

Interactive Programs with Scanner

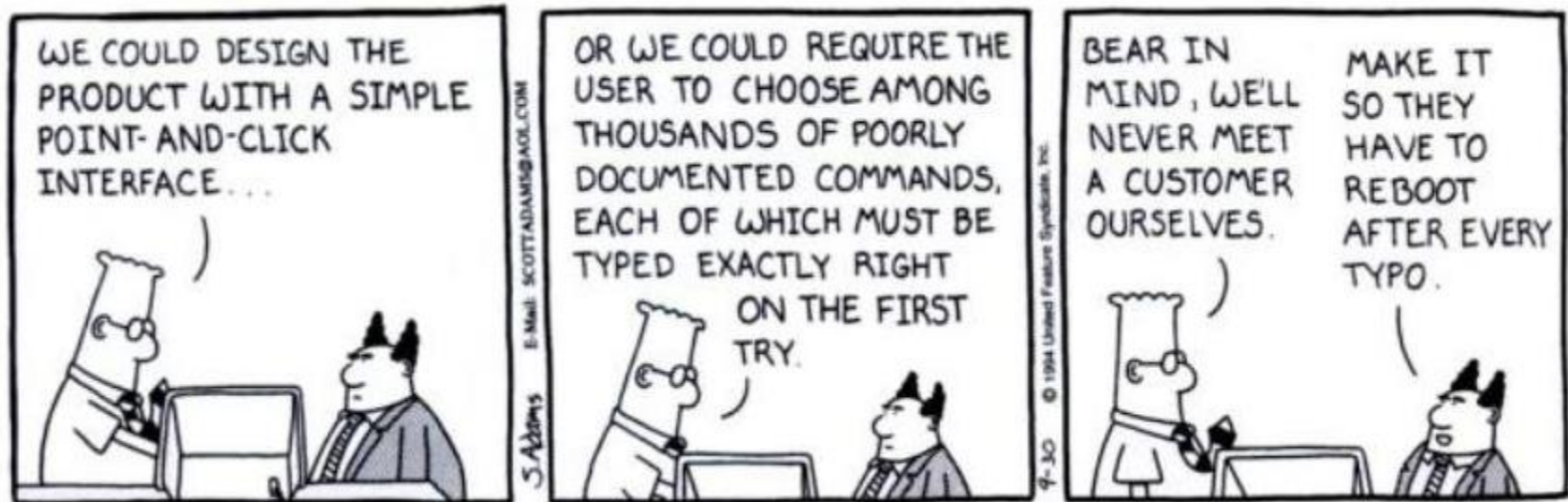
reading: 3.3 - 3.4

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”.



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.

```
import java.util.*;    // so you can use Scanner
```

- Constructing a `Scanner` object to read console input:

```
Scanner name = new Scanner(System.in);
```

- Example:

```
Scanner console = new Scanner(System.in);
```


Scanner methods

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

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

```
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.

Scanner example

```
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();
```



age

```
        int years = 65 - age;
```

```
        System.out.println(years + " years until retirement!");
```

years

```
    }
```

```
}
```

- Console (user input underlined):

```
How old are you? 12  
53 years until retirement!
```



Scanner example 2

```
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.

```
System.out.print("What is your age? ");  
int age = console.nextInt();
```

Output:

```
What is your age? Timmy  
java.util.InputMismatchException  
    at java.util.Scanner.next(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.

```
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

public 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)));
    }
}
```