Color(
        (int) (256 * Math.random()),
        (int) (256 * Math.random()),
        (int) (256 * Math.random())
    );
    return color;
}
}

public static void main(String[] args) {
    Asteroids frame = new Asteroids();
    frame.setTitle("Drawings");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(W, H);
    frame.setVisible(true);
}
```

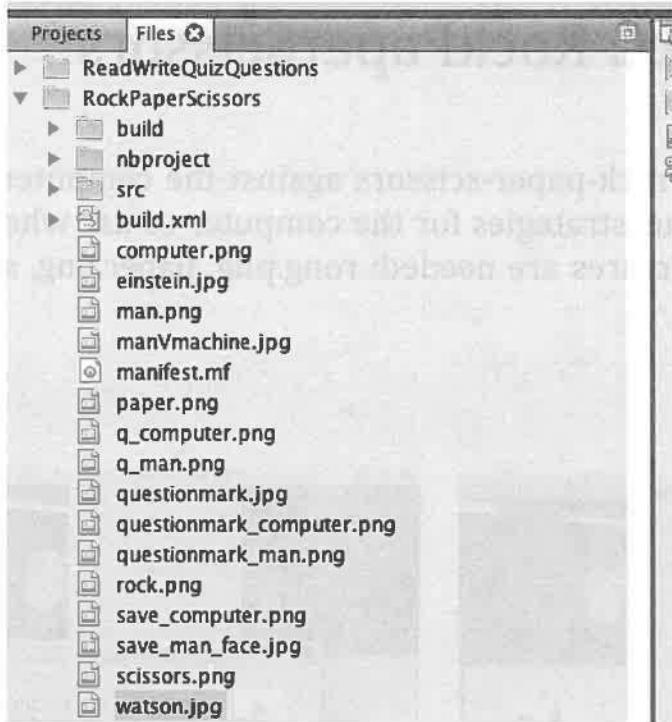
Java Project: RockPaperScissors

Description: Play rock-paper-scissors against the computer. The user can program various strategies for the computer to use when playing a human. Several pictures are needed: rong.png, paper.png, scissors.png etc.

Sample Output:



Need images:



```
package rockpaperscissors;

import java.awt.Cursor;
import java.awt.Font;
import java.awt.GridLayout;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.util.ArrayList;
import java.util.Random;
import javax.swing.ImageIcon;
import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JOptionPane;

import javax.swing.JPanel;

public class RockPaperScissors extends JFrame {

    ImageIcon rockImage = new ImageIcon("rock.png");
    ImageIcon paperImage = new ImageIcon("paper.png");
    ImageIcon scissorsImage = new ImageIcon("scissors.png");
    ImageIcon manImage = new ImageIcon("einstein.jpg");
    ImageIcon computerImage = new ImageIcon("watson.jpg");

    JButton rock = new JButton(rockImage);
    JButton paper = new JButton(paperImage);
    JButton scissors = new JButton(scissorsImage);

    JLabel manLabel = new JLabel(manImage);
    JLabel computerLabel = new JLabel(computerImage);
```

```

JLabel middle1 = new JLabel("vs");

JLabel new_manMove = new JLabel("(man move)");
JLabel new_computerMove = new JLabel("(computer move)");

int playerMove = -1;
int computerMove = -1;
int[][] payoff = new int[3][3];
int result = 0;
int total = 0;
int n = 1;
int manCount = 0;
int computerCount = 0;
String historyString = "";
ArrayList resultsHistory;
ArrayList playerHistory;
ArrayList computerHistory;
JLabel round = new JLabel("Round: " + n);
JLabel manScore = new JLabel("Man: " + manCount);
JLabel computerScore = new JLabel("Computer: " + computerCount);
JButton history = new JButton("Show History");

public RockPaperScissors() {
    resultsHistory = new ArrayList<>();
    playerHistory = new ArrayList<>();
    computerHistory = new ArrayList<>();
    JPanel newPanel = new JPanel(new GridLayout(3, 3));
    newPanel.setCursor(new Cursor(Cursor.HAND_CURSOR));

    newPanel.add(manLabel);
    newPanel.add(middle1);
    newPanel.add(computerLabel);
    newPanel.add(rock);
    newPanel.add(paper);
    newPanel.add(scissors);

    RPSListener rpsListener = new RPSListener();
    rock.addActionListener(rpsListener);
    paper.addActionListener(rpsListener);
    scissors.addActionListener(rpsListener);

    initializePayoff(payoff);

    middle1.setHorizontalAlignment(JLabel.CENTER);
    new_manMove.setHorizontalAlignment(JLabel.CENTER);
    new_computerMove.setHorizontalAlignment(JLabel.CENTER);

    //This is the lower, middle, panel:
    JPanel middle2 = new JPanel(new GridLayout(4, 1));
    Font f = new Font("New Courier", Font.BOLD, 18);
    round.setFont(f);
    manScore.setFont(f);
    computerScore.setFont(f);
    history.setFont(f);
}

```

```

        middle2.add(round);
        middle2.add(manScore);
        middle2.add(computerScore);
        middle2.add(history);
        HistoryListener historyListener = new HistoryListener();
        history.addActionListener(historyListener);

        newPanel.add(new_manMove);
        newPanel.add(middle2);
        newPanel.add(new_computerMove);

        this.add(newPanel);
    }

    class HistoryListener implements ActionListener {

        public void actionPerformed(ActionEvent e) {
            JOptionPane.showMessageDialog(null, historyString,
"information", JOptionPane.INFORMATION_MESSAGE);
        }
    }

    class RPSListener implements ActionListener {

        public void actionPerformed(ActionEvent e) {
            new_manMove.setText("");
            new_computerMove.setText("");
            if (e.getSource() == rock) {
                playerMove = 0;
                new_manMove.setIcon(rockImage);
            }
            if (e.getSource() == paper) {
                playerMove = 1;
                new_manMove.setIcon(paperImage);
            }
            if (e.getSource() == scissors) {
                playerMove = 2;
                new_manMove.setIcon(scissorsImage);
            }
            //Get the computer's move:
            computerMove = getComputerMove2(playerHistory);
            if (computerMove == 0) {
                new_computerMove.setIcon(rockImage);
            }

            if (computerMove == 1) {
                new_computerMove.setIcon(paperImage);
            }

            if (computerMove == 2) {
                new_computerMove.setIcon(scissorsImage);
            }

            result = payoff[playerMove][computerMove];
        }
    }
}

```

```

        if (result == 1) {
            //Man wins:
            manCount++;
        }

        if (result == -1) {
            //Computer wins:
            computerCount++;
        }

        playerHistory.add(playerMove);
        computerHistory.add(computerMove);
        historyString = playerHistory.toString();
        historyString += "\n" + computerHistory.toString();
        resultsHistory.add(result);
        total += result;
        n++;
        round.setText("Round: " + n);
        manScore.setText("Man: " + manCount);
        computerScore.setText("Computer: " + computerCount);

    }

}

private static void initializePayoff(int[][][] payoff) {
    //player move: Rock
    payoff[0][0] = 0;    //computer move: Rock
    payoff[0][1] = -1;   //computer move: Paper
    payoff[0][2] = 1;    //computer move: Scissors

    //player move: Paper
    payoff[1][0] = 1;    //computer move: Rock
    payoff[1][1] = 0;    //computer move: Paper
    payoff[1][2] = -1;   //computer move: Scissors

    //Player move: Scissors
    payoff[2][0] = -1;   //computer move: Scissors
    payoff[2][1] = 1;    //computer move: Scissors
    payoff[2][2] = 0;    //computer move: Scissors
}

private static int getComputerMove1() {
    //The computer is making a random move:
    Random rand = new Random();
    return rand.nextInt(3);
}

private static int getComputerMove2(ArrayList<Integer>
playerHistory) {
    //The computer is trying to be intelligent.
    //It looks at the player history and calculates the most
frequent
        //player move, and then assumes the player will make that
move
}

```

```

//and plays against it.
Random rand = new Random();
int mostCommonMove;

int[] counter = new int[3];
for (int i = 0; i < playerHistory.size(); i++) {
    counter[playerHistory.get(i)]++;
}

if (counter[0] == counter[1] && counter[1] == counter[2]) {
    // if all counts are equal, random move:
    return rand.nextInt(3);
} else {
    mostCommonMove = getMaxIndex(counter);
}
switch (mostCommonMove) {
    case 0: //if most common move is Rock
        return 1; //play Paper
    case 1: //if most common move is Paper
        return 2; //play Scissors
    case 2: //if most common move is Scissors
        return 0; //play Rock
}
return 0;
}

private static int getMaxIndex(int[] counter) {
//This does not account for ties.
//if there is a tie, it returns the first one found.
int max = -1, max_index = -1;
for (int i = 0; i < counter.length; i++) {
    if (counter[i] > max) {
        max = counter[i];
        max_index = i;
    }
}
return max_index;
}

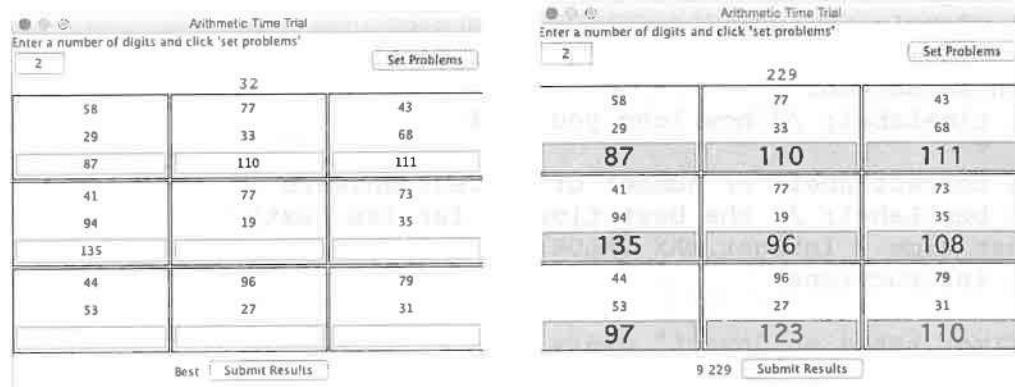
public static void main(String[] args) {
JFrame frame = new RockPaperScissors();
frame.setTitle("Play Rock-Paper-Scissors");
frame.setSize(500, 500);
frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
frame.setLocationRelativeTo(null);
frame.setVisible(true);
}
}

```

Java Project: ArithmeticGUI

Description: Solve arithmetic problems as fast as you can, with a GUI to help layout the problems in a graphical grid.

Sample Output:



```
//Melissa Wood
//CS 1351 D10
//Arithmetic GUI
package arithmeticgui;

import java.awt.BorderLayout;
import java.awt.Color;
import java.awt.FlowLayout;
import java.awt.Font;
import java.awt.GridLayout;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.BorderFactory;
import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JPanel;
import javax.swing.JTextField;
import javax.swing.SwingConstants;
import javax.swing.Timer;

public class ArithmeticGUI extends JFrame implements ActionListener
{
    int p = 3; // problems are p x q
    int q = 3;
```

```

int m = 3; // number of digits, default value

long start = System.currentTimeMillis();
JButton submit;

JLabel[][] add1 = new JLabel[p][q]; // the first number to add
JLabel[][] add2 = new JLabel[p][q]; // the second number to add
JTextField[][] result = new JTextField[p][q]; // your answer in
the text field
int[][] correct_ans = new int[p][q]; // correct answer
int[][] your_ans = new int[p][q]; // your answer

JLabel mLabel;
JTextField mTextField; // for the number of digits
JButton setButton;
JLabel timeLabel; // how long you took

JLabel correctLabel; // number of correct answers
JLabel bestLabel; // the best time so far (as text)
int best_time = Integer.MAX_VALUE; // best time so far (int)
JLabel instructions;

// this timer sends an "event" every 1000 milliseconds (1 second)
to TimerListener
Timer timer = new Timer(1000, new TimerListener());

public ArithmeticGUI() {
    // BorderLayout for the JFrame:
    this.setLayout(new BorderLayout());
    // add three panels:
    createTopPanel(); // the "settings" panel
    createMiddlePanel(); // the "problems" panel
    createBottomPanel(); // the "results" panel
}

public void createBottomPanel() {
    // for the "results" panel (Bottom Panel):
    JPanel resultsPanel = new JPanel(new FlowLayout());
    resultsPanel.setBackground(Color.white);
    correctLabel = new JLabel("Number Correct");
    bestLabel = new JLabel("Best");
    submit = new JButton("Submit Results");
    submit.addActionListener(this);
    resultsPanel.add(correctLabel);
    resultsPanel.add(bestLabel);
    resultsPanel.add(submit);
    this.add(resultsPanel, BorderLayout.SOUTH);
}

public void createTopPanel() {
    // for the "settings" panel (Top Panel):
    JPanel settingsPanel = new JPanel(new BorderLayout());
    settingsPanel.setBackground(Color.white);
}

```

```

mTextField = new JTextField();
mTextField.setHorizontalTextPosition(SwingConstants.CENTER);
mTextField.setColumns(4);

setButton = new JButton("Set Problems");
setButton.addActionListener(this);

timeLabel = new JLabel("", SwingConstants.CENTER);
Font f = new Font("Courier", Font.BOLD, 18);
timeLabel.setFont(f);
timeLabel.setForeground(Color.red);
timeLabel.setText("0");

String instructions = "Enter a number of digits and click 'set problems'";
JLabel instructionsLabel = new JLabel(instructions,
SwingConstants.LEFT);

settingsPanel.add(instructionsLabel, BorderLayout.NORTH);
settingsPanel.add(mTextField, BorderLayout.WEST);
settingsPanel.add(setButton, BorderLayout.EAST);
settingsPanel.add(timeLabel, BorderLayout.SOUTH);
this.add(settingsPanel, BorderLayout.NORTH);
}

public void createMiddlePanel() {
    // This is the Middle panel
    JPanel problemsPanel = new JPanel(new GridLayout(q, p, 2,
2));

    for (int i = 0; i < p; i++) {
        for (int j = 0; j < q; j++) {
            JPanel problem = new JPanel(new GridLayout(3, 1, 0,
0));
            problem.setBorder(BorderFactory.createLineBorder(Color.black));

            add1[i][j] = new JLabel("**",
SwingConstants.CENTER);
            problem.add(add1[i][j]);

            add2[i][j] = new JLabel("**",
SwingConstants.CENTER);
            problem.add(add2[i][j]);

            result[i][j] = new JTextField(3);

            result[i][j].setHorizontalAlignment(JTextField.CENTER);

            problem.add(result[i][j]);
            problemsPanel.add(problem);
        }
    }
    problemsPanel.setBackground(Color.yellow);
}

```

```

        this.add(problemsPanel, BorderLayout.CENTER);
    }

public static int getRandomInt(int a, int b) {
    return (int) ((b + 1 - a) * Math.random() + a);
}

@Override

public void actionPerformed(ActionEvent e) {
    if (e.getSource() == submit) {
        timer.stop();
        long stop = System.currentTimeMillis();
        timeLabel.setText("" + (stop - start) / 1000);
        int count = 0; // number right
        Color correctColor = new Color(200, 200, 255);
        Color wrongColor = new Color(255, 200, 200);
        for (int i = 0; i < p; i++) {
            for (int j = 0; j < q; j++) {
                your_ans[i][j] = getIntValue(result[i][j]);
                if (your_ans[i][j] == correct_ans[i][j]) {
                    result[i][j].setBackground(correctColor);
                    result[i][j].setFont(new Font("Geneva",
Font.BOLD, 24));
                    count++;
                } else {
                    result[i][j].setBackground(wrongColor);
                }
            }
        }
        correctLabel.setText("" + count);
        if ((Integer.parseInt(correctLabel.getText()) == p * q)
            && (Integer.parseInt(timeLabel.getText()) <
best_time)) {
            best_time = Integer.parseInt(timeLabel.getText());
            bestLabel.setText("" + best_time);
        }
    }
    if (e.getSource() == setButton) {
        resetProblems();
    }
}
public void resetProblems() {
    m = getIntValue(mTextField);

    correctLabel.setText("");
    timeLabel.setText("");

    int a = (int) Math.pow(10, m - 1);
    int b = (int) Math.pow(10, m) - 1;

    for (int i = 0; i < p; i++) {
        for (int j = 0; j < q; j++) {
            int x1 = getRandomInt(a, b);

```

```

        add1[i][j].setText(" " + x1);
        int x2 = getRandomInt(a, b);
        add2[i][j].setText(" " + x2);
        correct_ans[i][j] = x1 + x2;
        result[i][j].setText("");
        result[i][j].setBackground(Color.white); // added to
reset fields to white for new set of problems.
    }
}

start = System.currentTimeMillis();
timer.start();

}

public int getIntValue(JTextField in) {
    String s = in.getText();
    int out = 0;
    if (!s.equals("") && s.matches("\\d*")) {
        out = Integer.parseInt(s);
    } else {
        in.setText("0");
        out = 0; // default to 0 if input is not an integer
    }
    return out;
}

class TimerListener implements ActionListener {
    public void actionPerformed(ActionEvent e) {
        timeLabel.setText((System.currentTimeMillis() - start) /
1000 + "");
    }
}

