Basics of Scala

Vicente De Leon

UID: 2001014594

Assignment 3

1. Question 1

   Resources (Please check Scala Worksheet Resources for more detail):

   - Reading input: https://docs.scala-lang.org/overviews/scala-book/command-line-io.html
   - Taking input from user: https://stackoverflow.com/questions/5055349/how-to-take-input-from-a-user-in-scala
   - Print vs println: https://www.tutorialspoint.com/difference-between-print-and-println-in-java
   - Initializing variable: https://stackoverflow.com/questions/2754301/initialise-a-var-in-scala
   - While loop: https://stackoverflow.com/questions/46199788/java-while-loop-for-entering-username-and-password-3-times-issue-with-break-s
   - If/Else statement: https://www.tutorialspoint.com/scala/scala_if_else.htm

   Observations:

   - scala.io.StdIn.readLine is going to be used in order to read command_line input (easiest way to do it).
   - Username and password are provided within Question1 Scala program.
   - Since we are working with console input, “print()” is going to be also used.
   - Basic Scala program that asks the user to enter a username (vdeleonw) and a password (ScalaBasics).
   - Basic while loop will be implemented to let the user enter the password until it matches the username (similar to Python).

Please, see following page for images.

Question 1 images (inputs and outputs)

```scala
// Question 1
// Reading input: https://docs.scala-lang.org/overviews/scala-book/command-line-io.html
// Taking input from user: https://stackoverflow.com/questions/5055349/how-to-take-input-from-a-user-in-scala
// print vs println: https://www.tutorialspoint.com/difference-between-print-and-println-in-java
// Initializing variable: https://stackoverflow.com/questions/2754301/initialise-a-var-in-scala
// While loop: https://stackoverflow.com/questions/46199788/java-while-loop-for-entering-username-and-password-3-times-issue-with-break-s
// If/Else: https://www.tutorialspoint.com/scala/scala_if_else.htm
object HW3Question1 {
  val username = "vdeleonw"
  val password = "ScalaBasics"

  def main(args: Array[String]): Unit = {
    print("Please enter your username: ")
    val existingUsername = readLine() // read from the console
    if (existingUsername == username) {
      var existingPassword = "" // initialize empty string
      while (existingPassword != password) {
        print("Please enter your password: ")
        existingPassword = readLine() // read from the console
        if (existingPassword == password) {
          println("Welcome vdeleonw!")
        } else {
          println("Incorrect password. Please try again.")
        }
      }
    } else {
      println("Username not valid or doesn't exists. Please run the program again.")
    }
  }
}
```

```
Please enter your username: vdeleonw
Please enter your password: ScalaBasics
Welcome vdeleonw!
```

```
Please enter your username: vdeleon
Username not valid or doesn't exists. Please run the program again.
```

```
Please enter your username: vdeleonw
Please enter your password: i dont know
Incorrect password. Please try again.
Please enter your password: 1234
Incorrect password. Please try again.
Please enter your password: ScalaBasics
Welcome vdeleonw!
```

2. Question 2

   Resources (Please check Scala Worksheet Resources for more detail):

   - Following question 1 resources.
   - Scala Decision making: https://www.geeksforgeeks.org/scala-decision-making-if-if-else-nested-if-else-if-else-if/
   - For loop: https://www.geeksforgeeks.org/for-loop-in-scala/
   - String interpolation: https://docs.scala-lang.org/overviews/core/string-interpolation.html
   - Lower case vs caps lock: https://www.geeksforgeeks.org/scala-string-equalsignorecase-method-with-example/

   Observations:

   - We are using same resources as question plus a couple of new resources that help building the for loop, if, else, and else if statements. It is important to state that this is the expansion of question 1.
   - In this question we are including new steps to ensure the privacy of our program. These steps include a security question “What class did you take last semester?” and the answer “Applied Machine Learning” both being private values in Scala.
   - Again we use readLine() and print for user input console purposes and we expand the logic behind the program to include the following:
   - A for loop to let the user enter password up to 3 times until it matches the username.
   - Resetting the password if the three attempts fail.
   - Choosing between Yes or No, even if the user chooses to write in lower case. If he or she chooses yes or Yes, a security question will pop up asking a personal question.
   - There’s also a message integrated in case the answer for the security question fails.

