Guessing Game with Objects

Objectives	Practice writing an object-oriented program using different classes for different parts of the game.
Starter Code	There is starter code on Github Classroom. Use link http://bit.ly/OOP2020-lab1
What to Submit	Submit your code to Github Classroom, as instructed in class

1. Guessing Game

A guessing game is played on the console like this:

```
Guess a secret number.
I'm thinking of a number between 1 and 100.
your guess?  32
Sorry, too small.
your guess?  64
Sorry, too large.
your guess?  48
Right! The secret number is 48.
```

In object-oriented programs, we divide the problem into parts (classes) such that each class performs only one group of related **responsibilities**. We want classes and objects so that:

(a) each class has only one or a few closely related responsibilities

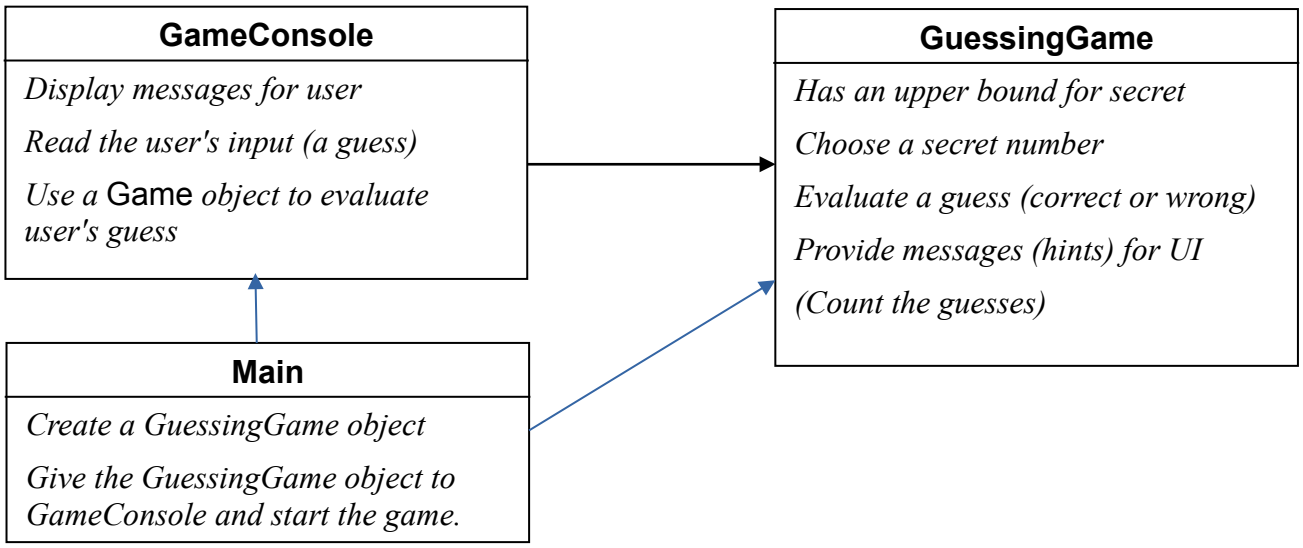
(b) classes are **simple** and easy to modify

(c) a class provides methods that other objects need to do their job

In the guessing game, there are 3 sets of **responsibilities**:

1. Interact with the user: *print messages and read input until game is over*
2. Manage the game: *pick the secret number, evaluate a guess, give hint, decide when game is over.*
3. Run the game. *Called the "Application class" or "main class".*

We will define one class for each sets of responsibilities:



Application Design in UML

This is a UML class diagram for the classes in your program.

GuessingGame
-upperBound: int #secret: int
<<constructor>> +GuessingGame( ) #setMessage(msg: String) +getMessage( ): String +getUpperBound(): int +guess(number: int): boolean +toString(): String

`getMessage( )` returns a message based on most recent guess. The initial message is something like "I'm thinking of a number between 1 and NNN". After a guess, the message will be something like "Your guess is too small".
`getUpperBound( )` returns the upper-bound for the secret number.
`guess( number )` submits a guess. guess( ) returns true if the guess matches the secret number, false otherwise.