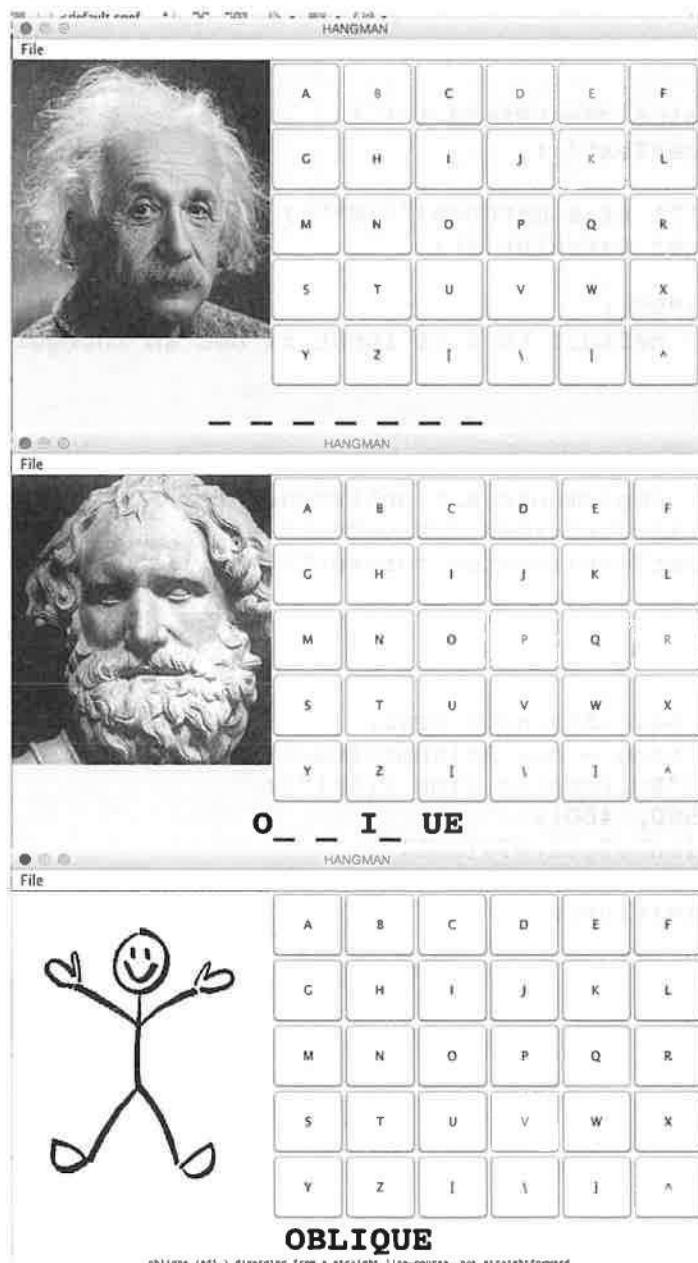
public static void main(String[] args) {
    ArithmeticGUI frame = new ArithmeticGUI();
    frame.setTitle("Arithmetic Time Trial");
    frame.setSize(500, 400);
    frame.setLocationRelativeTo(null);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setVisible(true);
}
}

```

Java Project: HangmanNew

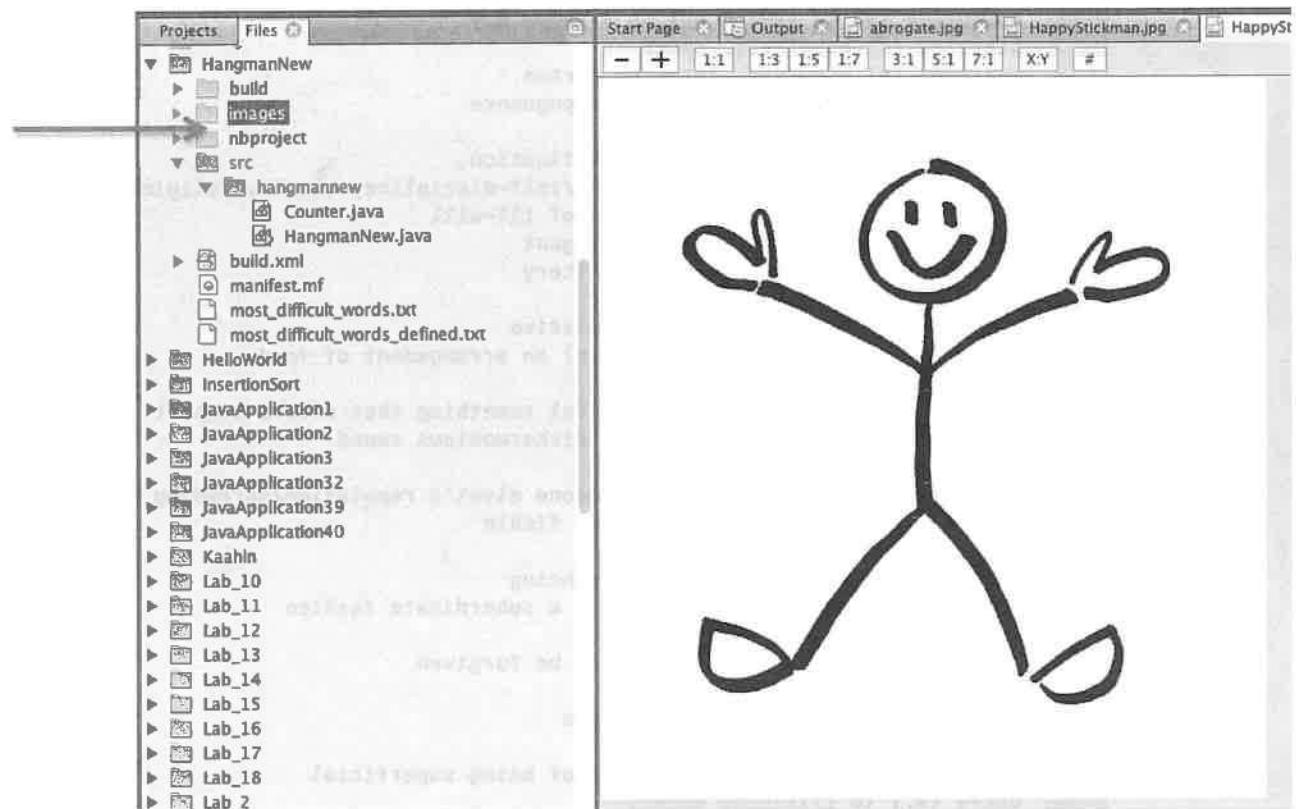
Description: Play hangman using a challenging set of words.

Sample Output:



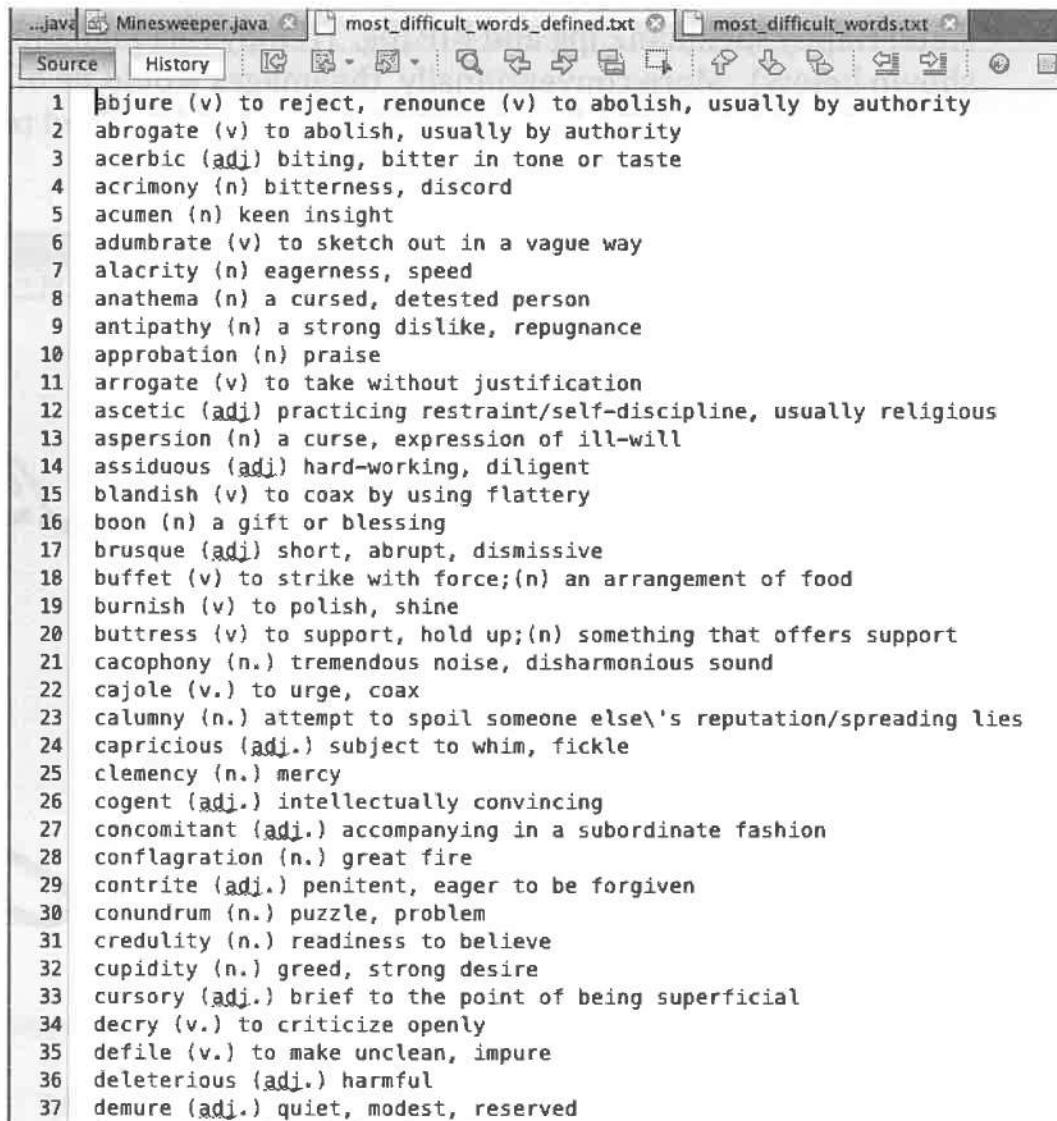
Need to include images in an images directory, named image0.jpg, image1.jpg,, image12.jpg. Also, images for the “win” and “lose”

state: HappyStickman2.jpg and RIP.jpg. (HappyStickman2.jpg is shown below). More conventionally, the images would be of successive stages of the hanging of stickman, but I decided to substitute pictures of famous scientists, geek that I am .



Notice also, the Counter.java class that is included with the HangmanNew.java main class.

Also, need the files: most_difficult_words_defined.txt, as shown in the next image:



The screenshot shows a Java code editor with several tabs at the top: "...java", "Minesweeper.java", "most_difficult_words_defined.txt", and "most_difficult_words.txt". The "most_difficult_words.txt" tab is active, displaying a list of words numbered 1 to 37. Each entry consists of a number followed by a word and its definition. The definitions are enclosed in parentheses, indicating their part of speech (e.g., v. for verb, adj. for adjective, n. for noun). The words include: 1. abjure (v) to reject, renounce (v) to abolish, usually by authority; 2. abrogate (v) to abolish, usually by authority; 3. acerbic (adj) biting, bitter in tone or taste; 4. acrimony (n) bitterness, discord; 5. acumen (n) keen insight; 6. adumbrate (v) to sketch out in a vague way; 7. alacrity (n) eagerness, speed; 8. anathema (n) a cursed, detested person; 9. antipathy (n) a strong dislike, repugnance; 10. approbation (n) praise; 11. arrogate (v) to take without justification; 12. ascetic (adj) practicing restraint/self-discipline, usually religious; 13. aspersion (n) a curse, expression of ill-will; 14. assiduous (adj) hard-working, diligent; 15. blandish (v) to coax by using flattery; 16. boon (n) a gift or blessing; 17. brusque (adj) short, abrupt, dismissive; 18. buffet (v) to strike with force;(n) an arrangement of food; 19. burnish (v) to polish, shine; 20. buttress (v) to support, hold up;(n) something that offers support; 21. cacophony (n.) tremendous noise, disharmonious sound; 22. cajole (v.) to urge, coax; 23. calumny (n.) attempt to spoil someone else's reputation/spreading lies; 24. capricious (adj.) subject to whim, fickle; 25. clemency (n.) mercy; 26. cogent (adj.) intellectually convincing; 27. concomitant (adj.) accompanying in a subordinate fashion; 28. conflagration (n.) great fire; 29. contrite (adj.) penitent, eager to be forgiven; 30. conundrum (n.) puzzle, problem; 31. credulity (n.) readiness to believe; 32. cupidity (n.) greed, strong desire; 33. cursory (adj.) brief to the point of being superficial; 34. decry (v.) to criticize openly; 35. defile (v.) to make unclean, impure; 36. deleterious (adj.) harmful; 37. demure (adj.) quiet, modest, reserved.

The program will read the first word of each line of the file and use them as the possible words for the Hangman game. At the end of the game, the program will display the rest of the line (i.e.: the definition of the word) that the hidden word was chosen from. This shows up at the bottom of the panel.

You can make up a list of words, keeping in mind that the program will read the first word in each line of your file as a candidate hidden word, and will display the rest of the line at the end of the game.

```

package hangmannew;

import java.awt.BorderLayout;
import java.awt.Color;
import java.awt.Dimension;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.GridLayout;
import java.awt.Image;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.io.FileNotFoundException;
import java.util.ArrayList;
import java.util.Scanner;
import java.util.logging.Level;
import java.util.logging.Logger;
import javax.swing.ImageIcon;
import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JMenu;
import javax.swing.JMenuBar;
import javax.swing.JMenuItem;
import javax.swing.JOptionPane;
import javax.swing.JPanel;

public class HangmanNew extends JFrame {

    private static String used_string = "";
    private static String state_string = "";
    private static String state_display = "";
    private static String choice = " ";
    private static JLabel used;
    private static JLabel state;
    private static boolean win = false;
    private static int random_index;
    private static final int max_guesses = 13;
    private static Counter counter1 = new Counter("counter1", 1000);
    private static String hidden_word = " ";
    private static String hidden_definition;
    private static final int n = 30; // number of letters
    private static JButton[] letters = new JButton[n];
    private static String[] fileItems = new String[]{"New", "Quit"};
    private static char[] fileShortcuts = {'N', 'Q'};

    public HangmanNew() throws FileNotFoundException {
        //set the secret word, randomly chosen from a file
        setWord();

        //set up this JFrame's menu bar and options:
        JMenuBar myMenuBar = new JMenuBar();
        JMenu fileMenu = new JMenu("File");
        for (int i = 0; i < fileItems.length; i++) {

```

```

        JMenuItem item = new JMenuItem(fileItems[i],
fileShortcuts[i]);
        item.addActionListener(new menuListener());
        fileMenu.add(item);
    }
myMenuBar.add(fileMenu);
this.setJMenuBar(myMenuBar);

//Three JPanels added to the JFrame
Drawing drawing = new Drawing(); //hangman gallows drawing
LetterButtons buttons = new LetterButtons(); //letters to
choose from
LetterLabels labels = new LetterLabels(); //ongoing results

add(drawing, BorderLayout.CENTER);
add(buttons, BorderLayout.EAST);
add(labels, BorderLayout.SOUTH);

}

public static void setWord() throws FileNotFoundException {
    //The text file "most_difficult_words_defined.txt" must be
in the project directory
    //In this case it contains the 250 most commonly missed SAT
words.
    java.io.File words_file = new
java.io.File("most_difficult_words_defined.txt");
    Scanner input = new Scanner(words_file);
    ArrayList<String> defined_list = new ArrayList<String>();
    while (input.hasNextLine()) {
        String line = input.nextLine();
        defined_list.add(line);
    }
    random_index = (int) (defined_list.size() * Math.random());
    hidden_definition = defined_list.get(random_index);
    String parts[] = hidden_definition.split(" ");
    hidden_word = parts[0];
}

public static void restart() throws FileNotFoundException {
    win = false;
    setWord();
    used_string = "";
    state_string = "";
    state_display = "";
    for (int i = 0; i < hidden_word.length(); i++) {
        state_string += " ";
        state_display += "_ ";
    }
    state.setText(state_display);
    used.setText(" ");
    counter1.setValue(0);
    choice = " ";
    for (int i = 0; i < n; i++) {
}
}

```

```

        letters[i].setBackground(Color.white);
        letters[i].setForeground(Color.black);
    }
}

class LetterButtons extends JPanel {

    public LetterButtons() {

        setLayout(new GridLayout(5, 6, 0, 0));
        for (int i = 0; i < n; i++) {
            letters[i] = new JButton(" " + (char) (i + 65));
            add(letters[i]);
            letters[i].addActionListener(new buttonListener());
        }
    }
}

class LetterLabels extends JPanel {

    LetterLabels() {

        for (int i = 0; i < hidden_word.length(); i++) {
            state_string += " ";
            state_display += "_";
        }
        state = new JLabel(state_display.toUpperCase());
        Font font1 = new Font("Courier", Font.BOLD, 36);
        state.setForeground(Color.black);
        state.setFont(font1);
        state.setHorizontalAlignment(JLabel.CENTER);

        used = new JLabel(state_string);
        used.setForeground(Color.black);
        Font font2 = new Font("Courier", Font.BOLD, 26);
        used.setFont(font2);
        used.setHorizontalAlignment(JLabel.CENTER);

        this.setLayout(new BorderLayout());
        add(state, BorderLayout.NORTH);
        add(used, BorderLayout.SOUTH);
    }
}

class Drawing extends JPanel {

    protected void paintComponent(Graphics g) {

        super.paintComponent(g);
        Image image = new ImageIcon("images/image" +
counter1.value() + ".jpg").getImage();
        g.drawImage(image, 0, 0, image.getHeight(null),
image.getHeight(null), this);
    }
}

```

```

        if (counter1.value() >= 13 && !win) {
            Image imageRIP = new
ImageIcon("images/RIP.jpg").getImage();
            int width = getWidth();
            int height = getHeight();
            g.drawImage(imageRIP, 0, 0, width, height, this);
        }

        Image imageWin = new
ImageIcon("images/HappyStickman2.jpg").getImage();
        if (win) {
            g.drawImage(imageWin, 0, 0, getWidth(), getHeight(),
this);
        }
    }
}

class menuListener implements ActionListener {

    @Override
    public void actionPerformed(ActionEvent e) {
        System.out.println(" action command = " +
e.getActionCommand());
        if (e.getActionCommand().equals("Quit")) {
            System.exit(0);
        }
        if (e.getActionCommand().equals("New")) {
            try {
                restart();
            } catch (FileNotFoundException ex) {

Logger.getLogger(HangmanNew.class.getName()).log(Level.SEVERE, null,
ex);
            }
        }
    }
}

class buttonListener implements ActionListener {

    @Override
    public void actionPerformed(ActionEvent e) {
        choice = e.getActionCommand();
        for (int i = 0; i < n; i++) {
            if
(letters[i].getActionCommand().equals(e.getActionCommand())) {
                letters[i].setForeground(Color.RED);
            }
        }

        if (used_string.indexOf(choice) < 0) {
            used_string += choice;
        } else {

```

```

        JOptionPane.showMessageDialog(null, "Letter " +
choice + " is already used");
    }

    choice = choice.toLowerCase();
    char[] char_choice = choice.toCharArray();
    char[] char_hidden = hidden_word.toCharArray();
    char[] char_state = state_string.toCharArray();
    boolean hit = false;
    for (int i = 0; i < char_hidden.length; i++) {
        if (char_hidden[i] == char_choice[0]) {
            char_state[i] = char_hidden[i];
            hit = true;
        }
    }
    if (!hit) {
        counter1.increment();
    }
    state_string = "";
    state_display = "";
    for (int i = 0; i < char_state.length; i++) {
        state_string += char_state[i];
        if (char_state[i] == ' ') {
            state_display += "_";
        } else {
            state_display += char_state[i] + "";
        }
    }
}

state.setText(state_display.toUpperCase());
if (counter1.value() >= max_guesses) {
    used.setForeground(Color.white);
    used.setOpaque(true);
    used.setBackground(Color.gray);
    Font font3 = new Font("Courier", Font.BOLD, 18);
    used.setFont(font3);
    used.setText(" Sorry, You Lose! (But, keep
playing!)");
}
int hit_count = 0;
for (int i = 0; i < char_hidden.length; i++) {
    if (char_hidden[i] == char_state[i]) {
        hit_count++;
    }
}

if (hit_count == hidden_word.length()) {
    win = true;
    used.setForeground(Color.black);
    used.setOpaque(true);
    used.setBackground(Color.white);
    Font font3 = new Font("Courier", Font.BOLD, 18);
    used.setFont(font3);
    used.setText(" " + hidden_definition + " ");
}

```

