A program is *robust* if nothing can make it crash or otherwise make it behave in an unexpected manner. For example, this code is not robust:

```
System.out.print("Age: ");
age = in.nextInt();
```

It's not robust because if the user types something other than an integer the program will throw an exception. This next one is better (though admittedly more work).

```
System.out.print("Age: ");
if (in.hasNextInt()) {
    age = in.nextInt();
} else {
    System.out.println("Input error. I'll assume 20!");
    age = 20;
}
in.nextLine();   // Flush rest of line typed by the user
```

Two things to note here. First, nothing the user types can make this program misbehave, so it's robust. Second, the nextLine call removes any remaining tokens from the input buffer that the user typed before hitting <enter>. Keeping the input buffer tidy can help keep a program robust.

1) Think of an input the user could type that would cause the following code to misbehave.

```
System.out.print("First name: ");
String first = in.next();
System.out.print("Age: ");
while (!in.hasNextInt()) {
    System.out.println("Please enter an integer.");
    System.out.print("Age: ");
}
int age = in.nextInt();
System.out.println(first + " is " + age);
```

2) Place the previous code segment in a small program. Run it with expected inputs to show that it works with good input. Run it again to demonstrate

that your input causes misbehavior.

3) Modify the program to make it robust. Each time you think you've made it robust, try again to find an input that makes it misbehave, and fix it if you do.

4) Blow is a guessing game. Is it robust? Why or why not?

5) Design using pseudocode a robust getGuess. It should only return an integer between lo and hi (inclusive). Implement and test your result.

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

public class Game {
    public static final int LO_START = 1;
    public static final int HI_START = 10;

    public static int getGuess(Scanner in, int lo, int hi) {
        System.out.print("Enter a number between " +
            lo + " and " + hi + ": ");
        return in.nextInt();
    }

    public static void main(String[] args) {
        int lo = LO_START;
        int hi = HI_START;
        Random rand = new Random();
        Scanner in = new Scanner(System.in);
        int target = lo + rand.nextInt(hi-lo+1);
        int guess = getGuess(in, lo, hi);
        while (guess != target) {
            if (target < guess) {
                System.out.println("Too high");
                hi = guess - 1;
            } else {
                System.out.println("Too low");
                lo = guess + 1;
            }
            guess = getGuess(in, lo, hi);
        }
        System.out.println("You got it! Yay!");
    }
}
```