Writing a Java Program (1/2)

** using our new programming skills to write a real program (and learning some new ones on the way!)
** arrays
** enhanced `for` loop

Chapter 5 (*) – “Head First Java” book

Some slides contain lots of animation.

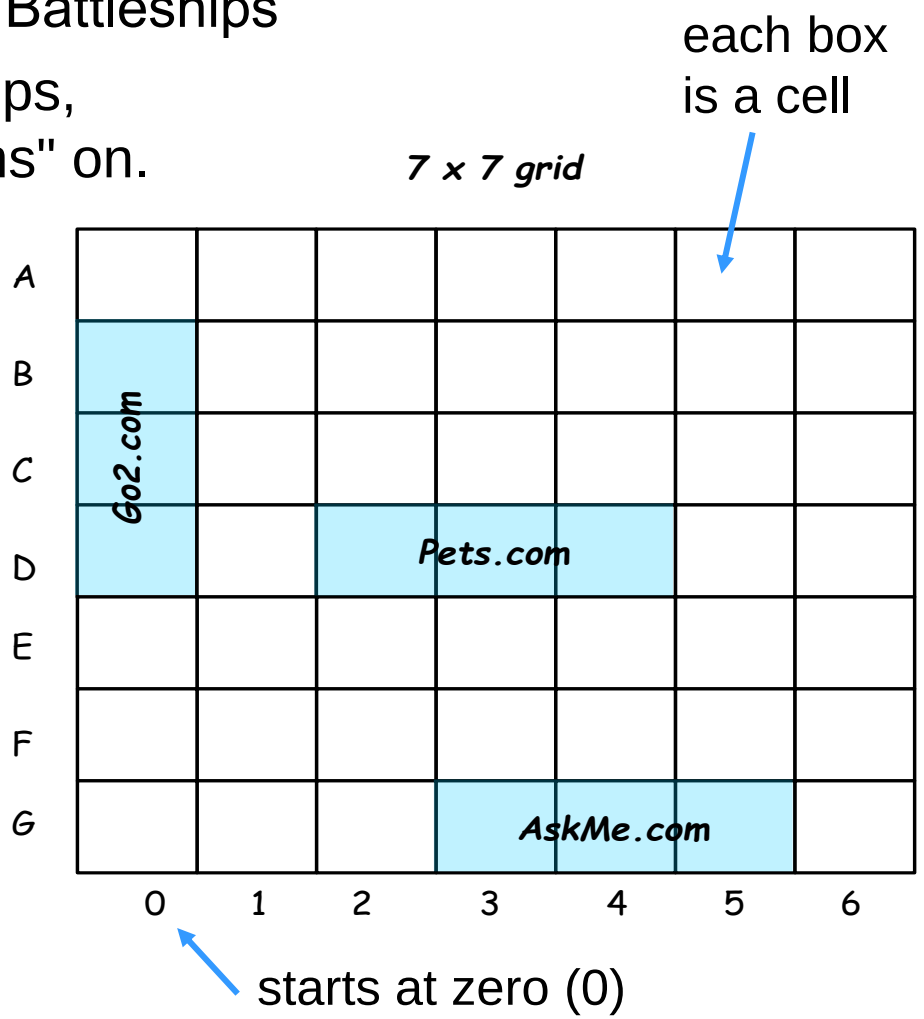
A Battleship Style Game: “Sink a Dot Com” (1/2)

Your Task:

- Build a game like the battleship guessing game.
- The basic idea of battleship is a number of ships are placed on a grid world board.
- In the board game version, there are 2 players who each have their own board.

A Battleship Style Game: “Sink a Dot Com” (2/2)

- Here, we will sink "Dot Coms“, instead of Battleships
- Just play against the computer's battleships, i.e. no board of your own to put "Dot Coms" on.



GOAL

- Sink all the computer's “Dot Coms” in the fewest number of steps/guesses.
- You are given a rating, based on how well you perform.

SETUP

- A virtual 7x7 board with 3 randomly placed “Dot Coms”.
- After that, the player should be prompted to enter their first guess.

