Week 3

Exercise 1.3.5

Write a program `RollLoadedDie` that prints the result of rolling a loaded die such that the probability of getting a 1, 2, 3, 4, or 5 is $\frac{1}{8}$ and the probability of getting a 6 is $\frac{3}{8}$.

```
public class RollLoadedDie {
  public static void main(String[] args) {
    double rand8 = Math.random() * 8.;
    // floor returns double. Round gives long for double input, so conversion needed
    int random = (int)(Math.round(Math.floor(rand8)) + 1);
    // 1 - 8 to 1 - 6, with 6 receiving the probabilities of 7 - 8
    random = Math.min(random, 6);
    System.out.println(random);
  }
}
```

Listing 1: RollLoadedDie

Exercise 1.3.24

Write a program `GamblerPlot` that traces a gambler's ruin simulation by printing a line after each bet in which one asterisk corresponds to each dollar held by the gambler.

```
public class GamblerPlot {
  public static void main(String[] args) {
    // Run trials experiments that start with
    // $stake and terminate on $0 or $goal.
    int stake = Integer.parseInt(args[0]);
    int goal = Integer.parseInt(args[1]);
    double probability = 0.5;
    int bets = 0;

    // Run one experiment.
    int cash = stake;
    while (cash > 0 && cash < goal) {
      // Simulate one bet.
      bets++;
      if (Math.random() < probability)
        cash++;
      else
        cash--;

      GamblerPlot.printCash(cash);
    }

    boolean won = cash == goal;
    String wonText = won ? "Won" : "Lost";
    System.out.println();
    System.out.printf("%s after %s bets", wonText, bets);
  }

  public static void printCash(int cash) {
    for(int i = 0; i < cash; i++) {
      System.out.print("*");
    }
    System.out.println();
  }
}
```

Listing 2: GamblerPlot

Exercise 1.3.25

Modify `Gambler` to take an extra command-line argument that specifies the (fixed) probability that the gambler wins each bet. Use your program to try to learn how this probability affects the chance of winning and the expected number of bets. Try a value of p close to 0.5 (say, 0.48).

```
public class Gambler {
  public static void main(String[] args) {
    // Run trials experiments that start with
    // $stake and terminate on $0 or $goal.
    int stake = Integer.parseInt(args[0]);
    int goal = Integer.parseInt(args[1]);
    int trials = Integer.parseInt(args[2]);
    double probability = Double.parseDouble(args[3]);
    int bets = 0;
    int wins = 0;
    for (int t = 0; t < trials; t++) {
      // Run one experiment.
      int cash = stake;
      while (cash > 0 && cash < goal) {
        // Simulate one bet.
        bets++;
        if (Math.random() < probability)
          cash++;
        else
          cash--;
      }
      // Cash is either 0 (ruin) or $goal (win).
      if (cash == goal)
        wins++;
    }
    System.out.println(100 * wins / trials + "% wins");
    System.out.println("Avg # bets: " + bets / trials);
  }
}
```

Listing 3: Gambler