CS 100: Section Assignment 8
(For the week of March 29)

Section assignments are discussed in section and are not submitted for grading. They relate to recent lecture topics and usually to the current Programming Assignment. Prelim questions are based on Section Assignments, Programming Assignments, and Lecture examples.

1. The following fragment simulates the rolling of one million dice pairs:

```
int kMax=1000000;
int D1,D2,score;
for (int k=1;k<=kMax;k++)
{
  D1 = (int)(1+Math.floor(6*Math.random()));
  D2 = (int)(1+Math.floor(6*Math.random()));
  score = D1 + D2;
  System.out.println(score);
}
```

Instead of printing the outcomes of these throws, tabulate the number of times that the dice sum to 2, 3,…, and 12. To do this, set up a length-13 array n and initialize each element to zero. Use n[j] to count the number of times that score has the value j. (It is OK not to "use" n[0] and n[1].)

2. To perform a 3-way perfect shuffle of a deck that has a 3*m* cards, you split the deck into thirds and then build the shuffled deck by taking (in turn) cards from each of the three subdecks. Thus, if the original deck is

10	20	30	40	50	60	70	80	90	100	110	120

then after the 3-way perfect shuffle we get

10	50	90	20	60	100	30	70	110	40	80	120

(m=4 in this example.) Implement in the class ArrayOps a method public static int[] shuffle3(int[]) that does this.

3. Implement in the class ArrayOps a method that takes a double real array and returns the number of array values that are strictly bigger than the average array value.

4. Implement the following methods in the class ArrayOps:

```
// Yields a reference to an array having the same length as a and whose
// ith entry is a[(i+1)%a.length].
public static int[] leftShift(int[] a)

// Yields a reference to an array having the same length as a and whose
// ith entry is a[(i+k)%a.length]. Assume k is nonnegative.
public static int[] leftShift(int[] a,int k)
```

Your implementation of the latter should make effective use of the former.

```java
// Repeated Perfect Shuffles on a length 8 array.
import java.io.*;
public class L16A
{
	public static void main(String args[])
	{
	    TokenReader in = new TokenReader(System.in);
	    int[] f0 = {10,20,30,40,50,60,70,80};
	    int[] f = new int[8];
	    int[] g = new int[8];

	    f = f0;
	    ArrayOps.println(f);
	    for (int k=1;k<=3;k++)
	    {
	        g = ArrayOps.Shuffle(f);
	        f = g;
	        ArrayOps.println(f);
	    }

	    System.out.println(" ");
	    f = f0;
	    ArrayOps.println(f);
	    for (int k=1;k<=3;k++)
	    {
	        f = ArrayOps.Shuffle(f);
	        ArrayOps.println(f);
	    }

	    System.out.println(" ");
	    f = f0;
	    ArrayOps.println(f);
	    for (int k=1;k<=3;k++)
	    {
	        ArrayOps.ShuffleAlt(f);
	        ArrayOps.println(f);
	    }

	    in.waitUntilEnter();
	}
}

/* Output:

 10 20 30 40 50 60 70 80
 10 50 20 60 30 70 40 80
 10 30 50 70 20 40 60 80
 10 20 30 40 50 60 70 80

 10 20 30 40 50 60 70 80
 10 50 20 60 30 70 40 80
 10 30 50 70 20 40 60 80
 10 20 30 40 50 60 70 80

 10 20 30 40 50 60 70 80
 10 50 20 60 30 70 40 80
 10 30 50 70 20 40 60 80
 10 20 30 40 50 60 70 80

*/
```

```java
public class ArrayOps
{

      // Yields a reference to an array whose values are obtained by
      // performing a perfect shuffle of a. Assumes that a has even length.
      public static int[] Shuffle(int[] a)
      {
         int n = a.length;
         int m = n/2;
         int[] b = new int[n];
         for(int i=0;i<m;i++)
         {
            b[2*i]   = a[i];
            b[2*i+1] = a[i+m];
         }
         return b;
      }

      // Perfect shuffles the entries in a. Assumes that a has even length.
      public static void ShuffleAlt(int[] a)
      {
         int n = a.length;
         int m = n/2;
         int[] b = new int[n];
         for(int i=0;i<m;i++)
         {
            b[2*i]   = a[i];
            b[2*i+1] = a[i+m];
         }
         for(int i=0;i<n;i++)
            a[i] = b[i];
      }

      // Prints on a single line the values in the (presumably short) array a.
      public static void println(int[] a)
      {
         int n= a.length;
         for(int k=0;k<n;k++)
            Format.print(System.out," %2d",a[k]);
         System.out.println(" ");
      }

}
```