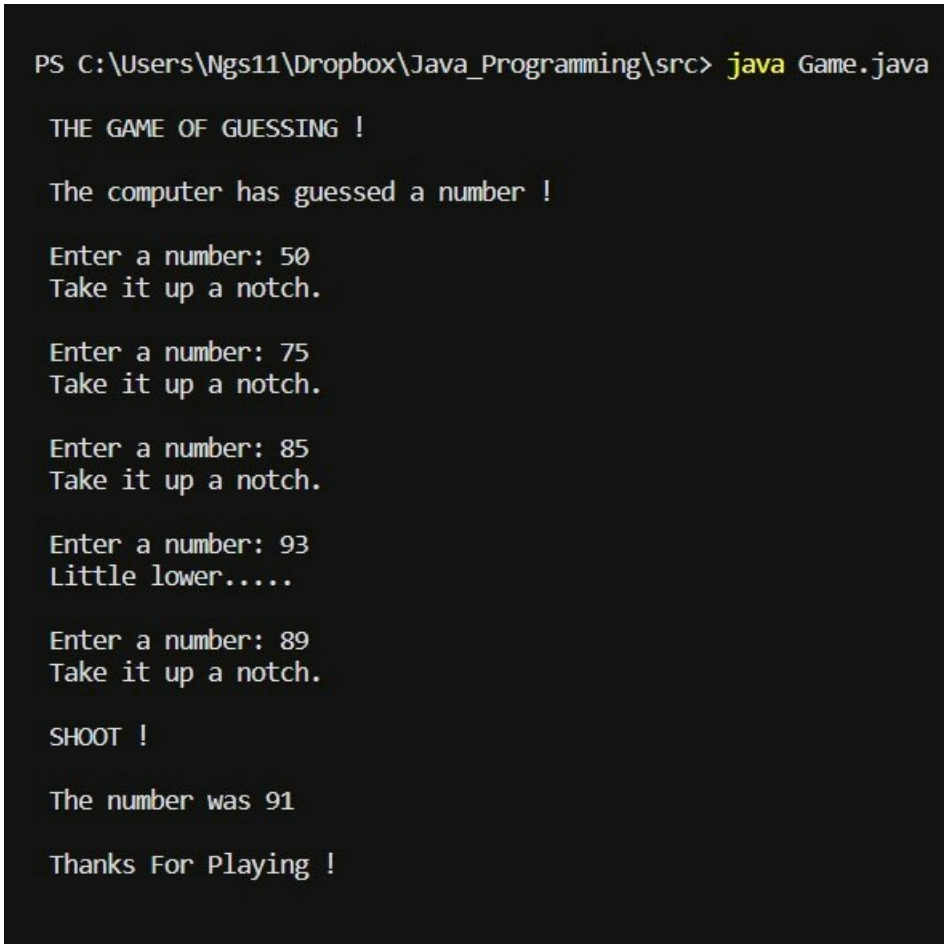
Java Project

PROJECT REPORT

Number Guessing Game



Friday 21st May, 2021.

1 Introduction

This is a simple game programmed using basic Java concepts. The game consists of the user requiring to guess a number randomly generated by the computer.

2 Working of the Game

Following is how the game works:

1. The computer generates a number between 1 to 100
2. The computer asks the user to guess
3. If the guess is correct user wins and program exits
4. Else computer gives a hint to the user for the correct answer
5. While the user exhausts his 5 attempts the cycle of guessing-checking continues.

