Interactive Programs with Scanner

reading: 3.3 - 3.4
Interactive programs

- We have written programs that print console output.

- It is also possible to read *input* from the console.
  - The user types the input into the console.
  - The program uses the input to do something.
  - Such a program is called an *interactive program*.
Interactive programs

- Interactive programs can be challenging.
  - Computers and users think in very different ways.
  - Users tend to “misbehave”.

![Interactive programs cartoon](Image)
**Scanner**

- **Scanner**: An object that can read input from many sources.
  - Communicates with `System.in`
  - Can also read from files (Ch. 6), web sites, databases, etc...

- **The Scanner class is found in the java.util package.**
  ```java
  import java.util.*; // so you can use Scanner
  ```

- **Constructing a Scanner object to read console input:**
  ```java
  Scanner name = new Scanner(System.in);
  ```

- **Example:**
  ```java
  Scanner console = new Scanner(System.in);
  ```
### Scanner methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>nextInt()</td>
<td>reads an <code>int</code> from the user and returns it</td>
</tr>
<tr>
<td>nextDouble()</td>
<td>reads a <code>double</code> from the user</td>
</tr>
<tr>
<td>next()</td>
<td>reads a one-word <code>String</code> from the user</td>
</tr>
<tr>
<td>nextLine()</td>
<td>reads a one-line <code>String</code> from the user</td>
</tr>
</tbody>
</table>

- Each method waits until the user presses Enter.
- The value typed by the user is returned.

```java
System.out.print("How old are you? ");  // prompt
int age = console.nextInt();
System.out.println("You typed " + age);
```

- **prompt**: A message telling the user what input to type.
import java.util.*;  // so that I can use Scanner

public class UserInputExample {
    public static void main(String[] args) {
        Scanner console = new Scanner(System.in);

        System.out.print("How old are you? ");
        int age = console.nextInt();

        int years = 65 - age;
        System.out.println(years + " years until retirement!");
    }
}

• Console (user input underlined):

How old are you? 12
53 years until retirement!
import java.util.*;  // so that I can use Scanner

public class ScannerMultiply {
    public static void main(String[] args) {
        Scanner console = new Scanner(System.in);
        System.out.print("Please type two numbers: ");
        int num1 = console.nextInt();
        int num2 = console.nextInt();
        int product = num1 * num2;
        System.out.println("The product is " + product);
    }
}

• Output (user input underlined):
  Please type two numbers: 8 6
  The product is 48

• The Scanner can read multiple values from one line.
Input tokens

- **token**: A unit of user input, as read by the `Scanner`.
  - Tokens are separated by *whitespace* (spaces, tabs, new lines).
  - How many tokens appear on the following line of input?
    23  John Smith  42.0  "Hello world"  $2.50  "  19"

- When a token is not the type you ask for, it crashes.
  
  ```java
  System.out.print("What is your age? ");
  int age = console.nextInt();
  ```

  Output:

  What is your age? **Timmy**
  `java.util.InputMismatchException`
  at `java.util.Scanner.nextInt(Unknown Source)`
  at `java.util.Scanner.nextInt(Unknown Source)`
  ...
Scanners as parameters

- If many methods need to read input, declare a `Scanner` in `main` and pass it to the other methods as a parameter.

```java
public static void main(String[] args) {
    Scanner console = new Scanner(System.in);
    int sum = readSum3(console);
    System.out.println("The sum is " + sum);
}

// Prompts for 3 numbers and returns their sum.
public static int readSum3(Scanner console) {
    System.out.print("Type 3 numbers: ");
    int num1 = console.nextInt();
    int num2 = console.nextInt();
    int num3 = console.nextInt();
    return num1 + num2 + num3;
}
```
Program puzzle

• Consider changing the output to include the minimum value:

Type 3 numbers: 8 6 13
The average is 9.0
The minimum value is 6

• How would we change the previous program?

public static void main(String[] args) {
    Scanner console = new Scanner(System.in);
    int sum = readSum3(console);
    double average = sum / 3.0
    System.out.println("The average is " + average);
    // What goes here?
}

public static int readSum3(Scanner console) {
    System.out.print("Type 3 numbers: ");
    int num1 = console.nextInt();
    int num2 = console.nextInt();
    int num3 = console.nextInt();
    return num1 + num2 + num3;
}
Can’t return multiple values!

import java.util.*; // so that I can use Scanner

class Average {
    public static void main(String[] args) {
        Scanner console = new Scanner(System.in);
        System.out.print("Type 3 numbers: ");
        int num1 = console.nextInt();
        int num2 = console.nextInt();
        int num3 = console.nextInt();

        double average = (num1 + num2 + num3) / 3.0;
        System.out.println("The average is " + average);
        System.out.println("The minimum value is " +
            Math.min(num1, Math.min(num2, num3)));
    }
}