GameConsole
+play(game: GuessingGame): int

Write a `GameConsole` to play a guessing game, which is given as a parameter to the play( ) method. The play( ) method prints messages (from the GuessingGame), prompts the user for a guess, and submits the guess to the game. The Java method signature is:

```
public int play( GuessingGame game ) {
    ...
}
```

Main
main(String[] args): void

The Main class contains no attributes and only a `static void main(String[] args)` method. main does this:

```
public static void main(String[] args) {
```

1. create a GuessingGame object
2. create a GameConsole object
3. call gameConsole.play(game)
4. print the answer returned by play()

```
}
```

1.1 Try the GuessingGame class in BlueJ Codepad

You can create objects and call their methods interactively. You can verify that the GuessingGame works.

```
> game = new GuessingGame();
> game.getMessage( )
"I'm thinking of a number between 1 and 100."
> game.guess(50)
false
> game.getMessage()
"Your guess is too small."
```

1.2 Write the GameConsole Class and Test It

Write this class in the default package. This class has only 1 method: **play**.

The **play** method should:

a) describe the game to the user (game.toString).

b) Use a loop to:

- print a message from the game
- ask the user to guess the answer.
- call game to evaluate the user's guess.

c) Return the correct answer when game.guess(number) returns true.

d) Only call `game.guess( )` one time for each value input by the user. Later you will add a counter to the game to count how many guesses the user makes!.

4. **Write Javadoc** comments for the GameConsole class and the **play** method.

```
/**
 * The play method plays a game using input from a user.
 * @param ...
 * @return ...
 */
public void play(GuessingGame game)
```

1.3 Write a Main class to create objects and start the game

1. Create a class named Main with a static **main** method.
The job of the main method is to create objects, connect user interface to the game, and start the user interface. main is a **static** method. main should be *simple (no application logic)*.

```
/** create objects and start the game */
public static void main( String [] args ) {
      GuessingGame game = new GuessingGame( );
      GameConsole ui = new GameConsole( );
      int solution = ui.play( game );
      //TODO print the solution
}
```

2. Test everything.

Problem 2: Add another Constructor to GuessingGame

The GuessingGame is too easy. We'd like to be able to create game with any upper bond for the secret.

Java classes can have more than one constructor, provided that each constructor has different parameters. This is different from Python -- Python only allow ones constructor, but parameters can have default values.

1. Add a constructor with an `int upperBound` parameter to GuessingGame.

```
/** A Constructor for new Game objects.
 *  @param upperbound is the upper limit for the secret number
 */
public Game(int upperbound) {
     this.upperBound = upperbound; // save the upper bound
     //TODO complete rest of the constructor
```

Now we can specify an upper bound when we create a game:

```
game = new Game(1000000);          // game with a secret between 1 and 1000000
```

2. Now your Game has **two constructors**: a *default* constructor and *parameterized* constructor.

3. The constructors contain **duplicate code** (two codes that do the same thing)**.** ***Duplicate code is bad.*** You can eliminate the duplicate code by having one constructor invoke the other constructor. ***Ask the TA to explain how***.

4. Modify **`Main`** to use the new constructor. Now you can control the game difficulty.

Set the Game Difficulty from the Command Line

Java lets you pass *arguments* from the command line to a Java program.

The command line arguments are Strings (even if the values are numbers) and are stored in the String array. These command line arguments are put in the `args[]` array that is a parameter to `main`. Here is how to get a number from the args array:

```
public static void main( String [] args )
{
   int bound = 20;  // default value
   if ( args.length > 0 ) bound = Integer.parseInt( args[0] );
```

Problem 3: Add a Counter to Count guesses

1. Add a counter to your guessing game class to count how many guesses the user makes.

Add a counter to the GuessingGame class, not the GameConsole class.

2. Provide an *accessor* method for the counter named **`int getCount`**( ).

3. Write good Javadoc for the method.

4. Modify the Main class so that it prints how many guesses the user made (call getCount).

Problem 4: Write a GameSolver Class to Automatically find the Secret

Write a GameSolver class that plays any GuessingGame and returns the answer (the secret).

This class has just one method: **`int play(NumberGame game)`**. Just like GameConsole.

The GameSolver should not print anything -- just return the solution.

Exception: if your GameSolver determines that there is no solution or the game is impossible, you can print a message on the console.

```
/**
 * Automatically find the secret to any GuessingGame.
 */
public class GameSolver {
    /**
     * Play a GuessingGame and return the solution.
     * The game must provide messages (getMessage) containing the
     * phrase "too small" if a guess is too small or "too large" if
     * a guess is too large, for efficient solution.
     *
     * @param game is the GuessingName to solve
     * @return //TODO what does it return?
     */
    public int play(GuessingGame game) ...
```