Please, see following page for images.

Question 2 images (inputs and outputs)

```scala
object HW3Question2 {
  val username = "vdeleonw"
  var password = "ScalaBasics"
  private val question = "What class did you take last semester?"
  private val answer = "Applied Machine Learning"

  def main(args: Array[String]): Unit = {
    print("Please enter your username: ")
    val existingUsername = readLine() // reading user input console
    if (existingUsername == username) {
      var attempts = 0 //initializing local variable
      for (attempts <- 1 ≤ to ≤ 3) { // for loop, range from 1-3
        print("Please enter your password: ")
        val existingPassword = readLine() // reading user input console
        if (existingPassword == password) {
          println("Welcome vdeleonw!")
          return
        } else if (attempts < 3) { // deciding amon options geek for geeks
          println("Incorrect password. Please try again.")
        }
      }

      print("Would you like to reset your password? Please choose Yes or No: ")
      if (readLine().equalsIgnoreCase( anotherString = "yes")) { // equalsIgnoreCase -> either lower case or cap locks
        print(s"$question: ") // string interpolation
        if (readLine() == answer) {
          print("Please enter your new password: ")
          password = readLine() // reading user input console
          println("Done. Your password has been reset.")
        } else {
          println("The answers you provided are not correct. Your account is blocked.")
        }
      }
    } else {
      println("Username not valid or doesn't exist. Please run the program again.")
    }
  }
}
```

```
Please enter your username: vdeleonw
Please enter your password: one
Incorrect password. Please try again.
Please enter your password: two
Incorrect password. Please try again.
Please enter your password: three
Would you like to reset your password? Please choose Yes or No: yes
What class did you take last semester?: Applied Machine Learning
Please enter your new password: ScalaBasics
Done. Your password has been reset.
```

```
Please enter your username: vdeleonw
Please enter your password: one
Incorrect password. Please try again.
Please enter your password: three
Incorrect password. Please try again.
Please enter your password: five
Would you like to reset your password? Please choose Yes or No: Yes
What class did you take last semester?: Intro to NLP for data science
The answers you provided are not correct. Your account is blocked.
```

```
Please enter your username: vdeleon2
Username not valid or doesn't exist. Please run the program again.
```