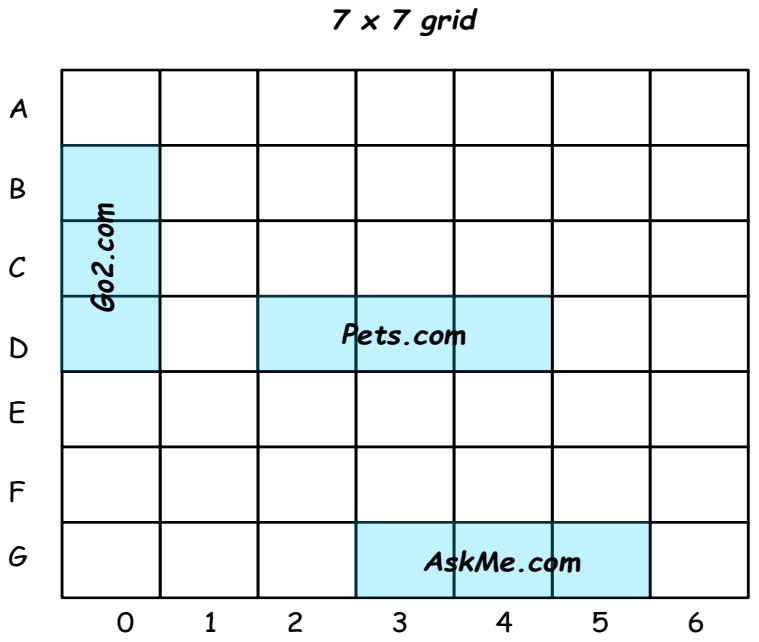
Dot Com = Company that conducts its business on the internet

"Sink a Dot Com" game: how to play and sample interaction

How to play:

- No GUI yet, as we do not know how to do that.
- Use the command line.
- Computer should prompt for a guess, and the player should enter a cell, e.g. **A3**, **C5**, etc.
- The computer should respond with hit or miss.
- After all 3 "Dot Coms" have been sunk, the game ends by printing out your rating.

```
>java DotComBust
Enter a guess  A3
miss
Enter a guess  D2
hit
Enter a guess  D3
hit
Enter a guess  D4
Ouch! You sunk Pets.com :(
kill
...
...
```

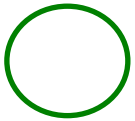


Program's high level design & Conversion to Flowchart

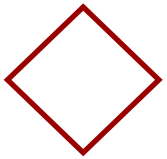
First …

- Work out the program interactions.
- Write everything in English, i.e. do not write Java code (for now).
- Define the general flow of the game, from the specification.

Then …

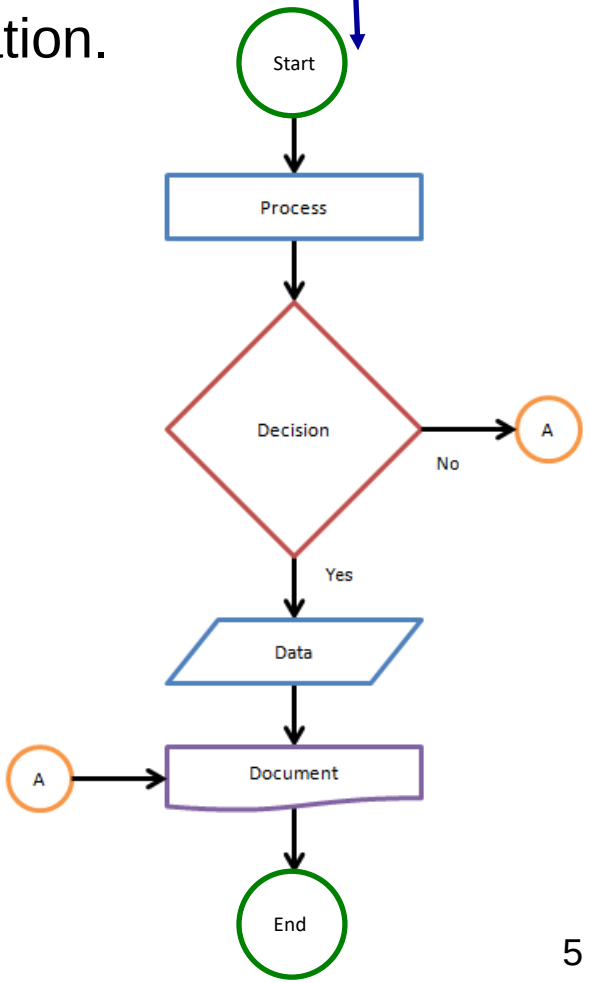


A circle means start or finish.