```

        }
        repaint();
    }
}

public static void main(String[] args) throws
FileNotFoundException {
    HangmanNew hangman = new HangmanNew();
    hangman.setTitle("HANGMAN");
    hangman.setSize(new Dimension(700, 400));
    hangman.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    hangman.setLocationRelativeTo(null);
    hangman.setVisible(true);
}

}

///////////////
package hangmannew;

public class Counter implements Comparable<Counter> {

    private final String name;      // counter name
    private final int maxCount;    // maximum value
    private int count;             // current value

    // create a new counter with the given parameters
    public Counter(String id, int max) {
        name = id;
        maxCount = max;
        count = 0;
    }

    // increment the counter by 1
    public void increment() {
        if (count < maxCount) count++;
        assert count >= 1;
    }

    // return the current count
    public int value() {
        return count;
    }

    // return a string representation of this counter
    public String toString() {
        return name + ":" + count;
    }

    // compare two Counter objects based on their count
    public int compareTo(Counter that) {
        if      (this.count < that.count) return -1;
        else if (this.count > that.count) return +1;
        else                           return 0;
    }
}

```

```
}

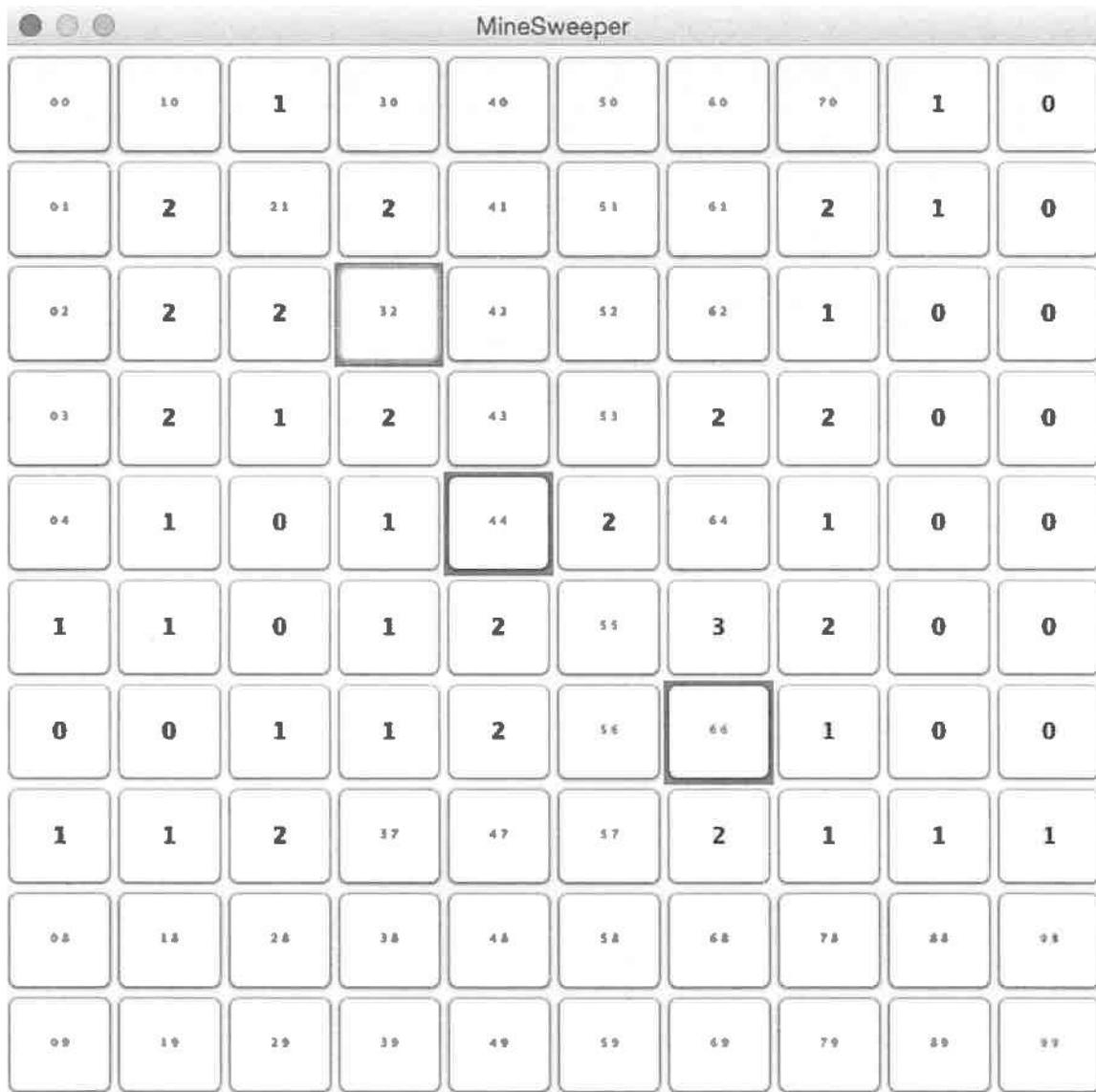
public void setValue(int n){
    count = n;
}

}
```

Java Project: Minesweeper

Description: Play Minesweeper. Left-click to open a cell. Right-click to mark the cell a bomb. Find all the bombs and win.

Sample Output:



```

package minesweeper;

import java.awt.Color;
import java.awt.Dimension;
import java.awt.Font;
import java.awt.GridLayout;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.MouseAdapter;
import java.awt.event.MouseEvent;
import java.util.Scanner;
import javax.swing.JButton;
import javax.swing.JOptionPane;
import javax.swing.JFrame;
import javax.swing.JPanel;

public class Minesweeper extends JFrame {
    final int N = 10; //NxN grid of cells 100
    int[][] grid = new int[N][N];
    int[][] cover = new int[N][N];
    JButton[][] buttons = new JButton[N][N];
    int colClick;
    int rowClick;
    boolean game_over = false;
    Font f2 = new Font("New Courier", Font.BOLD, 12);
    int bombs_marked = 0;
    int bombs_actual;

    public Minesweeper() {
        initializeButtons();
        initializeBombs();
        initializeNbhds();
    }

    public void initializeButtons() {
        JPanel panel = new JPanel(new GridLayout(N, N));
        Font f1 = new Font("New Courier", Font.PLAIN, 6);
        for (int j = 0; j < N; j++) {
            for (int i = 0; i < N; i++) {
                buttons[i][j] = new JButton();
                buttons[i][j].setFont(f1);
                buttons[i][j].setText(i + " " + j);
                buttons[i][j].setVisible(true);
                buttons[i][j].addActionListener(new buttonListener());
                buttons[i][j].addMouseListener(new myMouseListener(i, j));
                buttons[i][j].setOpaque(true);
                panel.add(buttons[i][j]);
            }
        }
        add(panel);
    }

    public void initializeNbhds() {
        for (int j = 0; j < N; j++) {

```

```

        for (int i = 0; i < N; i++) {
            if (grid[i][j] != -1) {
                grid[i][j] = getSum(i, j);
            }
        }
    }

    public int getSum(int i, int j) {
        int sum = 0;
        for (int q = j - 1; q <= j + 1; q++) {
            for (int p = i - 1; p <= i + 1; p++) {
                if (p >= 0 && p < N && q >= 0 && q < N) {
                    if (grid[p][q] == -1) {
                        sum++;
                    }
                }
            }
        }
        return sum;
    }

    public void initializeBombs() {
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++) {
                int number = (int) (0.5 * N * Math.random());
                System.out.println("number = " + number);
                if (number == 0) {
                    grid[i][j] = -1;
                    bombs_actual++;
                } else{
                    grid[i][j] = 0;
                }
                cover[i][j] = 0;
            }
        }
    }

    class buttonListener implements ActionListener {

        @Override
        public void actionPerformed(ActionEvent e) {

            Scanner scanner = new Scanner(e.getActionCommand());
            if (scanner.hasNextInt());{
                colClick = scanner.nextInt();
            }
            if (scanner.hasNextInt()) {
                rowClick = scanner.nextInt();
            }
            if (grid[colClick][rowClick] == -1) {
                game_over = true;
                JOptionPane.showMessageDialog(null, "KaBoom -- game
over");
            } else {
                cover[colClick][rowClick] = 1;
            }
        }
    }
}

```

```

        buttons[colClick][rowClick].setFont(f2);
        buttons[colClick][rowClick].setBackground(Color.white);
        buttons[colClick][rowClick].setText("") +
grid[colClick][rowClick]);
        if (grid[colClick][rowClick] == 0) {
            uncoverNbhd(colClick, rowClick);
        }
    }
}

public void uncoverNbhd(int i, int j) {
    for (int q = j - 1; q <= j + 1; q++) {
        for (int p = i - 1; p <= i + 1; p++) {
            if (p >= 0 && p < N && q >= 0 && q < N) {
                if (cover[p][q] == 0) {
                    if (grid[p][q] != -1) {
                        cover[p][q] = 1;
                        buttons[p][q].setFont(f2);

buttons[p][q].setBackground(Color.white);
                        buttons[p][q].setText("") + grid[p][q]);
                    }
                    if (grid[p][q] == 0) {
                        uncoverNbhd(p, q);
                    }
                }
            }
        }
    }
}

class myMouseListener extends MouseAdapter {

    private int i, j;

    public myMouseListener(int i, int j) {
        this.i = i;
        this.j = j;
    }

    @Override
    public void mouseClicked(MouseEvent e) {
        if(e.getButton() == e.BUTTON3) {
            Color this_color = new Color(238, 238, 238);
            if (buttons[i][j].getBackground().equals(this_color)) {
                buttons[i][j].setBackground(Color.red);
            } else {
                buttons[i][j].setBackground(this_color);
            }
            bombs_marked = 0;
            for (int ii = 0; ii < N; ii++) {
                for (int jj = 0; jj < N; jj++)
if
(buttons[ii][jj].getBackground().equals(Color.red)) {

```

```

        if (grid[ii][jj] == -1) {
            bombs_marked++;
        } else {
            bombs_marked--;
        }
    }
}

System.out.println("bombs_marked = " + bombs_marked);
System.out.println("bombs_actual = " + bombs_actual);
if (bombs_marked == bombs_actual) {
    JOptionPane.showMessageDialog(null, "You Win!!");
}
}

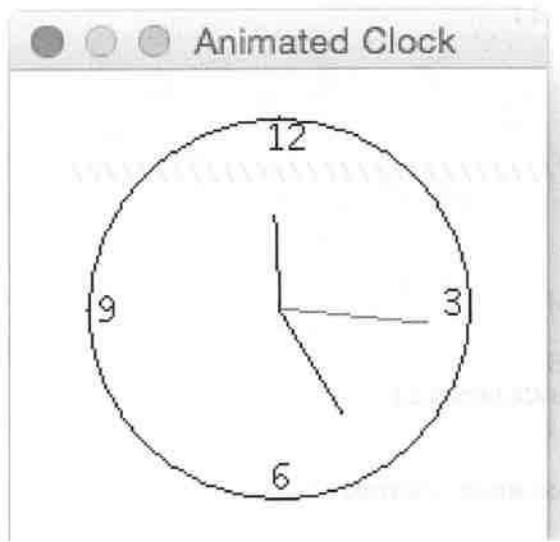
public static void main(String[] args) {
    Minesweeper minesweeper = new Minesweeper();
    minesweeper.setSize(new Dimension(600, 600));
    minesweeper.setTitle("MineSweeper");
    minesweeper.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    minesweeper.setLocationRelativeTo(null);
    minesweeper.setVisible(true);
}
}

```

Java Project: ClockAnimation

Description: Shows a simulated clock, with hour, minute and second hand, with accurate time. It uses a StillClock.java class in addition to the main class ClockAnimation.java

Sample Output:



There are two java files: ClockAnimation.java and StillClock.java. The program could use some embellishments, such as a better drawing of the clock and better/more numbers etc.

```
package clockanimation;

import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.JFrame;
import javax.swing.Timer;

public class ClockAnimation extends JFrame {

    private StillClock clock = new StillClock();

    public ClockAnimation() {
        this.add(clock);
        Timer timer = new Timer(1000, new TimerListener());
        timer.start();
    }
}
```

```

public static void main(String[] args) {
    JFrame frame = new ClockAnimation();
    frame.setTitle("Animated Clock");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    //frame.setLocationRelativeTo(null);
    frame.setSize(200, 200);
    frame.setVisible(true);
}

public class TimerListener implements ActionListener {

    public void actionPerformed(ActionEvent e) {
        clock.setCurrentTime();
        clock.repaint();
    }
}
}

//////////////////////////////////////////////////////////////////
package clockanimation;

import java.awt.Color;
import java.awt.Dimension;
import java.awt.Graphics;
import java.util.Calendar;
import java.util.GregorianCalendar;
import javax.swing.JPanel;

public class StillClock extends JPanel {

    private int hour;
    private int minute;
    private int second;

    public StillClock() {
        setCurrentTime();
    }

    public StillClock(int hour, int minute, int second) {
        this.hour = hour;
        this.minute = minute;
        this.second = second;
    }

    public int getHour() {
        return hour;
    }

    public int getMinute() {
        return minute;
    }

    public int getSecond() {
        return second;
    }
}

```

```

}

public void setHour(int hour) {
    this.hour = hour;
}

public void setMinute(int minute) {
    this.minute = minute;
}

public void setSecond(int second) {
    this.second = second;
}

protected void paintComponent(Graphics g) {
    super.paintComponent(g);

    int clockRadius = (int) (Math.min(getWidth(), getHeight()) *
0.8 * 0.5);
    int xCenter = getWidth() / 2;
    int yCenter = getHeight() / 2;

    g.setColor(Color.black);
    g.drawOval(xCenter - clockRadius, yCenter - clockRadius,
               2 * clockRadius, 2 * clockRadius);
    g.drawString("12", xCenter - 5, yCenter - clockRadius + 12);
    g.drawString("9", xCenter - clockRadius + 3, yCenter + 5);
    g.drawString("3", xCenter + clockRadius - 10, yCenter + 3);
    g.drawString("6", xCenter - 3, yCenter + clockRadius - 3);

    //Draw second hand:
    //Note: it may appear that the sin and cos should be
reversed,
    //but careful analysis shows we are dealing with cos(pi/2 -
theta)
    //which is equal to sin(theta), so the sin and cos get
exchanged.
    int sLength = (int) (clockRadius * 0.8);
    int xSecond = (int) (xCenter + sLength * Math.sin(second * 2
* Math.PI / 60));
    int ySecond = (int) (yCenter - sLength * Math.cos(second * 2
* Math.PI / 60));
    g.setColor(Color.red);
    g.drawLine(xCenter, yCenter, xSecond, ySecond);

    //Draw minute hand:
    int mLength = (int) (clockRadius * 0.65);
    int xMinute = (int) (xCenter + mLength * Math.sin(minute * 2
* Math.PI / 60));
    int yMinute = (int) (yCenter - mLength * Math.cos(minute * 2
* Math.PI / 60));
    g.setColor(Color.black);
    g.drawLine(xCenter, yCenter, xMinute, yMinute);
}

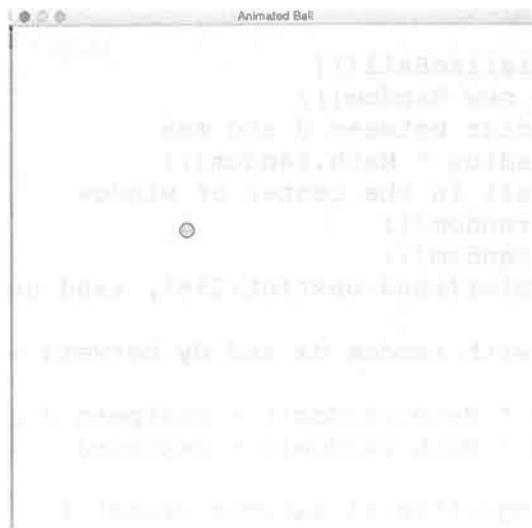
```

```
//Draw hour hand:  
int hLength = (int) (clockRadius * 0.5);  
int xHour = (int) (xCenter + hLength * Math.sin(hour * 2 *  
Math.PI / 12));  
int yHour = (int) (yCenter - hLength * Math.cos(hour * 2 *  
Math.PI / 12));  
g.setColor(Color.black);  
g.drawLine(xCenter, yCenter, xHour, yHour);  
}  
  
public void setCurrentTime() {  
    Calendar calendar = new GregorianCalendar();  
    this.hour = calendar.get(Calendar.HOUR_OF_DAY);  
    this.minute = calendar.get(Calendar.MINUTE);  
    this.second = calendar.get(Calendar.SECOND);  
}  
  
public Dimension getPreferredSize() {  
    return new Dimension(400, 400);  
}  
}
```

Java Project: SimpleAnimation

Description: This program shows a single ball (randomly generated : size, direction and color) bouncing in the drawing panel.

Sample Output:



```
/*
 * To change this license header, choose License Headers in Project
Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */
package simpleanimation;

import java.awt.Color;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.util.Random;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.Timer;
/**
 *
 * @author Adrian
 */
public class SimpleAnimation extends JFrame {

    public static final int W = 600;
    public static final int H = 600;
    public static double radius;
```

```

public static double maxRadius = W / 2;
public static double dx;
public static double dy;
public static double x;
public static double y;
public static Color color;
public static double maxSpeed = 20;

public SimpleAnimation() {
    MovingBallPanel panel = new MovingBallPanel();
    this.add(panel);
    initializeBall();
}
private void initializeBall(){
    Random rand = new Random();
    //create a radius between 0 and max
    radius = maxRadius * Math.random();
    //start the ball in the center of window
    x = W * Math.random();
    y = H * Math.random();
    color = new Color(rand.nextInt(256), rand.nextInt(256),
rand.nextInt(256));
    //start ball with random dx and dy between +maxspeed/2 and -
maxspeed/2
    dx = maxSpeed * Math.random() - maxSpeed / 2;
    dy = maxSpeed * Math.random() - maxSpeed / 2;
}
static class MovingBallPanel extends JPanel {
    //sends an event every 30 milliseconds
    //timer listener reacts to each
    //of these events by calling the method repaint();
    private Timer timer = new Timer(30, new TimerListener());

    public MovingBallPanel(){
        timer.start();
    }

    //must be called in order to draw to any JPanel
    //Graphics object g is from the OS
    protected void paintComponent(Graphics g){
        super.paintComponent(g);

        checkBoundary();
        updateXYPosition();
        drawBall(g);
    }
    private void checkBoundary() {
        if(x + radius > getWidth()){
            dx = -Math.abs(dx);
        }
        if (x - radius < 0){
            dx = Math.abs(dx);
        }
        if( y + radius > getHeight()){


```