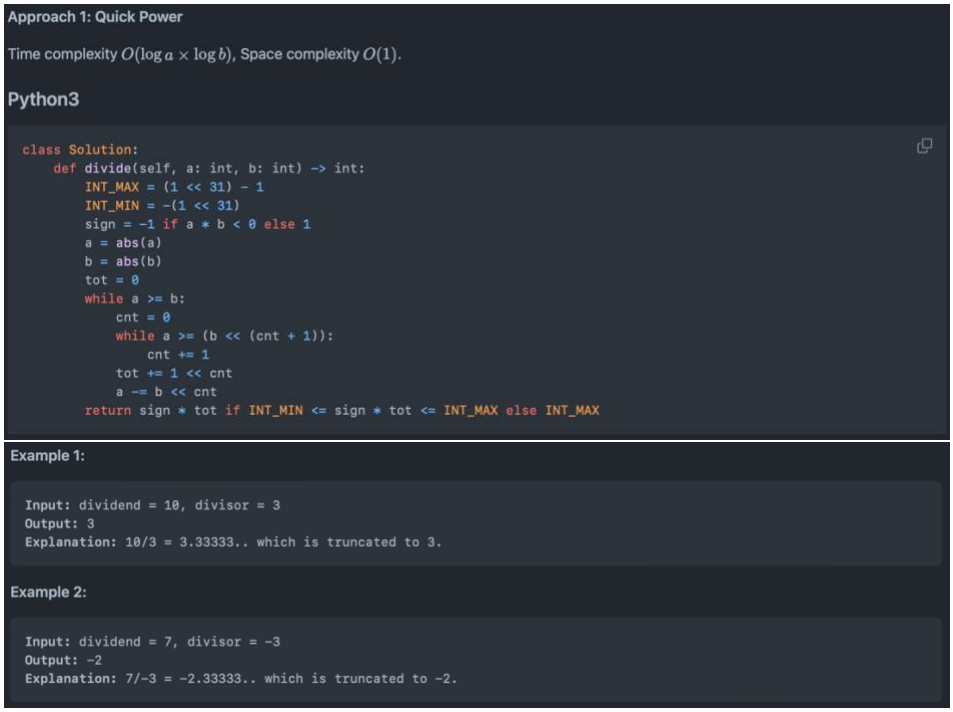
3. Question 3

   Resources (Please check Scala Worksheet Resources for more detail):

   - Tutorial code Python version: https://github.com/doocs/leetcode/blob/main/solution/0000-0099/0029.Divide%20Two%20Integers/README_EN.md
   - Operators: https://www.tutorialspoint.com/scala/scala_operators.htm
   - Math.abs(): https://www.alphacodingskills.com/scala/notes/scala-math-abs.php
   - toDouble: https://www.includehelp.com/scala/convert-int-to-double.aspx

   Observations:

   - This code is the Scala version of the Python code within the Tutorial code Python version resource. The reason I decided to take this count into account is due to the simple approach it takes to generate the desire results. Also, is worth mentioning that I feel comfortable using Python as I use it daily. The following images explain the Python version:



Approach 1: Quick Power

Time complexity $O(\log a \times \log b)$, Space complexity $O(1)$.

Python3

```
class Solution:
    def divide(self, a: int, b: int) -> int:
        INT_MAX = (1 << 31) - 1
        INT_MIN = -(1 << 31)
        sign = -1 if a * b < 0 else 1
        a = abs(a)
        b = abs(b)
        tot = 0
        while a >= b:
            cnt = 0
            while a >= (b << (cnt + 1)):
                cnt += 1
            tot += 1 << cnt
            a -= b << cnt
        return sign * tot if INT_MIN <= sign * tot <= INT_MAX else INT_MAX
```

Example 1:

```
Input: dividend = 10, divisor = 3
Output: 3
Explanation: 10/3 = 3.33333.. which is truncated to 3.
```

Example 2:

```
Input: dividend = 7, divisor = -3
Output: -2
Explanation: 7/-3 = -2.33333.. which is truncated to -2.
```

   - We are going to try and perform a division between “a” and “b”. MAX and MIN are just the maximum and minimum values of an integer. The sign has a similar but different syntax than the python version due to the if else statements in Scala.
   - The Math.abs() is used to calculate the absolute values (positive values). As stated in the code below, many operators like the binary left shift operator, the is false (&&), is not true, is true, and assignment operators follow the same pattern as the python version. The loop is being used to perform the division, subtracting the divisor (y) from the dividend (x). The toDouble was added to convert the integer value into double value (4.6666666667).

Please, see following page for images.