3 Code

```
1
2  /* A simple number guessing game.
3
4    Uses java.util.Random and java.util.Scanner packages
5    User gets 5 attempts to guess a random number from 1 to 100.
6
7    The number of attempts is intentionally kept less than 7.
8    If the number of guesses is 7 or more, a smart user can
9    use the concept of binary search to arrive at the correct
10   guess since 2^7 = 128.
11  */
12 /* ************************************/
13
14 import java.util.Random; // package to generate random numbers
15 import java.util.Scanner; // package to get user input
16
17 /* ************************************/
18
19 /**
20  * Game class starts the game.
21  */
22 public class Game {
23
24     public static void main(String[] args) // main function
```

```
25      {
26          System.out.println("\n THE GAME OF GUESSING !");
27
28          int num; // var for user input
29          int success = 7; // checks if user has exhausted all
    attempts
30
31          Working guess = new Working(success); // creating an object
     to play the game
32
33          try (Scanner sc = new Scanner(System.in)) {
34              while (guess.valid()) // loop till the guess is valid
35              {
36                  System.out.print("\n Enter a number: "); // user
    input
37                  num = sc.nextInt();
38
39                  guess.check(num); // checking user's guess
40                  success--; // incrementing the attempts used
41              }
42          }
43
44          if (success == 0) // if all attempts are exhausted
45              System.out.println("\n SHOOT !");
46
47          System.out.println("\n The number was " + guess.getNumber()
    ); // prompting the correct answer
48          System.out.println("\n Thanks For Playing !\n\n\n"); //
    outro
49      }
50  }
51
52  /* *************************************/
53
54  /**
55   * Working class implements the actual working of the game
56   */
57  class Working {
58      private final int number; // number should not be public or
    mutable
59      private int attempts; // number of attempts to validate
    guessing attempts
60      private final int noOfGuesses; // setting the maximum guesses
    the user can make
61
62      /**
63       * Constructor
64       * initialises the random number, number of guesses and
    attempts
65       */
66      Working(int _noOfGuesses) {
67          Random rand = new Random(); // generating random number
68          number = rand.nextInt(100) + 1;
69
70          System.out.println("\n The computer has guessed a number !"
```

```
    );

        noOfGuesses = _noOfGuesses;
        attempts = 0;
    }

    /**
     * Checks if the attempt is valid
     *
     * @return boolean value true if the attempt is valid
     */
    boolean valid() {
        return attempts < noOfGuesses;
    }

    /**
     * checks the guess of the user
     * informs the user about the guess made
     *
     * @param guess - guess of the user
     *
     */
    void check(int guess) {
        attempts = attempts + 1; // incrementing the number of
    attempts

        if (guess == number) { // case user guessed it right
            System.out.println("\n Congratulations You Guessed It !
    ");
            attempts = noOfGuesses;
        } else if (guess < number) { // case user guessed less than
     the answer
            System.out.println(" Take it up a notch.");
        } else { // case user guessed higher than answer
            System.out.println(" Little lower.....");
        }
    }

    /**
     * to get the random number generated
     *
     * @return generated random number
     */
    int getNumber() {
        return number; // number being private requires a method to
     get it
    }
}
// End of Code
/* *************************************/
```

Listing 1: Number Guessing Game

4 Working of the Program

The program uses basic Java Programming concepts like classes, for-loops, conditions, constructors and data protection. The Game class is the class that begins the execution of the program. The Working class is where the actual working of the game is implemented. An object is created of the working class which initialises the random number and the number of guesses the user will have. The check method checks for each guess if it is correct and provides hints for the next guess. The validate method makes sure that the user does not make more than 5 guesses. The get number method is used to retrieve the random number generated by the computer. The number generated is kept private and static so as to prevent its modification and make it inaccessible from outside the class. The noOfAttempts variable is also kept private and final so that one cannot modify or access it to their advantage.

5 Why only 5 attempts?

Quite intuitively, lesser the number of attempts the tougher the game gets. However there is also a mathematical argument to limit the number of guesses to 6.

This is because after every guess the computer is providing us with some extra information about the number. Since the numbers from 1 to 100 could be considered to be an array sorted in ascending order,we can use the concept of binary search to arrive at the answer.

However the binary search decreases the search space by half after every iteration. So, after 4 iterations, we can narrow down the search space to 6 numbers. Hence the game reduces to guessing a number from 6 numbers with the probability of getting the correct answer on the 5th guess to be 0.1666667.

Similarly in guess of 6 allowed attempts the game reduces to guessing a number out of 3 numbers on the 6th guess.This makes the probability of winning to be 0.333333.

And if the number of attempts are 7, then one could definitely win

every time if s/he plays smartly.

6 Example when allowed attempts are 7

```
PS C:\Users\Ngs11\Dropbox\Java_Programming\src> javac Game.java
PS C:\Users\Ngs11\Dropbox\Java_Programming\src> java Game.java

 THE GAME OF GUESSING !

 The computer has guessed a number !

 Enter a number: 50
 Little lower.....

 Enter a number: 25
 Little lower.....

 Enter a number: 12
 Little lower.....

 Enter a number: 6
 Take it up a notch.

 Enter a number: 9
 Little lower.....

 Enter a number: 7
 Take it up a notch.

 Enter a number: 8

 Congratulations You Guessed It !

 SHOOT !

 The number was 8

 Thanks For Playing !
```

Figure 1: With 7 guesses one is sure to win.