```

        dy = -Math.abs(dy);
    }
    if(y - radius < 0){
        dy = Math.abs(dy);
    }
}
private void updateXYPosition(){
    x =x + dx;
    y = y + dy;
}
private void drawBall(Graphics g){
    g.setColor(color);
    g.fillOval((int) (x - radius),(int) (y - radius) ,
(int) (2 * radius),(int) (2 * radius));
    g.setColor(Color.black);
    g.drawOval((int) (x - radius),(int) (y - radius) ,
(int) (2 * radius),(int) (2 * radius));
}
class TimerListener implements ActionListener{
    //this metho, action performed is called at each
event
    public void actionPerformed(ActionEvent e){
        repaint();
    }
}
}

public static void main(String[] args) {
SimpleAnimation frame = new SimpleAnimation();
frame.setTitle("Animated Ball");
frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
frame.setSize(W,H);
frame.setVisible(true);

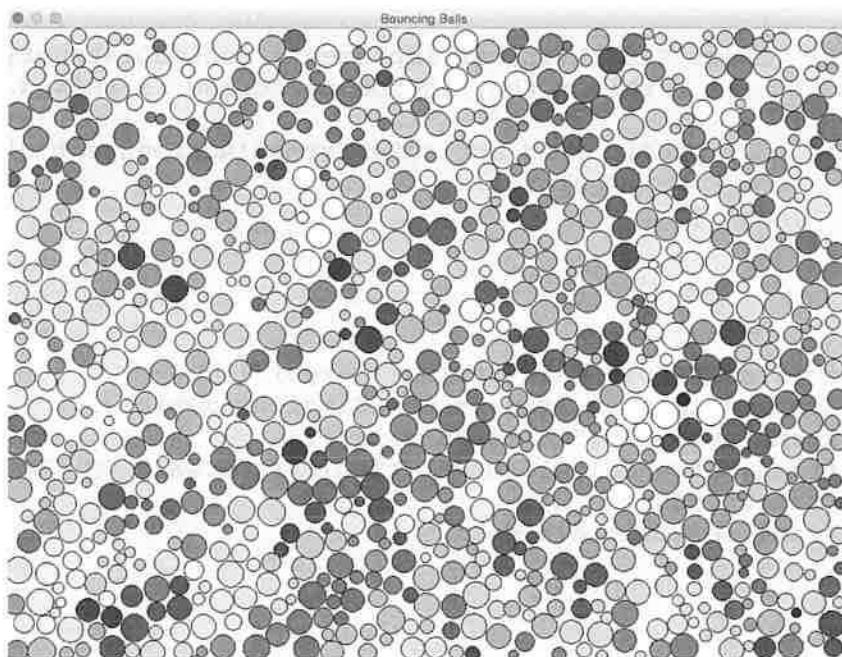
}
}

```

Java Project: AnimatedBalls

Description: This program shows many balls bouncing in the drawing panel. You can change the number of balls, their size, speed and color. You can also change what happens when they collide. The default code just has them bounce off each other and change color in a certain way (look at the code to see how/when a ball's color changes), but you can invent other things happens such as explosions etc.

Sample Output:



```

package animatedballs;

import java.awt.Color;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.MouseAdapter;
import java.awt.event.MouseEvent;
import java.util.Random;
import java.util.Vector;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.Timer;
import javax.swing.WindowConstants;

public class AnimatedBalls extends JFrame {

    public static int W = 900;
    public static int H = 700;
    public static int n = 1000;
    public static int m = 6;
    public static double[] radius = new double[n];
    public static double minRadius = 5;
    public static double maxRadius = 15;
    public static double[] dx = new double[n];
    public static double[] dy = new double[n];
    public static double[] x = new double[n];
    public static double[] y = new double[n];
    public static Color[] color = new Color[n];
    public static double speed = 1;
    public static int[] active = new int[n];
    public static int[] score = new int[n];
    public static int[][] gene = new int[n][m];

    public AnimatedBalls() {
        MovingBallPanel panel = new MovingBallPanel();
        this.add(panel);
        initializeBalls();
        printBalls();

    }

    public static void printBalls() {
        for (int i = 0; i < n; i++) {
            System.out.print(i);
            System.out.print(" ");
            for (int g = 0; g < m; g++) {
                System.out.print(gene[i][g]);
            }
            System.out.println("");
        }
    }

    private void initializeBalls() {
        Random rand = new Random();

```

```

        int r = 0;
        int g = 0;
        int b = 0;
        for (int i = 0; i < n; i++) {
            radius[i] = minRadius + (maxRadius - minRadius) *
Math.random();

            x[i] = radius[i] + (W - 2 * radius[i]) *
rand.nextDouble();
            y[i] = radius[i] + (H - 2 * radius[i]) *
rand.nextDouble();

            //x[i] = W/2;
            //y[i] = H/2;
            //color[i] = new Color(rand.nextInt(256),
rand.nextInt(256), rand.nextInt(256));
            active[i] = 1;
            for (int k = 0; k < m; k++) {
                gene[i][k] = (int) (2 * Math.random());
            }
            r = setColor(i, gene[i][0], gene[i][1]);
            g = setColor(i, gene[i][2], gene[i][3]);
            b = setColor(i, gene[i][4], gene[i][5]);
            color[i] = new Color(r, g, b);
            score[i] = setScore(i);

            dx[i] = score[i] * Math.random() - score[i] / 2;
            dy[i] = score[i] * Math.random() - score[i] / 2;

        }
        //color[n-1] = Color.GRAY;
    }

    public static int setScore(int i) {
        int sum = 0;
        for (int k = 0; k < m; k++) {
            sum += gene[i][k];
        }
        return sum;
    }

    public static int setColor(int i, int v1, int v2) {
        if (v1 == 0 && v2 == 0) {
            return (int) (64 * Math.random());
            //return 0;
        } else if (v1 == 0 && v2 == 1) {
            return 64 + (int) (64 * Math.random());
        } else if (v1 == 1 && v2 == 0) {
            return 128 + (int) (64 * Math.random());
        } else if (v1 == 1 && v2 == 1) {
            return 192 + (int) (64 * Math.random());
            //return 255;
        }
        return 0;
    }
}

```

```

}

static class MovingBallPanel extends JPanel {

    private Timer timer = new Timer(30, new TimerListener());
    public boolean timer_stop = false;

    public MovingBallPanel() {
        timer.start();
        this.addMouseListener(new MouseAdapter() {
            public void mouseClicked(MouseEvent e) {
                int delay = timer.getDelay();
                if (e.getButton() == MouseEvent.BUTTON1) {
                    if (timer_stop) {
                        timer.start();
                        timer_stop = false;
                    } else {
                        timer.stop();
                        timer_stop = true;
                    }
                }

                //timer.setDelay(delay > 5 ? delay - 5 : 5);
            } else if (e.getButton() == MouseEvent.BUTTON3)
            {
                timer.setDelay(delay < 5000 ? delay + 5 :
5000);
            }
        });
    }

    protected void paintComponent(Graphics g) {
        super.paintComponent(g);
        checkBoundary();
        checkCollisions();
        updateXYPositions();
        //pumpVelocities();
        drawBalls(g);
        //printBalls();
    }

    private void checkBoundary() {
        for (int i = 0; i < n; i++) {
            if (x[i] + radius[i] > getWidth()) {
                dx[i] = -Math.abs(dx[i]);
            }

            if (x[i] - radius[i] < 0) {
                dx[i] = Math.abs(dx[i]);
            }

            if (y[i] + radius[i] > getHeight()) {
                dy[i] = -Math.abs(dy[i]);
            }
        }
    }
}

```

```

        }

        if (y[i] - radius[i] < 0) {
            dy[i] = Math.abs(dy[i]);
        }
    }
}

private void updateXYPositions() {
    for (int i = 0; i < n; i++) {
        x[i] = x[i] + dx[i];
        y[i] = y[i] + dy[i];
    }
}

private void drawBalls(Graphics g) {
    for (int i = 0; i < n; i++) {
        if (active[i] == 1) {

            g.setColor(color[i]);
            g.fillOval((int) (x[i] - radius[i]), (int) (y[i]
- radius[i]), (int) (2 * radius[i]), (int) (2 * radius[i]));
            g.setColor(Color.black);
            g.drawOval((int) (x[i] - radius[i]), (int) (y[i]
- radius[i]), (int) (2 * radius[i]), (int) (2 * radius[i]));
            //g.drawString("'" + i, (int) (x[i]), (int)
(y[i]));
        }
    }
}

private void checkCollisions() {
    for (int i = 0; i < n; i++) {
        for (int j = i + 1; j < n; j++) {
            double dist = Math.sqrt(Math.pow(x[j] - x[i], 2)
+ Math.pow(y[j] - y[i], 2));

            if (active[i] == 1 && active[j] == 1) {
                if (dist > 0 && dist <= (radius[i] +
radius[j])) {
                    if (score[i] > score[j]) {
                        /*for (int k = 0; k < m; k++) {
                            gene[j][k] = gene[i][k];
                        }*/
                        int r = setColor(j, gene[j][0],
gene[j][1]);
                        int g = setColor(j, gene[j][2],
gene[j][3]);
                        int b = setColor(j, gene[j][4],
gene[j][5]);
                        color[j] = new Color(r, g, b);
                        score[j] = setScore(j);
                    */
                    color[j] = color[i];
                }
            }
        }
    }
}

```

```

        }
        /*
        else {
            for (int k = 0; k < m; k++) {
                gene[i][k] = gene[j][k];
            }
            int r = setColor(i, gene[i][0],
gene[i][1]);
            int g = setColor(i, gene[i][2],
gene[i][3]);
            int b = setColor(i, gene[i][4],
gene[i][5]);
            color[i] = new Color(r, g, b);
            score[i] = setScore(i);
            //color[i] = color[j];
        }
        */
        elasticCollision(i, j);
    }

}
}

}

}

public void pumpVelocities() {
    double epsilon = 0.5;
    for (int i = 0; i < n; i++) {
        if (Math.abs(dx[i]) < epsilon) {
            dx[i] *= 1.0;
        }
        if (Math.abs(dy[i]) < epsilon) {
            dy[i] *= 1.0;
        }
    }
}

private void checkCollissions2() {

}

public void elasticCollision(int i, int j) {
    // get the mtd

    double delta_x = x[i] - x[j];
    double delta_y = y[i] - y[j];
    double d = Math.sqrt((delta_x * delta_x + delta_y *
delta_y));
    double mtd_x = ((radius[i] + radius[j] - d) / d) *
delta_x;

```

```

        double mtd_y = ((radius[i] + radius[j] - d) / d) *
delta_y;
        double mtd_length = Math.sqrt(mtd_x * mtd_x + mtd_y * 
mtd_y);
        double mtd_norm_x = mtd_x / mtd_length;
        double mtd_norm_y = mtd_y / mtd_length;

        double im1 = 1.0 / radius[i];
        double im2 = 1.0 / radius[j];

        x[i] += (im1 / (im1 + im2)) * mtd_x;
        y[i] += (im1 / (im1 + im2)) * mtd_y;

        x[j] += -(im2 / (im1 + im2)) * mtd_x;
        y[j] += -(im2 / (im1 + im2)) * mtd_y;
        ///////////////////////////////////////////////////
        double v_x = dx[i] - dx[j];
        double v_y = dy[i] - dy[j];

        double vn = v_x * mtd_norm_x + v_y * mtd_norm_y;

        if (vn > 0.0) {
            return;
        }
        double elastic_constant = 1.0;

        double impulse_x = mtd_norm_x * (-(1 + elastic_constant)
* vn) / (im1 + im2);
        double impulse_y = mtd_norm_y * (-(1 + elastic_constant)
* vn) / (im1 + im2);

        dx[i] += im1 * impulse_x;
        dy[i] += im1 * impulse_y;

        dx[j] += -im2 * impulse_x;
        dy[j] += -im2 * impulse_y;

    }

    class TimerListener implements ActionListener {

        public void actionPerformed(ActionEvent e) {
            repaint();
        }
    }
}

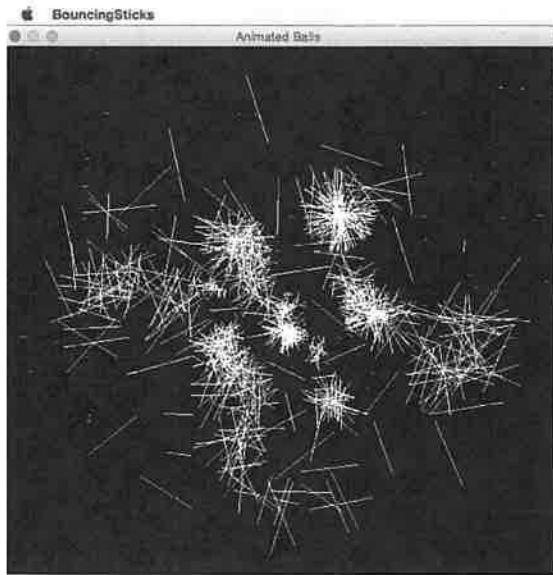
public static void main(String[] args) {
    AnimatedBalls frame = new AnimatedBalls();
    frame.setTitle("Bouncing Balls");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(W, H);
    frame.setVisible(true);
}

```

Java Project: BouncingSticks

Description: Displays randomly generating rotating sticks.

Sample Output:



```
package bouncingsticks;

import java.awt.Color;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.MouseAdapter;
import java.awt.event.MouseEvent;
import java.util.Random;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.Timer;

public class BouncingSticks extends JFrame {

    public static int W = 600;
    public static int H = 600;

    public BouncingSticks() {
        MovingBallPanel m1 = new MovingBallPanel();
        this.add(m1);
    }

    public static void main(String[] args) {
```

```

        BouncingSticks frame = new BouncingSticks();
        frame.setTitle("Animated Balls");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setSize(W, H);
        frame.setVisible(true);
    }

    static class MovingBallPanel extends JPanel {

        public static int n = 800;
        public static double[] a = new double[n];

        public static double[] da = new double[n];
        public static double[] r = new double[n];
        public static double[] dx = new double[n];
        public static double[] dy = new double[n];
        public static double[] x = new double[n];
        public static double[] y = new double[n];
        public static Color[] color = new Color[n];
        private Timer timer = new Timer(30, new TimerListener());

        public MovingBallPanel() {

            this.setBackground(Color.black);
            initializeBalls();
            timer.start();
            this.addMouseListener(new MouseAdapter() {
                public void mouseClicked(MouseEvent e) {
                    int delay = timer.getDelay();
                    if (e.getButton() == MouseEvent.BUTTON1) {
                        timer.setDelay(delay > 5 ? delay - 5 : 5);
                    } else if (e.getButton() == MouseEvent.BUTTON3)
{
                        timer.setDelay(delay < 5000 ? delay + 5 :
5000);
                    }
                }
            });
        }

        private void initializeBalls() {
            Random rand = new Random();
            double maxBallRadius = 40;
            double minBallRadius = 2;
            double maxBallSpeed = 10;
            double maxRotSpeed = 1.0;
            for (int i = 0; i < n; i++) {
                r[i] = minBallRadius + (maxBallRadius * *
Math.random());
                x[i] = W / 2;
                y[i] = H / 2;
                int red = rand.nextInt(256);
                int green = rand.nextInt(256);
                int blue = rand.nextInt(256);
            }
        }
    }
}

```

```

        color[i] = new Color(red, green, blue);
        color[i] = new Color(255,255,255);
        dx[i] = maxBallSpeed * Math.random() - maxBallSpeed
/ 2;
        dy[i] = maxBallSpeed * Math.random() - maxBallSpeed
/ 2;
        a[i] = 2.0 * Math.PI * Math.random();
        da[i] = maxRotSpeed * Math.random() - maxRotSpeed /
2;

    }
}

protected void paintComponent(Graphics g) {
    super.paintComponent(g);

    checkBoundary(); //check ball at window boundary
    checkCollisions(); //check for collisions between balls
    checkZeroVelocity(); // want ALL the balls to move.
    updateXYPositions(); //use dx, dy to get new x, y
    drawBalls(g); //draw all the balls
}

private void checkBoundary() {
    for (int i = 0; i < n; i++) {
        if (x[i] + r[i] > getWidth()) {
            dx[i] = -Math.abs(dx[i]);
        }
        if (x[i] - r[i] < 0) {
            dx[i] = Math.abs(dx[i]);
        }
        if (y[i] + r[i] > getHeight()) {
            dy[i] = -Math.abs(dy[i]);
        }
        if (y[i] - r[i] < 0) {
            dy[i] = Math.abs(dy[i]);
        }
    }
}

private void updateXYPositions() {
    for (int i = 0; i < n; i++) {
        x[i] = x[i] + dx[i];
        y[i] = y[i] + dy[i];
        a[i] = a[i] + da[i];
    }
}

private void drawBalls(Graphics g) {
    for (int i = 0; i < n; i++) {
        g.setColor(color[i]);
        g.drawLine(
            (int) (x[i] + r[i] * Math.cos(a[i] +
Math.PI)), ,

```

```

        (int) (y[i] + r[i] * Math.sin(a[i] +
Math.PI)),
        (int) (x[i] + r[i] * Math.cos(a[i])),
        (int) (y[i] + r[i] * Math.sin(a[i])));
    }
}

private void checkCollisions() {
    double[] unit = new double[2];
    double length = 0.0;
    double iLength = 0.0;
    double jLength = 0.0;
    double temp = 0.0;
    for (int i = 0; i < n; i++) {
        for (int j = i + 1; j < n; j++) {
            //check to see if ball i has collided with ball
            j:
            double dist = Math.sqrt(
                Math.pow(x[j] - x[i], 2)
                + Math.pow(y[j] - y[i], 2));
            if (dist > 0 && dist <= r[i] + r[j]) {
                unit[0] = (x[j] - x[i]) / dist;
                unit[1] = (y[j] - y[i]) / dist;
                length = Math.sqrt(
                    Math.pow(unit[0], 2)
                    + Math.pow(unit[1], 2));

                iLength = Math.sqrt(
                    Math.pow(dx[i], 2)
                    + Math.pow(dy[i], 2));
                jLength = Math.sqrt(
                    Math.pow(dx[j], 2)
                    + Math.pow(dy[j], 2));

                dx[i] = -jLength * unit[0];
                dy[i] = -jLength * unit[1];

                dx[j] = iLength * unit[0];
                dy[j] = iLength * unit[1];

                temp = a[i];
                a[i] = a[j];
                a[j] = temp;
            }
        }
    }
}

private void checkZeroVelocity() {
    for (int i = 0; i < n; i++) {
        if ((dx[i] * dx[i] + dy[i] * dy[i]) <= 0.1) {
            System.out.println("zero vel at " + i);
            dx[i] = 1 + (4 * Math.random() - 2);
            dy[i] = 1 + (4 * Math.random() - 2);
        }
    }
}

```

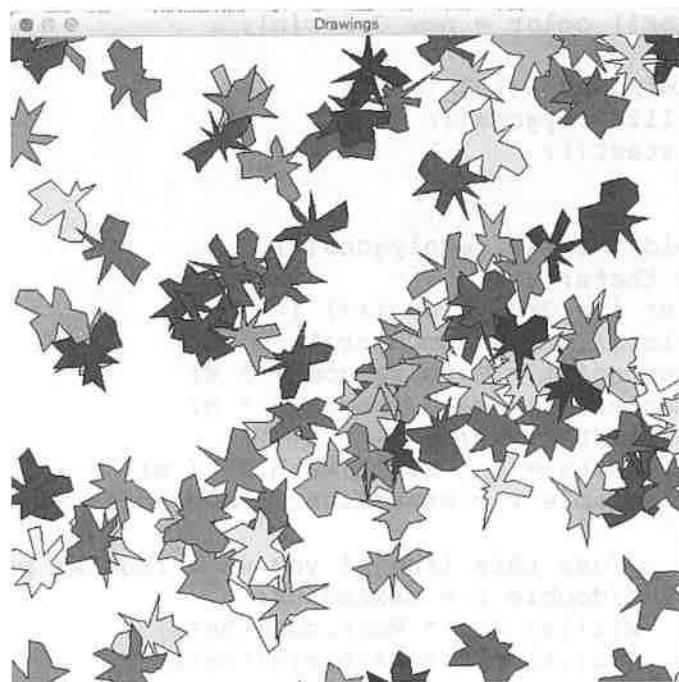
```
        }
    }
}

class TimerListener implements ActionListener {
    public void actionPerformed(ActionEvent e) {
        repaint();
    }
}
}
```

Java Project: RotatingPolygon

Description: Draw randomly placed polygons, and have them rotate in place.

Sample Output:



```
package rotatingpolygon;

import java.awt.Color;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.Timer;

public class RotatingPolygon extends JFrame {

    public static int W = 600;
    public static int H = 600;

    public RotatingPolygon() {
        DrawingPanel drawingPanel = new DrawingPanel();
        this.add(drawingPanel);
    }
}
```

```

}

static class DrawingPanel extends JPanel {

    private Timer timer = new Timer(30, new TimerListener());
    int m = 20; //points per poly
    int n = 100; // number of polys
    double[][] x = new double[n][m];
    double[][] y = new double[n][m];
    double maxRadius = 40;
    double minRadius = 5;
    double[] xCenter = new double[n];
    double[] yCenter = new double[n];
    public Color[] color = new Color[n];

    public DrawingPanel() {
        initializePolygons();
        timer.start();
    }

    private void initializePolygons(){
        double theta;
        for (int i = 0; i < n; i++) {
            color[i] = randomColor();
            xCenter[i] = Math.random() * W;
            yCenter[i] = Math.random() * H;
            for (int k = 0; k < m; k++) {
                theta = k * 2.0 * Math.PI / m;
                double r = minRadius + (maxRadius - minRadius) *
Math.random();
                //use this line if you want regular polygons:
                //double r = maxRadius;
                x[i][k] = r * Math.cos(theta) ;
                y[i][k] = r * Math.sin(theta) ;
            }
        }
    }

    protected void paintComponent(Graphics g) {
        super.paintComponent(g);
        updatePositions();
        drawPolygons(g);
    }

    private void updatePositions() {
        double alpha = 0.1;
        for(int i = 0; i < n; i++) {
            for(int k = 0; k < m; k++) {

                double newX = (x[i][k]) * Math.cos(alpha) +
(y[i][k]) * Math.sin(alpha);
                double newY = -(x[i][k]) * Math.sin(alpha) +
(y[i][k]) * Math.cos(alpha);
            }
        }
    }
}

```

```

        x[i][k] = newX ;
        y[i][k] = newY ;
    }
    //xCenter[i] += 1.0;
    //yCenter[i] += 1.0;
}
}

class TimerListener implements ActionListener {
    public void actionPerformed(ActionEvent e) {
        repaint();
    }
}

private void drawPolygons(Graphics g) {
    for (int i = 0; i < n; i++) {
        int[] polyX = new int[m];
        int[] polyY = new int[m];
        //Color color = randomColor();
        g.setColor(color[i]);
        for(int k = 0; k < m; k++) {
            polyX[k] = (int)(x[i][k] + xCenter[i]);
            polyY[k] = (int)(y[i][k] + yCenter[i]);
        }
        g.fillPolygon(polyX, polyY, m);
        g.setColor(Color.black);
        g.drawPolygon(polyX, polyY, m);
    }
}

private Color randomColor() {
    Color color = new Color(
        (int) (256 * Math.random()),
        (int) (256 * Math.random()),
        (int) (256 * Math.random())
    );
    return color;
}
}

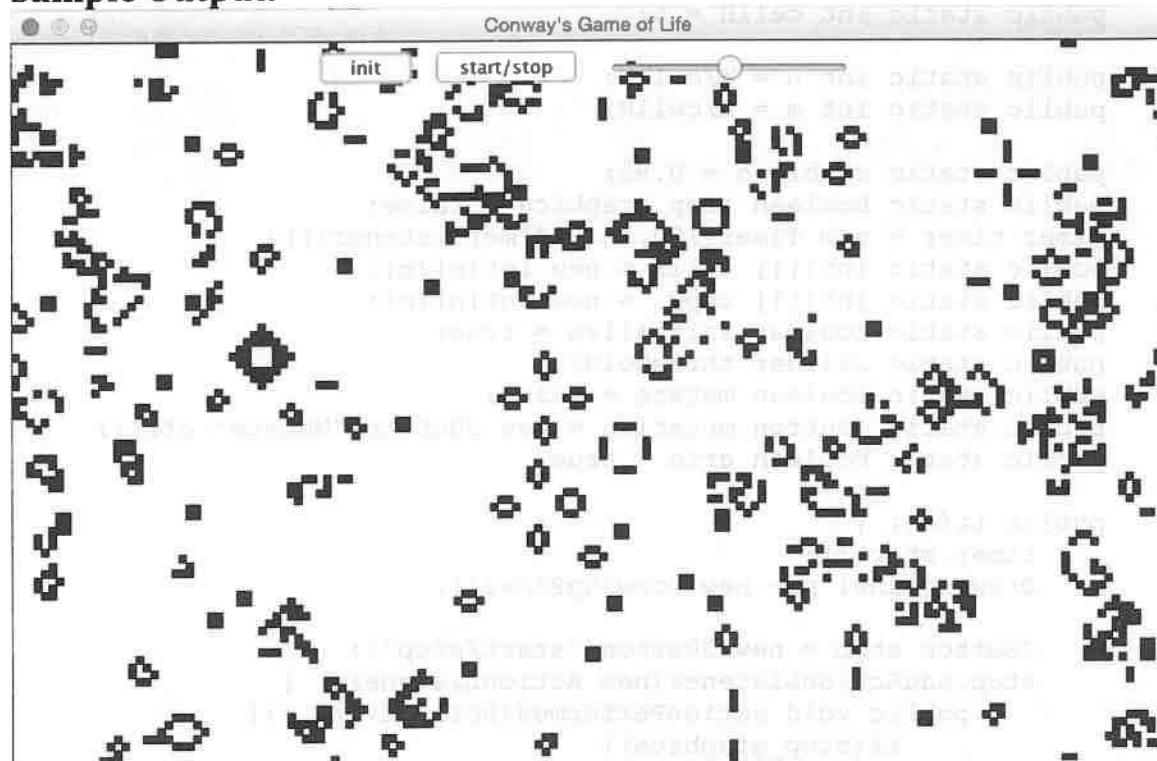
public static void main(String[] args) {
    RotatingPolygon frame = new RotatingPolygon();
    frame.setTitle("Drawings");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(W, H);
    frame.setVisible(true);
}
}

```

Java Project: Life

Description: This program simulates Conway's Game of Life. Using relatively simple rules, the cells change between black and white giving the impression of motion and other life-like activity. Various patterns emerge – very thought provoking. The program has a few settings that can be played with to get different effects, in particular a slide bar that allows for the density of white vs. black at the start of the simulation and “init” and “stop/start” buttons to restart or pause the simulation.

Sample Output:



```
/*
 * To change this license header, choose License Headers in Project
Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */
package life;

import java.awt.Color;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
```

```

import java.util.Random;
import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.JSlider;
import javax.swing.Timer;

/**
 *
 * @author wwoolfe3
 */
public class Life extends JFrame {

    public static int W = 800;
    public static int H = 500;

    public static int cellW = 5;
    public static int cellH = 5;

    public static int n = W/cellW;
    public static int m = H/cellH;

    public static double d = 0.92;
    public static boolean stop_graphics = false;
    Timer timer = new Timer(100, new TimerListener());
    public static int[][] cells = new int[n][m];
    public static int[][] copy = new int[n][m];
    public static boolean initialize = true;
    public static JSlider threshold;
    public static boolean mutate = false;
    public static JButton mutation = new JButton("Mutate: off");
    public static boolean grid = true;

    public Life() {
        timer.start();
        DrawingPanel p = new DrawingPanel();

        JButton stop = new JButton("start/stop");
        stop.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                if(stop_graphics){
                    stop_graphics = false;
                } else {
                    stop_graphics = true;
                }
            }
        });
        JButton init = new JButton("init");
        init.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                initialize = true;
                stop_graphics = true;
            }
        });
    }
}

```

```

    });

threshold = new JSlider(JSlider.HORIZONTAL, 0 , 100, 50);
p.add(init);
p.add(stop);
p.add(threshold);
this.add(p);

}

static class DrawingPanel extends JPanel {
    public DrawingPanel () {
        initializeCells();
    }

    public void initializeCells() {
        for(int j = 0; j < m; j++) {
            for(int i = 0; i < n; i++) {
                if(Math.random() > d) {
                    cells[i][j] = 1;
                } else {
                    cells[i][j] = 0;
                }
            }
        }
    }

    protected void paintComponent(Graphics g) {
        super.paintComponent(g);
        if(initialize) {
            d = threshold.getValue()/100.0;
            initializeCells();
        }
        initialize = false;
        if(grid) {
            drawGrid(g);
        } else {

        }

        if(!stop_graphics) {
            createCopy();
            updateGrid();
        }
    }

    private void updateGrid() {
        for(int j = 0; j < m; j++) {
            for(int i = 0; i < n; i++) {
                cells[i][j] = copy[i][j];
            }
        }
    }
}

```

```

private void createCopy() {
    for(int j = 0; j < m; j++) {
        for(int i = 0; i < n; i++) {
            copy[i][j] = cells[i][j];
            int count = getNeighborCount(i,j);
            if (cells[i][j] == 1 && count < 2) {
                copy[i][j] = 0;
            }
            if(cells[i][j] == 1 && (count == 2 || count == 3)
) {
                copy[i][j] = 1;
            }

            if(cells[i][j] == 1 && count > 3) {
                copy[i][j] = 0;
            }

            if(cells[i][j] == 0 && count == 3) {
                copy[i][j] = 1;
            }
        }
    }
}

private void drawGrid(Graphics g) {
    Random rand = new Random();
    g.drawRect(0,0,W,H);
    for(int j = 0; j < m; j++) {
        for(int i = 0; i < n; i++) {
            int x = i * cellW;
            int y = j * cellH;
            if(cells[i][j] == 1) {
                //Color color = new Color(rand.nextInt(256),
rand.nextInt(256), rand.nextInt(256));
                //g.setColor(color);
                g.fillRect(x,y, cellW, cellH);
                g.setColor(Color.BLACK);
                g.drawRect(x,y, cellW, cellH);

            }else {
                //g.drawRect(x,y, cellW, cellH);
            }
            if (cells[i][j] == 0) {
                if (Math.random() < 0.0001) cells[i][j] = 1;
            }
        }
    }
}

public static int getNeighborCount(int i, int j) {
    int i_minus = (i - 1) % n;
    if(i_minus == -1) {
        i_minus = n - 1;
    }
}

```

```

        int i_plus = (i + 1) % n;

        int j_minus = (j - 1) % m;
        if(j_minus == -1) {
            j_minus = m-1;
        }

        int j_plus = (j + 1) % m;

        int sum = cells[i_minus][j_minus]
                  + cells[i][j_minus]
                  + cells[i_plus][j_minus]
                  + cells[i_minus][j]
                  + cells[i_plus][j]
                  + cells[i_minus][j_plus]
                  + cells[i][j_plus]
                  + cells[i_plus][j_plus];
        return sum;
    }

}

public class TimerListener implements ActionListener {
    public void actionPerformed(ActionEvent e) {
        repaint();
    }
}

public static void main(String[] args) {
    Life frame = new Life();
    frame.setTitle("Conway's Game of Life");
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(W, H);
    frame.setVisible(true);
}

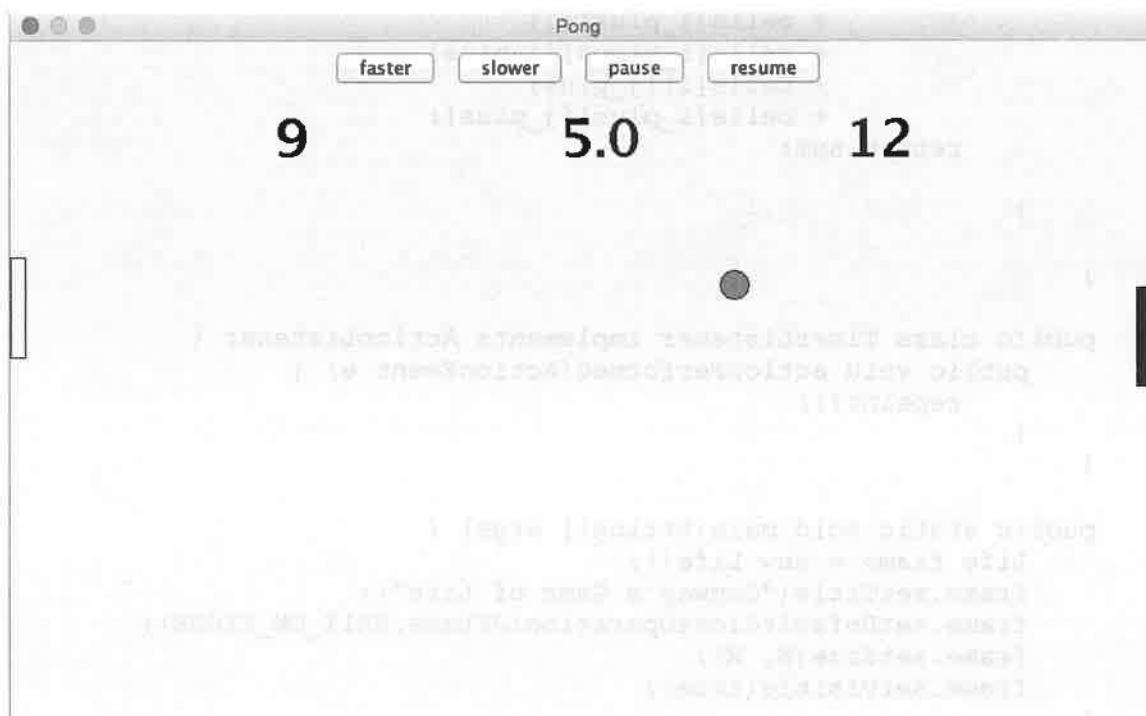
}

```

Java Project: Pong

Description: This programs simulates the game of Pong. It has controls to pause and speed up or slow down the speed of the ball. The P and L keys control the right paddle and the Q and A keys to control the left paddle.

Sample Output:



```
package pong;

import java.awt.Color;
import java.awt.Dimension;
import java.awt.Font;
import java.awt.FontMetrics;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.KeyAdapter;
import java.awt.event.KeyEvent;
import java.io.File;
import java.io.FileInputStream;
import java.io.InputStream;
import javax.swing.JButton;
import javax.swing.JFrame;
```

```

import javax.swing.JPanel;
import javax.swing.Timer;
import sun.audio.AudioPlayer;
import sun.audio.AudioStream;

public class Pong extends JFrame {

    public static int W = 800;
    public static int H = 500;

    public Pong() {
        JPanel canvas = new PongCanvas();
        canvas.requestFocus();
        add(canvas);
    }

    class PongCanvas extends JPanel {

        double ballRadius = 10;
        double ballX = W / 2;
        double ballY = H / 2;
        double theta = (Math.PI / 2.0) * Math.random() - Math.PI /
        4.0;
        int toggle = 1;
        double ballSpeed = 5;
        double ballDx = ballSpeed * Math.cos(theta);
        double ballDy = ballSpeed * Math.sin(theta);
        double paddleW = 10;
        double paddleH = 70;
        double paddleLeftX = paddleW / 2;
        double paddleLeftY = H / 2;
        double paddleRightX = W - paddleW / 2;
        double paddleRightY = H / 2;
        double paddleLeftSpeed = 0;
        double paddleRightSpeed = 0;
        double paddleMaxSpeed = 4;
        private Timer timer = new Timer(10, new TimerListener());
        int playerLeftCount = 0;
        int playerRightCount = 0;
        char keyChar = 'A';
        private InputStream in;
        JButton faster = new JButton("faster");
        JButton slower = new JButton("slower");
        JButton pause = new JButton("pause");
        JButton resume = new JButton("resume");

        public PongCanvas() {
            addKeyListener(new KeyAdapter() {
                public void keyPressed(KeyEvent e) {
                    System.out.println("keyCode = " +
e.getKeyCode());
                    System.out.println("keyChar = " +
e.getKeyChar());
                    switch (e.getKeyChar()) {

```

```

        case 'q':
            paddleLeftSpeed = -paddleMaxSpeed;
            break;
        case 'a':
            paddleLeftSpeed = +paddleMaxSpeed;
            break;
        case 'p':
            paddleRightSpeed = -paddleMaxSpeed;
            break;
        case 'l':
            paddleRightSpeed = +paddleMaxSpeed;
            break;
        default:
            keyChar = e.getKeyChar();
    }
}

public void keyReleased(KeyEvent e) {
    switch (e.getKeyChar()) {
        case 'q':
            paddleLeftSpeed = 0;
            break;
        case 'a':
            paddleLeftSpeed = 0;
            break;
        case 'p':
            paddleRightSpeed = 0;
            break;
        case 'l':
            paddleRightSpeed = 0;
            break;
        default:
            keyChar = e.getKeyChar();
    }
}
});

faster.addActionListener(new FasterListener());
faster.setFocusable(false);
this.add(faster);

slower.addActionListener(new SlowerListener());
slower.setFocusable(false);
this.add(slower);

pause.addActionListener(new PauseListener());
pause.setFocusable(false);
this.add(pause);

resume.addActionListener(new ResumeListener());
resume.setFocusable(false);
this.add(resume);

this.setFocusable(true);

```

```

        timer.start();
    }

    class FasterListener implements ActionListener {
        @Override
        public void actionPerformed(ActionEvent e) {
            ballSpeed++;
        }
    }

    class SlowerListener implements ActionListener {
        @Override
        public void actionPerformed(ActionEvent e) {
            ballSpeed--;
            if (ballSpeed <= 1) {
                ballSpeed = 1;
            }
        }
    }

    class PauseListener implements ActionListener {
        @Override
        public void actionPerformed(ActionEvent e) {
            timer.start();
        }
    }

    class ResumeListener implements ActionListener {
        @Override
        public void actionPerformed(ActionEvent e) {
            timer.stop();
        }
    }

    protected void paintComponent(Graphics g) {
        super.paintComponent(g);
        theta = (Math.PI / 2.0) * Math.random() - Math.PI / 4.0;
        leftWallHit();
        rightWallHit();
        bottomHit();
        topHit();
        paddleLeftHit();
        paddleRightHit();
        updateBall();
        drawBall(g);
        updateLeftPaddle();
        drawLeftPaddle(g);
        updateRightPaddle();
        drawRightPaddle();
    }
}

```