Question 3 images (inputs and outputs)

```scala
// Question 3
// Python version tutorial: https://github.com/doocs/leetcode/blob/main/solution/0000-0099/0029.Divide%20Two%20Integers/README_EN.md
// <<, <= =>, && operators: https://www.tutorialspoint.com/scala/scala_operators.htm
// math.abs(): https://www.alphacodingskills.com/scala/notes/scala-math-abs.php
// toDouble: https://www.includehelp.com/scala/convert-int-to-double.aspx
object HW3Question3 {
  private def divide(a: Int, b: Int): Int = {
    val INT_MAX = (1 << 31) - 1 // << -> binary left shift operator
    val INT_MIN = -(1 << 31) // // << -> binary left shift operator
    val sign = if (a * b < 0) -1 else 1
    var new_a = Math.abs(a) // specify a number whose absolute value need to be determined.
    val new_b = Math.abs(b) // specify a number whose absolute value need to be determined.
    var tot = 0
    while (new_a >= new_b) { // new_a >= new_b is not true
      var cnt = 0
      do {
        cnt += 1 // assignment just like python
      } while (new_a >= (new_b << cnt))
      cnt -= 1 // assignment just like python
      tot += 1 << cnt
      new_a -= new_b << cnt
    }
    val ans = sign * tot
    if (INT_MIN <= ans && ans <= INT_MAX) ans else INT_MAX // (INT_MIN <= ans && ans <= INT_MAX) is false
  }

  def main(args: Array[String]): Unit = {
    val x = 14 // dividend
    val y = 3 // divisor
    val division = divide(x, y)
    val result = x.toDouble / y.toDouble
    println(f"Explanation: $x/$y = $result%.10f. which is truncated to $division.") // string interpolation
  }
}
```

```
Explanation: 14/3 = 4.6666666667. which is truncated to 4.

Process finished with exit code 0
```

4. Question 4

   Resources:

   - Code tutorial: https://www.geeksforgeeks.org/all-unique-combinations-whose-sum-equals-to-k/
   - Scala Lists: https://www.geeksforgeeks.org/scala-lists/
   - ListBuffer: https://www.scala-lang.org/api/2.13.6/scala/collection/mutable/ListBuffer.html
   - ListBuffer: https://www.geeksforgeeks.org/scala-listbuffer/
   - mkString(): https://www.geeksforgeeks.org/scala-list-mkstring-method-with-a-separator-with-example/
   - operators: https://www.tutorialspoint.com/scala/scala_operators.htm

   Observations:

   - Just like question 3, this code follows a python version to find all unique combinations of given elements such that their sum is K.
   - The Scala code generates unique combinations of numbers from a given list (assignment example) that its addition is equal to the desired target. In this case the list [10,1,2,7,6,1,5] and the target value is 8. So, if the sum equals to target 8, results in "local" list will be print out. We are going to be using the Scala ListBuffer() is going to be used to store and modify data (mutable data).
   - We are going to be checking for logical condition and duplicates using the following code: if (newSum <= K && !(i > l && A(i) == A(i - 1))).
   - We proceed to recursive call the first function, after adding elements, and then remove last element of local list.
   - We use main method() to call the uniqueCombination() function to both A list and target vale K.

Please, see following page for images.

Question 4 images (inputs and outputs)

```scala
// Question 4
// Code tutorial: https://www.geeksforgeeks.org/all-unique-combinations-whose-sum-equals-to-k/
// Lists: https://www.geeksforgeeks.org/scala-lists/
// ListBuffer:  https://www.scala-lang.org/api/2.13.6/scala/collection/mutable/ListBuffer.html
// ListBuffer: https://www.geeksforgeeks.org/scala-listbuffer/
// mkString(): https://www.geeksforgeeks.org/scala-list-mkstring-method-with-a-separator-with-example/
// operators: https://www.tutorialspoint.com/scala/scala_operators.htm
object HW3Question4 {
  def uniqueCombination(l: Int, sum: Int, K: Int, local: ListBuffer[Int], A: List[Int]): Unit = {
    if (sum == K) { // if sum equals k print results within local
      println(local.mkString(",")) // aesthetic purposes mkString separation with ,
      return
    }
    for (i <- l ≤ until  < A.length) { // iterate over elements
      val newSum = sum + A(i) // newSum contains the values from "sum"
      if (newSum <= K && !(i > l && A(i) == A(i - 1))) { // checks if newSum is less than or equal to target k and it check for duplicates
        local += A(i) // local list containing combinations
        uniqueCombination(i + 1, newSum, K, local, A) // (recursive) implement above function after adding elements
        local.remove(local.length - 1) // remove last element of local list
      }
    }
  }

  def main(args: Array[String]): Unit = {
    val A = List(10, 1, 2, 7, 6, 1, 5) // assignment list example
    val K = 8 // target example
    uniqueCombination(0,  sum= 0, K, ListBuffer(), A.sorted) // mutable data with ListBuffer and sorting list A for aesthetic purposes
  }
}
```

```
1,1,6
1,2,5
1,7
2,6

Process finished with exit code 0
```