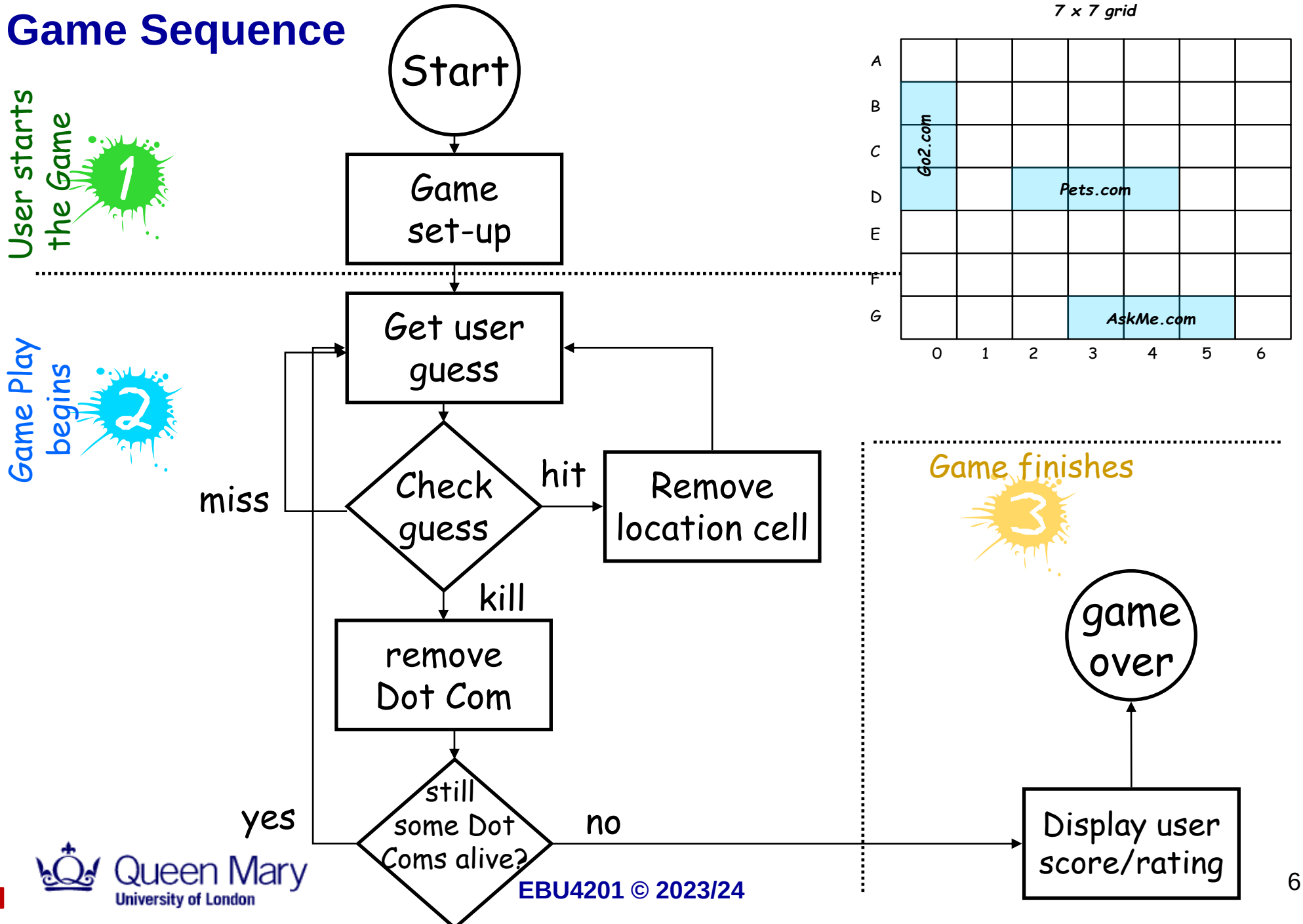


A diamond represents a decision point.

A rectangle represents an action point.