```

        Font font = new Font("New Courier", Font.BOLD, 36);
        g.setFont(font);

        FontMetrics metris = g.getFontMetrics(font);

        int hgt = metris.getHeight();

        String textLeft, textRight, textCenter;
        int adv;

        textLeft = "" + playerLeftCount;
        textRight = "" + playerRightCount;
        textCenter = "" + ballSpeed;
        adv = metris.stringWidth(textLeft);
        Dimension size = new Dimension(adv + 2, hgt + 2);
        g.drawString(textLeft, getWidth() / 4 - size.width / 2,
        getHeight() / 8 + size.height / 2);
        g.drawString(textCenter, getWidth() / 2 - size.width /
        2, getHeight() / 8 + size.height / 2);
        g.drawString(textRight, 3 * getWidth() / 4 - size.width
        / 2, getHeight() / 8 + size.height / 2);
    }

    private void updateLeftPaddle() {
        paddleLeftY += paddleLeftSpeed;
        if (paddleLeftY > getHeight() - paddleH / 2) {
            paddleLeftY = getHeight() - paddleH / 2;
        }
        if (paddleLeftY < paddleH / 2) {
            paddleLeftY = paddleH / 2;
        }
    }

    private void updateRightPaddle() {
        paddleRightY += paddleRightSpeed;
        if (paddleRightY > getHeight() - paddleH / 2) {
            paddleRightY = getHeight() - paddleH / 2;
        }

        if (paddleRightY < paddleH / 2) {
            paddleRightY = paddleH / 2;
        }
    }

    private void leftWallHit() {
        if (ballX - ballRadius <= 0) {
            playerRightCount++;
            playSound("miss2.wav");
            resetBall();
        }
    }

    private void rightWallHit() {

```

```

        if (ballX + ballRadius >= getWidth()) {
            playerLeftCount++;
            playSound("miss2.wav");
            resetBall();
        }
    }

private void bottomHit() {
    if (ballY >= getHeight() - ballRadius) {
        ballDy = -ballDy;
        playSound("hit2.wav");
    }
}

private void topHit() {
    if (ballY - ballRadius < 0) {
        ballDy = -ballDy;
        playSound("hit2.wav");
    }
}

private void resetBall() {
    ballX = getWidth() / 2;
    ballY = getHeight() / 2;
    toggle = -1 * toggle;
    theta = (Math.PI / 2.0 * Math.random() - Math.PI / 4.0);
    if (toggle == -1) {
        theta += Math.PI;
    }
    ballDx = ballSpeed * Math.cos(theta);
    ballDy = ballSpeed * Math.sin(theta);
}

private void paddleLeftHit() {
    if ((ballX < paddleW + ballRadius)
        && (ballY < paddleLeftY + paddleH / 2)
        && (ballY > paddleLeftY - paddleH / 2)) {

        ballDx = -ballDx;
        ballDy += 2.0 * Math.random() - 1.0;
        playSound("hit2.wav");
    }
}

private void paddleRightHit() {
    if ((ballX > getWidth() - paddleW - ballRadius)
        && (ballY < paddleRightY + paddleH / 2)
        && (ballY > paddleRightY - paddleH / 2)) {
        ballDx = -ballDx;
        ballDy += 2.0 * Math.random() - 1.0;
        playSound("hit2.wav");
    }
}

```

```

private void playSound(String fileName) {
    try {
        in = new FileInputStream(new File(fileName));
        AudioStream audioStream = new AudioStream(in);
        AudioPlayer.player.start(audioStream);

    } catch (Exception e) {
        System.out.println("problem withsound effect: " +
fileName);
    }
}

private void drawBall(Graphics g) {
    g.setColor(Color.red);
    g.fillOval((int) (ballX - ballRadius), (int) (ballY -
ballRadius), (int) (2 * ballRadius), (int) (2 * ballRadius));
    g.setColor(Color.black);
    g.drawOval((int) (ballX - ballRadius), (int) (ballY -
ballRadius), (int) (2 * ballRadius), (int) (2 * ballRadius));
}

private void drawLeftPaddle(Graphics g) {
    g.drawRect(0, (int) (paddleLeftY - paddleH / 2), (int)
paddleW, (int) (paddleH));
}

private void drawRightPaddle(Graphics g) {
    g.fillRect((int) (getWidth() - paddleW), (int)
(paddleRightY - paddleH / 2), (int) paddleW, (int) (paddleH));
}

private void updateBall() {
    ballX += ballDx;
    ballY += ballDy;
}

class TimerListener implements ActionListener {

    public void actionPerformed(ActionEvent e) {
        repaint();
    }
}

public static void main(String[] args) {
    JFrame frame = new Pong();
    frame.setTitle("Pong");
    frame.setSize(W, H);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setLocationRelativeTo(null);
    frame.setVisible(true);
}
}

```

Java Project: ShootingGameNew

Description: This is a simple target shooting game. The player gets a shooter at the bottom of the screen. The player shoots with the up arrow key. Left and right arrows change the angle of the gun's turret. Targets are spawned, one at a time, from the top of the screen. If a bullet hits a target there is a simulated explosion and the player gains points.

Need a few files to make this work:

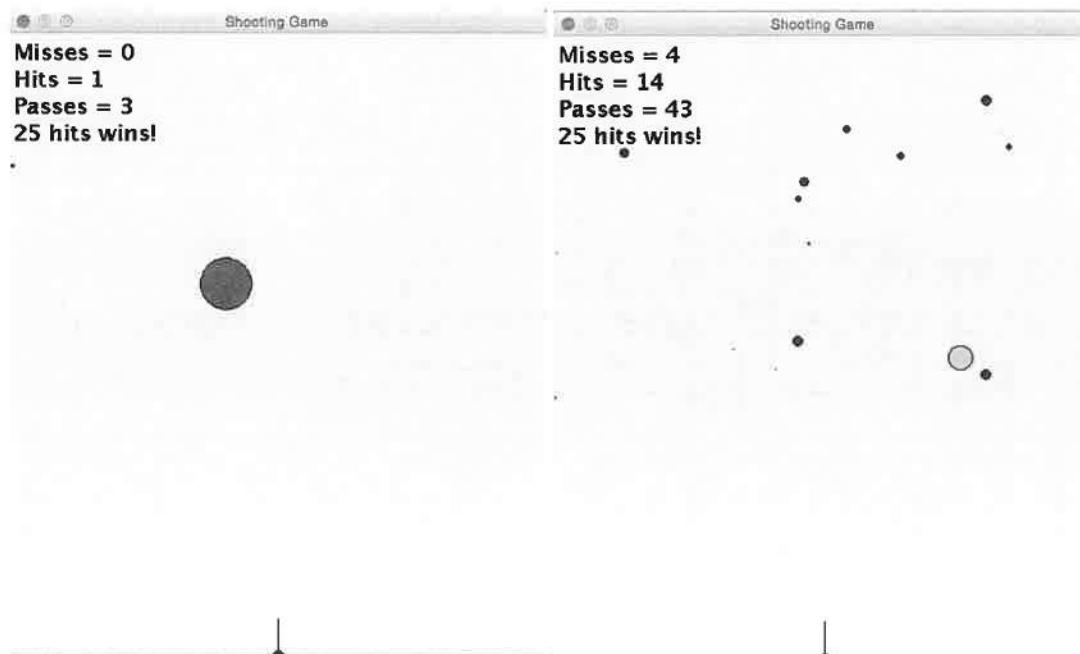
Ball.java: A simple class to define the targets in the game.

Particle.java: A class to model the bits and pieces that emerge when a target is hit and explodes.

ParticleSystem.java: A class to manage the many particles that are spawned at an explosion.

ShootingGameNew.java: The main class.

Sample Output:



```

package shootinggamenew;

import java.applet.AudioClip;
import java.awt.Color;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.KeyAdapter;
import java.awt.event.KeyEvent;
import java.io.File;
import java.io.FileInputStream;
import java.io.InputStream;
import java.util.Random;
import javax.swing.JFrame;
import javax.swing.JOptionPane;
import javax.swing.JPanel;
import javax.swing.Timer;
import sun.audio.AudioPlayer;
import sun.audio.AudioStream;

/**
 * @author william wolfe -- idea from Liang's text, Chapter 16 A
ball falls from
 * above. you have an arrow-controlled gun at bottom of screen.
left-arrow:
 * swivel left right-arrow: swivel right up-arrow fires a shot in
direction gun
 * is pointing -- added a few variations: changing ball
size/color/speed --
 * "win" particle system -- "explosion" particle system
 */
public class ShootingGameNew extends JFrame {

    public static final int W = 500;
    public static final int H = 600;
    public static boolean shoot;

    public ShootingGameNew() {
        JPanel game = new GameCanvas();
        game.setFocusable(true);
        add(game);
    }

    class GameCanvas extends JPanel {

        public double gunW;
        public double gunH;
        public double theta;//gun pointing
        public double dTheta;//gun rotation rate
        public double speed;
        public boolean shot; // true when bullet in motion
    }
}

```

```

public Ball target;
public Ball bullet;

public double maxTargetSpeed = 20;
public double maxTargetRadius = 30;

public int misses = 0;
public int hits = 0;
public int passes = 0;
public int bounce = 0;

Timer timer = new Timer(10, new TimerListener());
//sound:
AudioClip clip;
//particle system for explosions:
ParticleSystem particleSystem;
ParticleSystem particleSystemWin;

public GameCanvas() {
    //initialize the gun parameters:
    gunW = 35;
    gunH = 5;
    theta = Math.PI / 2.0; //gun pointing straight up at
start
    dTheta = 0.1;//gun rotation rate
    speed = 20.0;//gun speed (or "power")
    shot = false;

    //initialize the target parameters:
    target = new Ball();

    target.setRadius(25);
    resetTarget();

    //initialize the bullet parameters:
    bullet = new Ball();
    bullet.setRadius(5);
    resetBullet();

    //initialize the explosion particle system:
    particleSystem = new ParticleSystem(30, W / 2.0, H /
2.0);
    //initialize the "win" particle system:
    particleSystemWin = new ParticleSystem(500, W / 2, H /
2);
    particleSystemWin.name = "WIN";
    particleSystemWin.reset(W / 2, H / 2);
    particleSystemWin.maxR = 50;

    timer.start();

    this.addKeyListener(new KeyAdapter() {
        public void keyPressed(KeyEvent e) {
            if (e.getKeyCode() == KeyEvent.VK_LEFT) {

```

```

        theta += dTheta;
        if (theta >= Math.PI) {
            theta = Math.PI - 0.01;
        }
    }
    if (e.getKeyCode() == KeyEvent.VK_RIGHT) {
        theta -= dTheta;

        if (theta <= 0.0) {
            theta = 0.01;
        }
    }

    if (e.getKeyCode() == KeyEvent.VK_UP) {
        if (!shot) {
            InputStream in;
            try {
                in = new FileInputStream(new
File("audio/bullet.wav"));
                AudioStream audioStream = new
AudioStream(in);

                AudioPlayer.player.start(audioStream);
            } catch (Exception soundException) {
                JOptionPane.showMessageDialog(null,
soundException);
            }
            bullet.setVelocityPolar(theta, speed);
            shot = true;
        }
    }
}
};

public void updateGun() {
    //this does nothing right now -- for future mods
}

public void drawGun(Graphics g) {
    g.drawLine(
        getWidth() / 2,
        getHeight(),
        (int) (getWidth() / 2 + gunW * Math.cos(theta)),
        (int) (getHeight() - gunW * Math.sin(theta))
    );
    g.drawOval((int) (getWidth() / 2 - bullet.r), (int)
(getHeight() - bullet.r), (int) (2 * bullet.r), (int) (2 *
bullet.r));
}

public boolean collision() {

```

```

        if (target.distanceTo(bullet) < target.r + bullet.r) {
            InputStream in;
            try {
                in = new FileInputStream(new
File("audio/hit2.wav"));
                AudioStream audioStream = new AudioStream(in);
                AudioPlayer.player.start(audioStream);
            } catch (Exception e) {
                JOptionPane.showMessageDialog(null,
e.toString());
            }
            return true;
        } else {
            return false;
        }
    }

    public void drawScore(Graphics g) {
        Font font = new Font("New Courier", Font.BOLD, 20);
        g.setFont(font);
        g.setColor(Color.black);
        g.drawString("Misses = " + misses, 5, 25);
        g.drawString("Hits = " + hits, 5, 50);
        g.drawString("Passes = " + passes, 5, 75);
        g.drawString("25 hits wins!", 5, 100);
    }

    public void resetTarget() {
        //target.r = Math.random() * maxTargetRadius;
        if (getWidth() > 0) {
            target.x = getWidth() / 2.0;
        } else {
            target.x = w / 2.0;
        }

        target.y = target.r;
        target.dx = maxTargetSpeed * Math.random() -
maxTargetSpeed / 2;
        target.dy = maxTargetSpeed / 2 * Math.random();

        Random rand = new Random();
        target.color = new Color(rand.nextInt(256),
rand.nextInt(256), rand.nextInt(256));
    }

    public void resetBullet() {
        if (getWidth() > 0) {
            bullet.setPosition(getWidth() / 2.0, getHeight());
        } else {
            bullet.setPosition(w / 2.0, h);
        }

        bullet.setVelocityPolar(theta, 0);
        shot = false;
    }
}

```

```

}

public int checkBounce(Ball ball) {
    //check target against East wall:
    if (ball.x >= getWidth() - ball.r) {
        return -1;
    }
    //check target against West wall:
    if (ball.x <= ball.r) {
        return +1;
    }
    return 0;
}

public void checkPass(Ball target) {
    //Check target against South wall:
    if (target.y >= getHeight() + target.r) {
        passes++;
        resetTarget();
    }
}

public void checkMiss(Ball bullet) {
    //Check bullet against the North wall
    if (bullet.y - bullet.r < 0) {
        misses++;
        resetBullet();
    }
}

protected void paintComponent(Graphics g) {
    super.paintComponent(g);

    //check for target bounce off the side walls:
    bounce = checkBounce(target);
    if (bounce == -1) {
        target.dx = -Math.abs(target.dx);
    } else if (bounce == +1) {
        target.dx = +Math.abs(target.dx);
    }
    checkPass(target);
    target.move();

    //check for bullet bounce off side walls:
    bounce = checkBounce(bullet);
    if (bounce == -1) {
        bullet.dx = -Math.abs(bullet.dx);
    } else if (bounce == +1) {
        bullet.dx = +Math.abs(bullet.dx);
    }
    checkMiss(bullet);
    bullet.move();

    updateGun();
}

```

```

        particleSystem.update();

        if (collision()) {
            //initiate explosion at target.x, target.y:
            particleSystem.reset(target.x, target.y);
            particleSystem.setColor(target.color);
            //reset Target and Bullet:
            resetTarget();
            resetBullet();
            //bullet hit the target:
            hits++;
            //make the target harder it hit:
            target.r -= 1.0;
        }

        target.draw(g);
        bullet.draw(g);
        drawGun(g);
        particleSystem.draw(g);
        drawScore(g);
        //check for win:
        if (hits == 25) {
            particleSystemWin.setColor(Color.black);
            particleSystemWin.update();
            particleSystemWin.draw(g);
            setBackground(Color.red);
            target.r = 25;
        }
    }

    class TimerListener implements ActionListener {

        public void actionPerformed(ActionEvent e) {
            repaint();
        }
    }
}

public static void main(String[] args) {
    JFrame frame = new ShootingGameNew();
    frame.setTitle("Shooting Game");
    frame.setVisible(true);
    frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    frame.setSize(W, H);
}
}

///////////////
package shootinggamenew;

import java.awt.Color;
import java.awt.Graphics;

public class Ball {

```

```

public double x;
public double y;
public double r;
public double dx;
public double dy;
public Color color;

public Ball() {
    this.x = 0;
    this.y = 0;
    this.dx = 0;
    this.dy = 0;
    this.r = 25;
    this.color = Color.black;
}

public void draw(Graphics g) {
    g.setColor(color);
    g.fillOval((int) (x - r), (int) (y - r), (int) (2 * r),
(int) (2 * r));
    g.setColor(Color.black);
    g.drawOval((int) (x - r), (int) (y - r), (int) (2 * r),
(int) (2 * r));
}

public void move() {
    x += dx;
    y += dy;
}

public void move(double dx, double dy) {
    x += dx;
    x += dy;
}

public void moveTo(double x, double y) {
    this.x = x;
    this.y = y;
}

public void setPosition(double x, double y) {
    this.x = x;
    this.y = y;
}

public void setColor(Color color) {
    this.color = color;
}

public void setRadius(double r) {
    this.r = r;
}

```

```

        public double distanceTo(Ball b) {
            double distance = Math.sqrt(Math.pow(this.x - b.x, 2.0) +
Math.pow(this.y - b.y, 2.0));
            return distance;
        }

        public void setVelocityCartesian(double dx, double dy) {
            this.dx = dx;
            this.dy = dy;
        }

        public void setVelocityPolar(double theta, double speed) {
            this.dx = speed * Math.cos(theta);
            this.dy = -speed * Math.sin(theta);
        }
    }

/////////////////////////////////////////////////////////////////
package shootinggamenew;

import java.awt.Color;
import java.awt.Graphics;

public class Particle {

    public double x;
    public double y;
    public double dx;
    public double dy;
    public double speed;
    public Color color;
    public double r;
    public boolean isActive;
    public String name;

    public Particle() {
        x = 0;
        y = 0;
        dx = 0;
        dy = 0;
        speed = 0;
        color = new Color((int)(256 * Math.random()),
(int)(256*Math.random()), (int)(256*Math.random()));
        r = 1;
        isActive = false;
        name = "";
    }

    public void draw(Graphics g) {
        g.setColor(color);
        g.fillOval((int) (x - r), (int) (y - r), (int) (2 * r),
(int) (2 * r));
        g.setColor(Color.BLACK);

```

```

        g.drawOval((int) (x - r), (int) (y - r), (int) (2 * r),
(int) (2 * r));
        g.drawString(name, (int)x,(int)y);