5. Question 5

   Resources:

   - Arrays: https://www.geeksforgeeks.org/scala-arrays/
   - Distinct: https://www.geeksforgeeks.org/scala-list-distinct-method-with-example/
   - mkString(): https://www.geeksforgeeks.org/scala-list-mkstring-method-with-a-separator-with-example/

   Observations:

   - This is basic and self-explanatory. We have a list, and we want to avoid duplicates.
   - Question 5 images (inputs and outputs):

```scala
// Question 5
// Arrays: https://www.geeksforgeeks.org/scala-arrays/
// Distinct: https://www.geeksforgeeks.org/scala-list-distinct-method-with-example/
// mkString(): https://www.geeksforgeeks.org/scala-list-mkstring-method-with-a-separator-with-example/
object HW3Question5 {
  def main(args: Array[String]): Unit = {
    val nums = Array(0,0,1,1,1,2,2,3,3,4)
    val noDuplicates = nums.distinct // simpler approach to avoid duplicates within list "num"
    println(noDuplicates.mkString(", ")) // mkString for aesthetic results
  }
}
```

```
0, 1, 2, 3, 4

Process finished with exit code 0
```

6. Question 5

   Resources (Please check Scala Worksheet Resources for more detail):

   - List: https://www.geeksforgeeks.org/scala-lists/
   - ::: method: https://www.includehelp.com/scala/merge-lists-in-scala.aspx
   - Descending order: https://blog.knoldus.com/sorting-in-scala-using-sortedsortby-and-sortwith-function/

   Observations:

   - Last question is also very basic, it's about merging two lists.
   - Question 6 images (inputs and outputs):

```scala
// Question 6
// Lists: https://www.geeksforgeeks.org/scala-lists/
// ::: method: https://www.includehelp.com/scala/merge-lists-in-scala.aspx
// Descending order: https://blog.knoldus.com/sorting-in-scala-using-sortedsortby-and-sortwith-function/
object HW3Question6 {
  def main(args: Array[String]): Unit = {
    val list_1 = List(14, 12, 25, 0, 1)
    val list_2 = List(123, 2, 44, 3)
    val list_3 = list_1 ::: list_2 // Merging 2 lists using the ::: method
    val FinalList = list_3.sortWith(_ > _) // SortWith() function
    println(FinalList)
  }
}
```

```
List(123, 44, 25, 14, 12, 3, 2, 1, 0)

Process finished with exit code 0
```