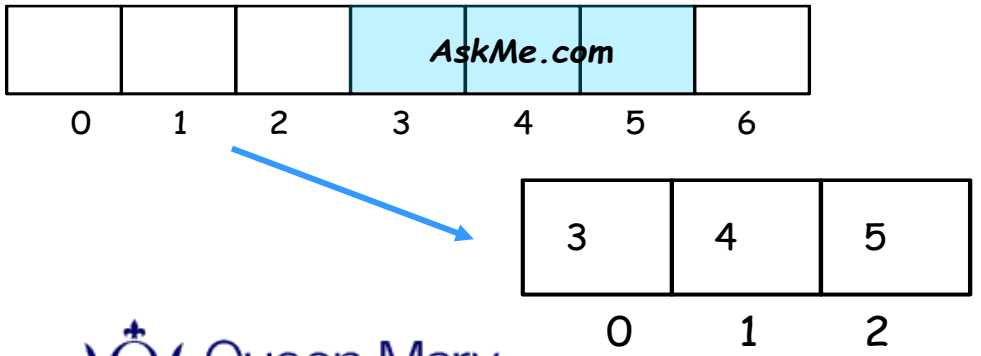


Game Sequence



Developing the classes for the “Sink a Dot Com” game

- Always try to make things simpler on the first iteration of your programs!
  - You can go back and improve what you know works ...
- An even simpler "Sink a Dot Com":
  - Only 1 “Dot Com” on the board, instead of 3.
  - No 2D grid; put the “Dot Com” just in a row.
  - The goal is still the same.



- We are going to need 2 classes (at least – see later):
  - `Game` Class
  - `DotCom` Class
- Simple version:
  - The `Game` class has no instance variables and all the "coding stuff" is in `main()`.
  - When launched, it will create 1 instance of a `DotCom` class and choose a location for it.
    - in 3 consecutive array cell locations
  - After that, play the game!

UML & Example Game Interaction

SimpleDotCom
int[] locationCells; int numberOfHits;
String checkYourself(String guess); void setLocationCells(int[] loc)

SimpleDotComGame
void main(String[] args)

A complete game interaction:

```
>java SimpleDotComGame
enter a number   3
hit
enter a number   4
hit
enter a number   2
miss
enter a number   5
kill
You took 4 guesses
```

Steps to develop a Java class (Revision)

1. Decide what the class is supposed to do.
2. List the instance variables and methods.
3. Write "prep code" for the methods.
4. Write test code for the methods.
5. Implement the class.
6. Test the methods.
7. Debug and re-implement, as necessary.

"Prep code" for `SimpleDotCom`

- A form of pseudocode, to help focus on the logic without the worry of syntax.

SimpleDotCom
int[] locationCells; int numberOfHits;
String checkYourself(String guess); void setLocationCells(int[] loc)

DECLARE an `int` array for location cells. Call it `locationCells`.

DECLARE an `int` to hold the number of hits. Call it `numberOfHits` and **SET** it to 0.

DECLARE a `checkYourself()` method that takes a `String` for the user's guess ("1", "3", etc), checks it, and returns a result representing a "hit", "miss", or "kill".

DECLARE a `setLocationCells()` setter method that takes an `int` array (which has the three cell locations as `int` values (2, 3, 4, etc.).

Methods `checkYourself()` and `setLocationCells()`

METHOD: `String checkYourself(String userGuess)`

GET the user guess as a `String` parameter

CONVERT the user guess to an `int`

REPEAT with each of the location cells in the `int` array

// **COMPARE** the user guess to the location cell

IF the user guess matches

INCREMENT the number of hits

// **FIND OUT** if it was the final location cell

IF number of hits is 3, **RETURN** "kill"

ELSE if it was not a kill, **RETURN** "hit"

ELSE the user guess did not match, so **RETURN** "miss"

END IF

END REPEAT

END METHOD

METHOD: `void setLocationCells(int[] cellLocations)`

GET the cell locations as an `int` array parameter

ASSIGN cell locations parameter to the cell location instance variable

END METHOD

Time to start coding!

- We have our **`SimpleDotCom`** class; shouldn't we just write it up and create our game?
  - No!
- We need to test it!
  - How do you test it? What would prove that it works?
  - Writing test code helps clarify what it is we want the method to do.