    }

    public void reset() {
        isActive = false;
    }

    public void update() {
        x += dx;
        y += dy;
    }

    public void setColor(Color color){
        this.color = color;
    }

    public String toString() {
        String out = "";
        out = "[" + x + ", " + y + ", " + dx + ", " + dy + ", " +
color.toString() + "]";
        return out;
    }

}

```

//////////
package shootinggamenew;

```

import java.awt.Color;
import java.awt.Graphics;

public class ParticleSystem {

    Particle[] particles;
    public double maxR = 5;
    public double maxSpeed = 5;
    public int n;
    public String name = "";

    ParticleSystem(int n, double x, double y) {
        this.n = n;
        particles = new Particle[n];
        for (int i = 0; i < n; i++) {
            particles[i] = new Particle();
            particles[i].isActive = false;
            particles[i].x = x;
            particles[i].y = y;
            particles[i].dx = 2 * maxSpeed * Math.random() -
maxSpeed;
            particles[i].dy = 2 * maxSpeed * Math.random() -
maxSpeed;
        }
    }
}
```

```

        particles[i].r = maxR * Math.random();
        particles[i].name = this.name;
    }
}

public void setColor(Color c) {
    for (int i = 0; i < n; i++) {
        particles[i].color = c;
    }
}

public void draw(Graphics g) {
    for (int i = 0; i < n; i++) {
        if (particles[i].isActive) {
            particles[i].draw(g);
        }
    }
}

public void reset(double x, double y) {

    for (int i = 0; i < n; i++) {
        particles[i] = new Particle();
        particles[i].isActive = true;
        particles[i].x = x;
        particles[i].y = y;
        particles[i].dx = 2 * maxSpeed * Math.random() -
maxSpeed;
        particles[i].dy = 2 * maxSpeed * Math.random() -
maxSpeed;
        particles[i].r = maxR * Math.random();
        particles[i].name = this.name;
    }
}

public void update() {
    for (Particle p : particles) {
        p.update();
    }
}

public String toString() {
    String out = "";
    for (int i = 0; i < n; i++) {
        out += " " + particles[i].toString();
    }
    return out;
}
}

```

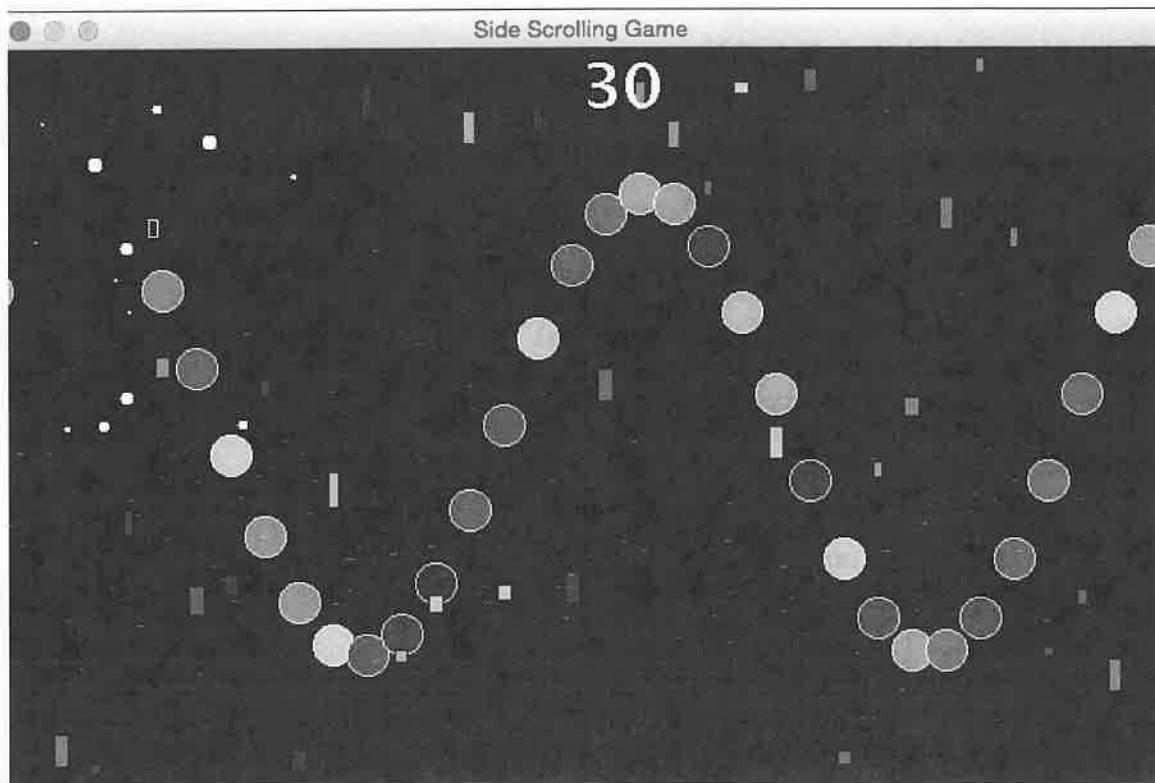
Java Project: SideScrollGame

Description: This sidescroll game challenges the player to collect certain objects while avoiding the obstacles. The added feature of the game is that it automatically gets harder as the player's score increases and gets correspondingly easier as the player's score goes down.

The collectables are colored balls, and the obstacles are rectangles. They change in size as the player earns or loses points.

The player is a small white, hollow, rectangle, controlled by the arrow keys.

Sample Output:



```

package sidescrollgame;

import java.awt.Canvas;
import java.awt.Color;
import java.awt.Font;
import java.awt.Graphics;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.awt.event.KeyAdapter;
import java.awt.event.KeyEvent;
import java.io.File;
import java.io.FileInputStream;
import java.io.InputStream;
import java.util.ArrayList;
import java.util.Random;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.Timer;
import sun.audio.AudioData;
import sun.audio.AudioPlayer;
import sun.audio.AudioStream;
import sun.audio.ContinuousAudioDataStream;

public class SideScrollGame extends JFrame {

    public final int W = 400;
    public final int H = 400;
    public int nEvents = 0;

    public SideScrollGame() {
        JPanel canvas = new Canvas();
        add(canvas);
    }

    public class Canvas extends JPanel {

        public ArrayList<Ball> balls = new ArrayList<Ball>();
        public ArrayList<Obstacle> obstacles = new
ArrayList<Obstacle>();
        public Player player;
        public int timerRate = 10;
        public int spawnSpacing = 20;
        public double maxBallRadius = 12.0;
        public double minBallRadius = 12.0;
        public int minObstacleW = 5;
        public int maxObstacleW = 10;
        public int minObstacleH = 5;
        public int maxObstacleH = 20;
        public double speed = 1.0;

        public double f = 0.3;
        private InputStream in;
        public int score = 0;
        int ballHitPoints = 10;
    }
}

```

```

int obstacleHitPoints = 20;

//for the explosion, we need "debris":
public int nDebris = 20;
public Color debrisColor = Color.WHITE;
public double[] debrisX = new double[nDebris];
public double[] debrisY = new double[nDebris];
public double[] debrisDX = new double[nDebris];
public double[] debrisDY = new double[nDebris];
public double[] debrisR = new double[nDebris];
public boolean[] isActive = new boolean[nDebris];

public Canvas() {
    initializeBalls();
    initializePlayer();
    resetDebris();
    Timer timer = new Timer(timerRate, new TimerListener());
    timer.start();
    //playes an audio file:
    playSound("audio/DeadlySkirmish(loop).wav");

    addKeyListener(new KeyAdapter() {
        public void keyPressed(KeyEvent e) {
            switch (e.getKeyCode()) {
                case 37://left arrow
                    player.dx = -player.speed;
                    break;
                case 39://right arrow
                    player.dx = +player.speed;
                    break;
                case 38://up arrow
                    player.dy = -player.speed;
                    break;
                case 40: //down arrow
                    player.dy = +player.speed;
                    break;
                default:
                    // keyChar = e.getKeyChar();
            }
        }
    });

    public void keyReleased(KeyEvent e) {
        switch (e.getKeyCode()) {
            case 37:
                player.dx = 0;
                player.dy = 0;
                break;
            case 39:
                player.dx = 0;
                player.dy = 0;
                break;
            case 38:
                player.dy = 0;
                player.dx = 0;
        }
    }
}

```

```

                break;
            case 40:
                player.dy = 0;
                player.dx = 0;
                break;
            default:
                //keyChar = e.getKeyChar();
            }
        }
    });
    setFocusable(true);
}

protected void paintComponent(Graphics g) {
    super.paintComponent(g);
    setBackground(Color.black);
    if (nEvents % spawnSpacing == 0) {
        spawnBall();
        spawnObstacle();
    }
    setMaxObstacleHeight();
    updatePlayer();
    updateBalls();
    updateObstacles();
    updateDebris();
    if (collision()) {
        explosion();
    }
    drawPlayer(g);
    drawBalls(g);
    drawObstacles(g);
    drawDebris(g);
    drawScore(g);
}

public void setMaxObstacleHeight() {
    //an ad-hoc way to make the game harder as the player
    get more points:
    if (score < 100) {
        maxObstacleH = getHeight() / 20;
        setBallRadius(maxBallRadius);
    }
    if (score < 0) {
        maxObstacleH = minObstacleH + 1;
        setBallRadius(2 * maxBallRadius);
    }

    if (score < -50) {
        maxObstacleH = minObstacleH + 1;
        setBallRadius(4 * maxBallRadius);
    }
    if (score > 100) {
        maxObstacleH = getHeight() / 10;
        setBallRadius(maxBallRadius / 2);
    }
}

```

```

        }
        if (score == 100) {
            //playSound("audio/Coin_Pick_Up_03.wav");
            //playSound("audio/bullet.wav");
        }
        if (score > 200) {
            maxObstacleH = getHeight() / 5;
            setBallRadius(maxBallRadius / 3);
        }
        if (score == 200) {
            //playSound("audio/Coin_Pick_Up_03.wav");
            //playSound("audio/miss2.wav");
        }

        if (score > 300) {
            maxObstacleH = getHeight() / 2;
            setBallRadius(maxBallRadius / 4);
        }
        if (score == 300) {
            //playSound("audio/Coin_Pick_Up_03.wav");
            //playSound("audio/hit2.wav");
        }
        if (score > 400) {
            maxObstacleH = getHeight() / 2;
            setBallRadius(maxBallRadius / 6);
        }
        if (score == 400) {
            //playSound("audio/Coin_Pick_Up_03.wav");
            playSound("audio/hit2.wav");
        }
    }

    public void drawScore(Graphics g) {
        Font f = new Font("New Courier", Font.BOLD, 36);
        g.setColor(Color.white);
        g.setFont(f);
        g.drawString(" " + score, getWidth() / 2, f.getSize());
    }

    public boolean collision() {
        boolean return_value = false;
        for (int i = balls.size() - 1; i > -1; i--) {
            double distance = Math.sqrt((player.x -
balls.get(i).x) * (player.x - balls.get(i).x)
                + (player.y - balls.get(i).y) * (player.y -
balls.get(i).y));
            if (distance <= player.h / 2 + balls.get(i).r) {
                return_value = true;
                balls.remove(i);
                playSound("audio/hit2.wav");
                score += ballHitPoints;
            }
        }
    }
}

```

```

        for (int i = obstacles.size() - 1; i > -1; i--) {

            boolean xAxis = intervalOverlap(
                player.x - player.w / 2,
                player.x + player.w / 2,
                obstacles.get(i).x - obstacles.get(i).w / 2,
                obstacles.get(i).x + obstacles.get(i).w / 2
            );

            boolean yAxis = intervalOverlap(
                player.y - player.h / 2,
                player.y + player.h / 2,
                obstacles.get(i).y - obstacles.get(i).h / 2,
                obstacles.get(i).y + obstacles.get(i).h / 2
            );

            if (xAxis && yAxis) {
                return_value = true;
                obstacles.remove(i);
                playSound("audio/miss2.wav");
                score -= obstacleHitPoints;
            }
        }

        return return_value;
    }

    public boolean intervalOverlap(double a, double b, double c,
double d) {
        if ((c > a && c < b) || (d > a && d < b)) {
            return true;
        } else if (c < a && d > b) {
            return true;

        } else {
            return false;
        }
    }

    private void playSound(String fileName) {
        try {
            in = new FileInputStream(new File(fileName));
            AudioStream audioStream = new AudioStream(in);
            AudioPlayer.player.start(audioStream);

        } catch (Exception e) {
            System.out.println("problem with sound effect: " +
fileName);
        }
    }

    private void playBackgroundSound(String fileName) {
        sun.audio.ContinuousAudioDataStream loop = null;
        AudioStream audioStream;

```

```

        AudioData AD;
        try {//note: this does not work with a larger than 1MB
file:
        //It will not make a data object from audio streams
        //using a file larger than 1 MB.
        //input stream:
        in = new FileInputStream(new File(fileName));
        audioStream = new AudioStream(in);
        AD = audioStream.getData();
        loop = new ContinuousAudioDataStream(AD);

    } catch (Exception e) {
        System.out.println("problem with sound effect: " +
fileName);
        System.out.println("error: " + e.toString());
    }
    AudioPlayer.player.start(loop);
}

public void drawPlayer(Graphics g) {
    g.setColor(player.color);
    g.drawRect((int) (player.x - player.w / 2), (int)
(player.y - player.h / 2), (int) player.w, (int) player.h);
}

public void updatePlayer() {

    player.x += player.dx;
    player.y += player.dy;
    if (player.x < player.w / 2) {
        player.x = player.w / 2;
    }

    if (player.x > getWidth() - player.w / 2) {
        player.x = getWidth() - player.w / 2;
    }

    if (player.y < player.h / 2) {
        player.y = player.h / 2;
    }

    if (player.y > getHeight() - player.h / 2) {
        player.y = getHeight() - player.h / 2;
    }
}

public void initializePlayer() {
    player = new Player();
    player.w = 5;
    player.h = 10;
    player.x = player.w / 2.0;
    player.y = H / 2.0;
    player.dx = 0;
    player.dy = 0;
}

```

```

        player.speed = 1;
        player.color = Color.white;
    }

    public void spawnBall() {
        Ball b = new Ball();
        double t = nEvents * timerRate / 1000.0;
        double A = getHeight() / 3.0 - maxBallRadius;
        b.r = minBallRadius + (maxBallRadius - minBallRadius) *
Math.random();
        b.x = getWidth();
        b.y = getHeight() / 2.0 - A * Math.sin(2 * Math.PI * f *
t);
        b.speed = speed;
        b.dx = -b.speed;
        b.dy = 0.0;
        b.color = getRandomColor();
        balls.add(b);
    }

    public void spawnObstacle() {
        Obstacle obstacle = new Obstacle();
        obstacle.x = getWidth();
        obstacle.y = getRandom(0, getHeight());
        obstacle.color = getRandomColor();
        obstacle.speed = speed;
        obstacle.dx = -obstacle.speed;
        obstacle.dy = 0;
        obstacle.w = (double) getRandom(minObstacleW,
maxObstacleW);
        obstacle.h = (double) getRandom(minObstacleH,
maxObstacleH);
        obstacles.add(obstacle);
    }

    public Color getRandomColor() {
        Random r = new Random();
        return new Color(r.nextInt(256), r.nextInt(256),
r.nextInt(256));
    }

    public void drawBalls(Graphics g) {
        for (Ball b : balls) {
            g.setColor(b.color);
            g.fillOval((int) (b.x - b.r), (int) (b.y - b.r),
(int) (2 * b.r), (int) (2 * b.r));
            g.setColor(Color.white);
            g.drawOval((int) (b.x - b.r), (int) (b.y - b.r),
(int) (2 * b.r), (int) (2 * b.r));
        }
    }

    public void setBallRadius(double r) {
        for (Ball b : balls) {

```

```

        b.r = r;
    }
}

public void drawObstacles(Graphics g) {
    for (Obstacle obstacle : obstacles) {
        g.setColor(obstacle.color);
        g.fillRect(
            (int) (obstacle.x - obstacle.w / 2),
            (int) (obstacle.y - obstacle.h / 2),
            (int) obstacle.w,
            (int) obstacle.h
        );
        g.setColor(Color.black);
        g.drawRect(
            (int) (obstacle.x - obstacle.w / 2),
            (int) (obstacle.y - obstacle.h / 2),
            (int) obstacle.w,
            (int) obstacle.h
        );
    }
}

public void updateBalls() {
    for (int i = balls.size() - 1; i > -1; i--) {
        balls.get(i).x += balls.get(i).dx;
        if (balls.get(i).x <= -balls.get(i).r) {
            balls.remove(i);
        }
    }
}

public void updateObstacles() {
    for (int i = obstacles.size() - 1; i > -1; i--) {
        obstacles.get(i).x += obstacles.get(i).dx;
        if (obstacles.get(i).x <= -obstacles.get(i).w) {
            obstacles.remove(i);
        }
    }
}

public void initializeBalls() {
    Ball b = new Ball();
    b.r = maxBallRadius;
    b.x = W;
    b.y = H / 2.0;
    b.speed = 5.0;
    b.dx = -b.speed;
    b.dy = 0.0;
    balls.add(b);
}

public void initializeObstacles() {
    Obstacle obstacle = new Obstacle();
}

```

```

        obstacle.x = getWidth();
        obstacle.y = getRandom(0, getHeight());
        obstacle.speed = 5.0;
        obstacle.dx = -obstacle.speed;
        obstacle.dy = 0.0;
        obstacle.w = (double) getRandom(minObstacleW,
maxObstacleW);
        obstacle.h = (double) getRandom(minObstacleH,
maxObstacleH);
        obstacle.color = Color.black;
        obstacles.add(obstacle);
    }

    public void explosion() {
        for (int i = 0; i < nDebris; i++) {
            isActive[i] = true;
        }
        for (int i = 0; i < nDebris; i++) {
            debrisX[i] = player.x;
            debrisY[i] = player.y;
            debrisDX[i] = 10 * Math.random() - 5;
            debrisDY[i] = 10 * Math.random() - 5;
            debrisR[i] = 5 * Math.random();
        }
    }

    public void resetDebris() {
        for (int i = 0; i < nDebris; i++) {
            isActive[i] = false;
        }
    }

    public void updateDebris() {
        for (int i = 0; i < nDebris; i++) {
            if (debrisX[i] - debrisR[i] <= 0
                || debrisX[i] + debrisR[i] >= W) {
                isActive[i] = false;
            }
            if (debrisY[i] + debrisR[i] >= H
                || debrisY[i] - debrisR[i] <= 0) {
                isActive[i] = false;
            }
            debrisX[i] += debrisDX[i];
            debrisY[i] += debrisDY[i];
        }
    }

    public void drawDebris(Graphics g) {
        for (int i = 0; i < nDebris; i++) {
            if (isActive[i]) {
                g.setColor(debrisColor);
                g.fillOval((int) (debrisX[i] - debrisR[i]),
                           (int) (debrisY[i] - debrisR[i]),
                           (int) (2 * debrisR[i]),

```