Codes:

```
//General: https://www.geeksforgeeks.org/scala-programming-language/
import scala.io.StdIn.readLine // easiest way to read command_line input
import scala.collection.mutable.ListBuffer // creating mutable data

// Question 1
object HW3Question1 {
  val username = "vdeleonw"
  val password = "ScalaBasics"

  def main(args: Array[String]): Unit = {
    print("Please enter your username: ")
    val existingUsername = readLine() // read from the console
    if (existingUsername == username) {
      var existingPassword = "" // initialize empty string
      while (existingPassword != password) {
        print("Please enter your password: ")
        existingPassword = readLine() // read from the console
        if (existingPassword == password) {
          println("Welcome vdeleonw!")
        } else {
          println("Incorrect password. Please try again.")
        }
      }
    } else {
      println("Username not valid or doesn't exists. Please run the program again.")
    }
  }
```

```
}
// Question 2
object HW3Question2 {
  val username = "vdeleonw"
  var password = "ScalaBasics"
  private val question = "What class did you take last semester?"
  private val answer = "Applied Machine Learning"

  def main(args: Array[String]): Unit = {
    print("Please enter your username: ")
    val existingUsername = readLine() // reading user input console
    if (existingUsername == username) {
      var attempts = 0 //initializing local variable
      for (attempts <- 1 to 3) { // for loop, range from 1-3
        print("Please enter your password: ")
        val existingPassword = readLine() // reading user input console
        if (existingPassword == password) {
          println("Welcome vdeleonw!")
          return
        } else if (attempts < 3) { // deciding amon options geek for geeks
          println("Incorrect password. Please try again.")
        }
      }
```

```
    print("Would you like to reset your password? Please choose Yes or No: ")
    if (readLine().equalsIgnoreCase("yes")) { // equalsIgnoreCase -> either lower case or cap locks
      print(s"$question: ") // string interpolation
      if (readLine() == answer) {
        print("Please enter your new password: ")
        password = readLine() // reading user input console
        println("Done. Your password has been reset.")
      } else {
        println("The answers you provided are not correct. Your account is blocked.")
      }
    }
  } else {
    println("Username not valid or doesn't exist. Please run the program again.")
  }
 }
}
```

```
// Question 3
object HW3Question3 {
  private def divide(a: Int, b: Int): Int = {
    val INT_MAX = (1 << 31) - 1 // << -> binary left shift operator
    val INT_MIN = -(1 << 31) // // << -> binary left shift operator
    val sign = if (a * b < 0) -1 else 1
    var new_a = Math.abs(a) // specify a number whose absolute value need to be determined.
    val new_b = Math.abs(b) // specify a number whose absolute value need to be determined.
    var tot = 0
    while (new_a >= new_b) { // new_a >= new_b is not true
      var cnt = 0
      do {
        cnt += 1 // assignment just like python
      } while (new_a >= (new_b << cnt))
      cnt -= 1 // assignment just like python
      tot += 1 << cnt
      new_a -= new_b << cnt
    }
    val ans = sign * tot
    if (INT_MIN <= ans && ans <= INT_MAX) ans else INT_MAX // (INT_MIN <= ans && ans <= INT_MAX) is
false
  }
```

```
  def main(args: Array[String]): Unit = {
    val x = 14 // dividend
    val y = 3 // divisor
    val division = divide(x, y)
    val result = x.toDouble / y.toDouble
    println(f"Explanation: $x/$y = $result%.10f. which is truncated to $division.") // string interpolation
  }
}
```

```
// Question 4

object HW3Question4 {

  def uniqueCombination(l: Int, sum: Int, K: Int, local: ListBuffer[Int], A: List[Int]): Unit = {

    if (sum == K) { // if sum equals k print results within local

      println(local.mkString(",")) // aesthetic purposes mkString separation with ,

      return

    }

    for (i <- l until A.length) { // iterate over elements

      val newSum = sum + A(i) // newSum contains the values from "sum"

      if (newSum <= K && !(i > l && A(i) == A(i - 1))) { // checks if newSum is less than or equal to target k and it check for duplicates

        local += A(i) // local list containing combinations

        uniqueCombination(i + 1, newSum, K, local, A) // (recursive) implement above function after adding elements

        local.remove(local.length - 1) // remove last element of local list

      }

    }

  }


  def main(args: Array[String]): Unit = {

    val A = List(10, 1, 2, 7, 6, 1, 5) // assignment list example

    val K = 8 // target example

    uniqueCombination(0, 0, K, ListBuffer(), A.sorted) // mutable data with ListBuffer and sorting list A for aesthetic purposes

  }

}
```

```
// Question 5
object HW3Question5 {
  def main(args: Array[String]): Unit = {
    val nums = Array(0,0,1,1,1,2,2,3,3,4)
    val noDuplicates = nums.distinct // simpler approach to avoid duplicates within list "num"
    println(noDuplicates.mkString(", ")) // mkString for aesthetic results
  }
}
```

```
// Question 6
object HW3Question6 {
  def main(args: Array[String]): Unit = {
    val list_1 = List(14, 12, 25, 0, 1)
    val list_2 = List(123, 2, 44, 3)
    val list_3 = list_1 ::: list_2 // Merging 2 lists using the ::: method
    val FinalList = list_3.sortWith(_ > _) // SortWith() function
    println(FinalList)
  }
}
```