- The main thing we want to test is the **`checkYourself()`** method.
  - Basic idea of this method: check to see if the **`DotCom`** object has been hit.
  - To test it, we could:
    1. Instantiate a **`SimpleDotCom`** object.
    2. Assign it a location (i.e. an array of 3 **`int`** values, like **`{2,3,4}`**).
    3. Create a **`String`** to represent a user guess (e.g. **`"2"`**, **`"0"`**, etc).
    4. Invoke the **`checkYourself()`** method, passing it a fake guess.
    5. Print out the result and see if it is what we expected.

Test Code for `SimpleDotCom` class (version 1)

```
public class SimpleDotComTest {
  public static void main(String[] args) {
    SimpleDotCom dot = new SimpleDotCom();
    int[] locations = {2, 3, 4};
    dot.setLocationCells(locations);

    String userGuess = "2"; // result should be "hit" or "kill"
    String result = dot.checkYourself(userGuess);
    String testResult = "failed"; // default value
    if (result.equals("hit") || result.equals("kill")) {
      testResult = "passed";
    }
    System.out.println(testResult);
  }
}
```

First version of `SimpleDotCom` class

```
public class SimpleDotCom {
  private int[] locationCells;
  private int numberOfHits = 0;

  public void setLocationCells(int[] loc) { locationCells = loc; }

  public String checkYourself(String stringGuess) {
    int guess = Integer.parseInt(stringGuess);
    String result = "miss"; // default value
    for (int i : this.locationCells) {
      if (guess == i) {
        result = "hit";
        this.numberOfHits++;
        break;
      }
    }
    if (this.numberOfHits == this.locationCells.length) { result = "kill"; }
    System.out.println(result);
    return result;
  }
} // end of SimpleDotCom
```

equivalent to

```
for (int i=0; i<locationCells.length; i++) {
  if (guess == locationCells[i]) {
    // rest of the code as before
  }
}
```

The `main()` method in the `SimpleDotComGame` class

DECLARE an `int` variable to hold the number of user guesses, named `numOfGuesses`; **SET** it to 0

MAKE a new `SimpleDotCom` instance

COMPUTE a random number between 0 and 4 that will be the starting location cell position

MAKE an `int` array with 3 `int` values using the randomly-generated number incremented by 1, and that number incremented by 2 (e.g. 3, 4, 5)

INVOKE the `setLocationCells()` method on the `SimpleDotCom` instance

DECLARE a `boolean` variable representing the state of the game, named `isAlive`; **SET** it to `true`

WHILE dot com is alive (`isAlive == true`)

GET user input from command line

// **CHECK** the user guess

INVOKE the `checkYourself()` method on the `SimpleDotCom` instance

INCREMENT `numberOfGuesses` variable

// **CHECK** for dot com death

IF result is "kill"

SET `isAlive` to `false` (no more looping)

PRINT the number of guesses

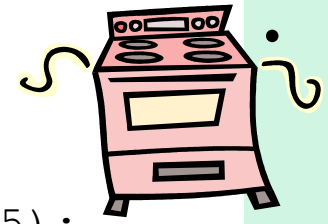
END IF

END WHILE

Test code for `SimpleDotCom` class (version 2)

```
public static void main(String[] args) {
  int numOfGuesses = 0;
  GameHelper helper = new GameHelper();
  SimpleDotCom dot = new SimpleDotCom();
  int randomNum = (int) (Math.random() * 5);
  int[] locations = {randomNum, randomNum + 1,
                     randomNum + 2};
  dot.setLocationCells(locations);
  boolean isAlive = true;

  while (isAlive == true) {
    String guess = helper.getUserInput("Enter a number ");
    String result = dot.checkYourself(guess);
    numOfGuesses++;
    if (result.equals("kill")) {
      isAlive = false;
      System.out.println("You took " + numOfGuesses + " guesses");
    }
  }
}
```



`GameHelper` = pre-written "ready baked" class.

- We are not going to worry about how it works!
- It gets the input from the user; that is all we need to know (for now).

Testing the first version of the game …

A complete game interaction:

```
>java SimpleDotComGame
enter a number   3
hit
enter a number   4
hit
enter a number   2
miss
enter a number   5
kill
You took 4 guesses
```

This may be different, depending on **`Math.random()`**.

Another complete game interaction:

```
>java SimpleDotComGame
enter a number   3
hit
enter a number   3
hit
enter a number   3
kill
You took 3 guesses
```

Bug!

… and things for you to try out!