```

                (int) (2 * debrisR[i]));
            }
        }
    }

    public int getRandom(int p, int q) {
        Random r = new Random();
        return p + r.nextInt(q - p);
    }

    public class TimerListener implements ActionListener {

        public void actionPerformed(ActionEvent e) {
            nEvents++;
            repaint();
        }
    }

    public static void main(String[] args) {
        JFrame frame = new SideScrollGame();
        frame.setTitle("Side Scrolling Game");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        //frame.setLocationRelativeTo(null);
        frame.setSize(400, 400);
        frame.setVisible(true);
    }
}

///////////

```

```

package sidescrollgame;

import java.awt.Color;

public class Ball {
    public double x;
    public double y;
    public double dx;
    public double dy;
    public double speed;
    public double r;
    public Color color;
    public boolean visible;

    public Ball(){
        x = 0;
        y = 0;
        dx = 0;
        dy = 0;
        speed = 0;
        r = 1.0;
    }
}

```

```

        color = Color.red;
        visible = true;
    }
}
///////////////////////////////
package sidescrollgame;

import java.awt.Color;

public class Obstacle {

    public double x;
    public double y;
    public double dx;
    public double dy;
    public double speed;
    public Color color;
    public boolean visible;
    public double w;
    public double h;

    public Obstacle() {
        x = 0;
        y = 0;
        dx = 0;
        dy = 0;
        speed = 0;
        color = Color.red;
        visible = true;
        w = 1;
        h = 1;
    }
}
///////////////////////////////

package shootinggamenew;

import java.awt.Color;
import java.awt.Graphics;

public class ParticleSystem {

    Particle[] particles;
    public double maxR = 5;
    public double maxSpeed = 5;
    public int n;
    public String name = "";

    ParticleSystem(int n, double x, double y) {
        this.n = n;
        particles = new Particle[n];
        for (int i = 0; i < n; i++) {
            particles[i] = new Particle();
            particles[i].isActive = false;
    }
}

```

```

        particles[i].x = x;
        particles[i].y = y;
        particles[i].dx = 2 * maxSpeed * Math.random() -
maxSpeed;
        particles[i].dy = 2 * maxSpeed * Math.random() -
maxSpeed;
        particles[i].r = maxR * Math.random();
        particles[i].name = this.name;
    }
}

public void setColor(Color c) {
    for (int i = 0; i < n; i++) {
        particles[i].color = c;
    }
}

public void draw(Graphics g) {
    for (int i = 0; i < n; i++) {
        if (particles[i].isActive) {
            particles[i].draw(g);
        }
    }
}

public void reset(double x, double y) {

    for (int i = 0; i < n; i++) {
        particles[i] = new Particle();
        particles[i].isActive = true;
        particles[i].x = x;
        particles[i].y = y;
        particles[i].dx = 2 * maxSpeed * Math.random() -
maxSpeed;
        particles[i].dy = 2 * maxSpeed * Math.random() -
maxSpeed;
        particles[i].r = maxR * Math.random();
        particles[i].name = this.name;
    }
}

public void update() {
    for (Particle p : particles) {
        p.update();
    }
}

public String toString() {
    String out = "";
    for (int i = 0; i < n; i++) {
        out += " " + particles[i].toString();
    }
    return out;
}

```

Java Project: MadLib5

Description: This program mimics the classical “Mad-Lib” game. But instead of having the player choose words from certain categories, the computer uses lists of possible words and substitutes them in specified places in the original literature.

The setup begins by selecting a piece of literature (original text) and then tagging certain words for replacement. The tags are associated with files containing possible substitutions.

After the original file is “tagged”, the tagged version is referred to as the “Template”. The computer program runs through the template file looking for tags. When a tag is found, a random word is chosen from the corresponding options file, and then substituted for the tagged word. The final output is referred to as the “mad-lib” version of the original text.

The “tags.txt” file lists all the possible tags that might be found in the template file. There is a file for each tag that lists all the words than can be substituted for that tag.

For example, the tags.txt file might contain such words as:

aching
adjective
adverb
amount
animal
another
bands

And, the template file might have something like:

The <aching> feeling was <adjective> to the <bands> of the <animal> etc.

The program will detect the tagged word <aching> and then look for a file with that name (aching.txt), which might look like this:

aching
shaking
throbbing
singing
yelling
hearing
seeing
being
having
etc.

Each of the listed words in the aching.txt file can be substituted for the tagged word.

The same process is followed for each of the tags found in the template file.

As you can see, the words in aching.txt are not necessarily synonyms, and in fact might be antonyms, or any other word that might substitute for the original tagged word in any way the user wants to allow or imagine.

This program therefore relies on several additional text files that list the tags and tag substitutions.

For a given piece of literature (original text) , the user must decide where to place tags to create the template file. And, the user must define a text file for each tag.

This project was easy when I first starting using grammatical tags such as <noun> and <adjective> and became more challenging, and more fun, when I extended it to tags that capture semantic variations.

Here are two sample outputs (A Christmas Carol and The Raven):
Original piece of Literature:

Mad Lib

MadLibs Originals



Marley was dead: to begin with. There is no doubt whatever about that. The register of his burial was signed by the clergyman, the clerk, the undertaker, and the chief mourner. Scrooge signed it: and Scrooge's name was good upon 'Change, for anything he chose to put his hand to. Old Marley was as dead as a door-nail. Mind! I don't mean to say that I know, of my own knowledge, what there is particularly dead about a door-nail. I might have been inclined, myself, to regard a coffin-nail as the deadliest piece of ironmongery in the trade. But the wisdom of our ancestors is in the simile; and my unhallowed hands shall not disturb it, or the Country's done for. You will therefore permit me to repeat, emphatically, that Marley was as dead as a door-nail.

A Christmas Carol

Madlib Version:

Mad Lib

MadLibs Originals



Dewayne was sad: to begin with. There is no Sadness whatever about that. The chopping_block of the hanger was signed by the Surveyor, the Psychologist, the Teacher, and the chief Accountant. Even Scrooge signed it: and Scrooge's name was atrocious upon DVD_player, for anything he chose to put a senses to. No doubt about it, old Malena was as thoughtful as a bar_accessory. Mind! I don't mean to say that I know, of my own knowledge, what there is particularly late about a door-nail. I might have been inclined, myself, to regard a coffin-nail as the deadliest piece of ironmongery in the trade. But the wisdom of our ancestors is in the simile: and my unhallowed hands shall not disturb it, or the Country's done for. You will therefore permit me to repeat, emphatically, that Marley was as dead as a door-nail.

A Christmas Carol

Original text:

Mad Lib

MadLibs Originals

Once upon a midnight dreary, while I pondered, weak and weary,
Over many a quaint and curious volume of forgotten lore,
While I nodded, nearly napping, suddenly there came a tapping,
As of some one gently rapping, rapping at my chamber door.
"Tis some visitor," I muttered, "tapping at my chamber door-
Only this, and nothing more."



The Raven

Madlib version:

Mad Lib

MadLibs Originals

Once upon a daylight distressful , while I reasoned flimsy and feeble ,
Over many a aberrant and bizarro volume of miserable lore .
While I sang , nearly milking , suddenly there came a wheezing ,
As of some one gently pulsing , drumming at my Dutch_door .
"Tis some mechanic , " I gasped , " crashing at my doggy_door -
Only this and nothing more."



The Raven

```
package madlib5;

import java.awt.BorderLayout;
import java.awt.Font;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
import java.io.File;
import java.io.FileNotFoundException;
import java.util.ArrayList;
import java.util.Scanner;
import java.util.logging.Level;
import java.util.logging.Logger;
```

```

import javax.swing.ImageIcon;
import javax.swing.JFrame;
import javax.swing.JMenu;
import javax.swing.JMenuBar;
import javax.swing.JMenuItem;

public class MadLib5 extends JFrame {

    private StoryPanel storyPanel = new StoryPanel();
    private String[] fullName = new String[]{"Friendship", "I Loved", "Declaration of Independence", "Not in Vain", "The Raven", "A Christmas Carol", "The Tiger", "The Great Gatsby", "Where the Sidewalk Ends", "The Road Not Taken", "How a Toilet Works", "Tale of Two Cities"};
    private String[] shortName = new String[] {"Friendship", "Loved", "Declaration", "Vain", "Raven", "Christmas", "Tiger", "Gatsby", "Sidewalk", "Road", "Toilet", "Tale"};
    private String[] author = new String[] {"Lucius Seneca", "Langston Hughes", "Ben Franklin", "Emily Dickinson", "Edgar Allan Poe", "Charles Dickens", "William Blake", "F. Scott Fitzgerald", "Shel Silverstein", "Robert Frost", "How Stuf Works", "Charles Dickens"};
    public char[] madlibsShortcuts = {'F', 'L', 'N', 'V', 'R', 'O', 'T', 'G', 'S', 'D', 'Q', 'H', 'C'};
    public char[] originalsShortcuts = {'F', 'L', 'N', 'V', 'R', 'O', 'T', 'G', 'S', 'D', 'Q', 'H', 'C'};
    public String storyTemplateFile = "";
    public String storyTitle = "";
    public String story = "";
    public static ArrayList<String> tags = new ArrayList<String>();

    public static void main(String[] args) throws FileNotFoundException {
        MadLib5 frame = new MadLib5();
        frame.pack();
        frame.setTitle("Mad Lib");
        frame.setSize(800, 400);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setVisible(true);
    }

    public MadLib5() throws FileNotFoundException {
        //read all the tags into an array list:
        Scanner fileScanner = new Scanner(new File("tags.txt"));
        while (fileScanner.hasNext()) {
            tags.add(fileScanner.next());
        }
        fileScanner.close();

        //initialize the display so the first story pops up at start:
        storyTitle = fullName[0];
        storyTemplateFile = shortName[0] + "Original.txt";
        String story = getStory(storyTemplateFile);
    }
}

```

```

        storyPanel.setImageIcon(new ImageIcon("images/" +
shortName[0] + ".jpg"));
        storyPanel.setTitle(storyTitle);
        storyPanel.setStory(story);
        setLayout(new BorderLayout());
        add(storyPanel, BorderLayout.CENTER);

        //Now, build the menu bar and selections:
        JMenuBar myMenuBar = new JMenuBar();
        //use this listener for all the menu selections:
        MenuListener myListener = new MenuListener();
        //first menu, for the madlibs:
        JMenu madlibs = new JMenu("MadLibs");
        for (int i = 0; i < fullName.length; i++) {
            JMenuItem item = new JMenuItem(fullName[i] + "
(MadLib)", madlibsShortcuts[i]);
            item.addActionListener(myListener);
            madlibs.add(item);
        }
        //add the "quit" option to the first file menu:
        JMenuItem item = new JMenuItem("Quit",
madlibsShortcuts[fullName.length]);
        item.addActionListener(new MenuListener());
        madlibs.add(item);
        myMenuBar.add(madlibs);

        //second menu, for the originals:
        JMenu originals = new JMenu("Originals");
        for (int i = 0; i < fullName.length; i++) {
            item = new JMenuItem(fullName[i] + " (Original)",
originalsShortcuts[i]);
            item.addActionListener(myListener);
            originals.add(item);
        }
        myMenuBar.add(originals);
        setJMenuBar(myMenuBar);
    }

    class MenuListener implements ActionListener {

        @Override
        public void actionPerformed(ActionEvent e) {
            //if the selection is "quit", then exit the program:
            if (e.getActionCommand().equals("Quit")) {
                System.exit(0);
            }
            //if not "quit", then see which story was selected:
            for (int i = 0; i < fullName.length; i++) {
                //check which story name matches the selected item:
                if (e.getActionCommand().indexOf(fullName[i]) == 0)
{
                    try {
                        //If the selection has "(MadLib)" in the
text, then

```

```

                //set the storyTemplateFile to the template
for
                //that story: (else, set it to the original
story)
                if (e.getActionCommand().indexOf("(MadLib)") >= 0) {
                        storyTemplateFile = shortName[i] +
"Template.txt";
                } else {
                        storyTemplateFile = shortName[i] +
"Original.txt";
                }
                storyPanel.setImageIcon(new
 ImageIcon("images/" + shortName[i] + ".jpg"));
                storyTitle = fullName[i];
                storyPanel.setTitle(storyTitle);
                story = getStory(storyTemplateFile);
                storyPanel.setStory(story);
            } catch (Exception ex) {
                System.out.println("exception: " +
ex.toString());
                System.out.println("could not implement: " +
fullName[i]);
            }
        }
    }
}

public static String getStory(String templateFile) throws
FileNotFoundException {
    String story = "";
    String template = getTemplate(templateFile);
    Scanner scanner = new Scanner(template);
    int wordCount = 0; //might want to count the words

    while (scanner.hasNext()) {
        String word = scanner.next();
        wordCount++;

        //check the word against each of the tags
        for (int i = 0; i < tags.size(); i++) {
            //the new line tag is special:
            if (word.equals("<endl>")) {
                word = "\n";
            } else {
                //if the word matches one of the tags
                //then get a random word from the relevant file:
                if (word.equals("<" + tags.get(i) + ">")) {
                    word = getRandomWord(tags.get(i));
                }
            }
        }
    }
}

```

```

        story += word + " ";
    }
    scanner.close();
    return story;
}

public static String getTemplate(String fileName) throws
FileNotFoundException {
    //read the story template from a file:
    String template = "";
    //System.out.println("fileName = " + fileName);
    File f = new File(fileName);
    //System.out.println("file exists(): " + f.exists());
    //System.out.println("file canRead(): " + f.canRead());
    //System.out.println("file length(): " + f.length());
    //System.out.println("file canExecute: " + f.canExecute());
    //System.out.println("file getAbsoluteFile" +
f.getAbsoluteFile());

    Scanner fileScanner = new Scanner(f, "ISO-8859-1");

    //System.out.println("fileScanner.hasNext(): " +
fileScanner.hasNext());
    while (fileScanner.hasNext()) {
        // System.out.println("scanning a line of the file");
        template += fileScanner.nextLine();
    }
    fileScanner.close();
    //System.out.println("template = " + template);
    return template;
}

public static String getRandomWord(String category) throws
FileNotFoundException {
    //This method gets a random word from the file
    //defined by category --> category.txt
    File file = new File(category + ".txt");
    Scanner fileScanner = new Scanner(file);
    //Now, copy all the words from the file into an array list:
    ArrayList<String> words = new ArrayList<String>();
    while (fileScanner.hasNext()) {
        String word = fileScanner.next();
        words.add(word);
        if (fileScanner.hasNext()) {
            fileScanner.nextLine();
        }
    }
    //pick a random number up to the number of words in the
list:
    int rand = (int) (words.size() * Math.random());
    //return the word at the random index:
    return words.get(rand);
}
}

```

```

//////////



/*
 * To change this license header, choose License Headers in Project
Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */

package madlib5;

import java.awt.BorderLayout;
import java.awt.Font;
import javax.swing.ImageIcon;
import javax.swing.JLabel;
import javax.swing.JPanel;
import javax.swing.JScrollPane;
import javax.swing.JTextArea;

/**
 *
 * @author wwolf3
 */
public class StoryPanel extends JPanel {

    private JLabel imageTitle = new JLabel();
    private JTextArea jtaStory = new JTextArea();

    public StoryPanel() {
        imageTitle.setHorizontalAlignment(JLabel.CENTER);
        imageTitle.setHorizontalTextPosition(JLabel.CENTER);
        imageTitle.setVerticalTextPosition(JLabel.BOTTOM);
        imageTitle.setFont(new Font("SansSerif", Font.BOLD, 20));
        jtaStory.setFont(new Font("Serif", Font.PLAIN, 16));
        jtaStory.setLineWrap(true);
        jtaStory.setWrapStyleWord(true);
        jtaStory.setEditable(false);
        jtaStory.setSize(350, 250);

        JScrollPane scrollPane = new JScrollPane(jtaStory);
        setLayout(new BorderLayout(5,5));
        add(scrollPane, BorderLayout.CENTER);
        add(imageTitle, BorderLayout.WEST);
    }

    public void setTitle(String title) {
        imageTitle.setText(title);
    }

    public void setImageIcon(ImageIcon icon) {
        imageTitle.setIcon(icon);
    }
}

```

```
    public void setStory(String story) {
        jtaStory.setText(story);
    }
}
//////////
```

Marley was dead: to begin with. There is no doubt whatever about that. The register of his burial was signed by the clergyman, the clerk, the undertaker, and the chief mourner. Scrooge signed it: and Scrooge's name was good upon 'Change, for anything he chose to put his hand to. Old Marley was as dead as a door-nail. Mind! I don't mean to say that I know, of my own knowledge, what there is particularly dead about a door-nail. I might have been inclined, myself, to regard a coffin-nail as the deadeast piece of ironmongery in the trade. But the wisdom of our ancestors is in the simile; and my unhallowed hands shall not disturb it, or the Country's done for. You will therefore permit me to repeat, emphatically, that Marley was as dead as a door-nail.

```

//////////
<name> was <stateofbeing> : to begin with. There is no
<nounAbstract> whatever about that. The <randomstuff> of the
<randomstuff> was signed by the <profession> , the <profession> ,
the <profession> , and the chief <profession> . Even Scrooge signed
it: and Scrooge's name was <quality> upon <randomstuff> , for
anything he chose to put a <bodypart> to. No doubt about it, old
<name> was as <stateofbeing> as a <randomstuff> . Mind! I don't mean
to say that I know, of my own knowledge, what there is particularly
<dead> about a door-nail. I might have been inclined, myself, to
regard a coffin-nail as the deadeast piece of ironmongery in the
trade. But the wisdom of our ancestors is in the simile; and my
unhallowed hands shall not disturb it, or the Country's done for.
You will therefore permit me to repeat, emphatically, that Marley
was as dead as a door-nail.
```

```

//////////
name.txt:
```

Greta
Weston
Kristan
Eilene
Quyen
Valentin
Verdie
Venice
Sandie
Kirstie
Freeda
Gita
Geraldine

...
...
//////////
tags.txt:

aching
adjective
adverb
amount
animal
another
bands
bendPast
bodypart
breaking
breaking
candy
causes
chemical
color
container
cool
dead
declare
dissolve
divergeP
divergePast
door
dreary
earth
ease
emotion
endl
entitle
fainting
far
flushGerund
flushVerb
force
forgotten
friend
friendship
gas
gerund
health
help
human
impel
laws
liquid
live
live
location

long
lookPast
loved
mankind
midnight
mutterPast
name
nature
necessary
nest
nothing
noun
nounAbstract
nounPlural
number
object
opinions
pain
pastParticiplePassive
people
poem
political
pondered
ponderPast
pourGerund
pourPast
pourVerb
powers
process
profession
quaint
quality
randomstuff
respect
roadPlural
sat
say
separation
soft
sorry
soundGerund
standPast
stateofbeing
stop
stuff
suckGerund
suckPast
suckVerb
superlative
timeofday
timeperiod
travel

