University of Khartoum

Faculty of Mathematical Sciences &
Informatics

جامعة الخرطوم

كلية العلوم الرياضية والمعلوماتية

Programming Fundamentals II

Midterm Project: Helper Document

Multiplication Test Program

Project Duration: 2 weeks

Project Total Mark: 20 out of the course total

Friday, 07 June 2024

Project Structure

This project is designed to be Completed individually. The project is structured into eight sections:

1. Project Objectives.
2. Problem Description.
3. Sample Output.
4. Program Template
5. Problem-Solving Tips.
6. Follow-Up Questions and Activities.
7. Submission Guidelines.
8. Evaluation Criteria.

- **Note: Upon delivery, we will discuss your work to finalize the evaluation process.**

- **سوف يكون هناك تقييم فردي مع كل طالب من خلال مقابلة مباشرة بعد التسليم .**

1 - Project Objectives:

This project is designed to gauge your comprehension of the chapters covered (First 6 Chapters) and evaluate your proficiency in applying programming skills to problem-solving. It holds significant weight as a checkpoint throughout the semester and will contribute to your overall academic evaluation for the year.

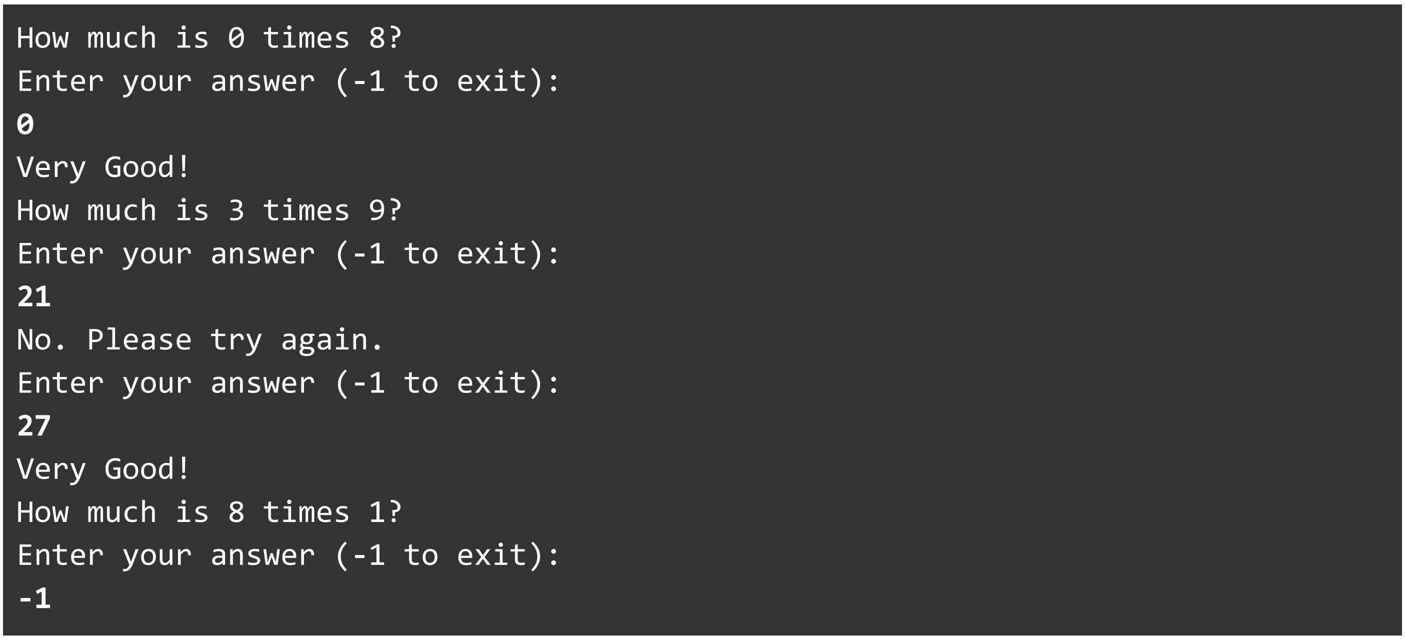
2 - Problem Description (10 marks):

Computers are playing an increasing role in education. Write a program that will help an elementary school student learn multiplication. Use a Random object to produce two positive one-digit integers. The program should then prompt the user with a question, such as

```
How much is 6 times 7?
```

The student then inputs the answer. Next, the program checks the student’s answer. If it is correct, display the message "Very good!" and ask another multiplication question. If the answer is wrong, display the message "No. Please try again." and let the student try the same question repeatedly until the student finally gets it right. A separate method should be used to generate each new question. This method should be called once when the application begins execution and each time the user answers the question correctly.

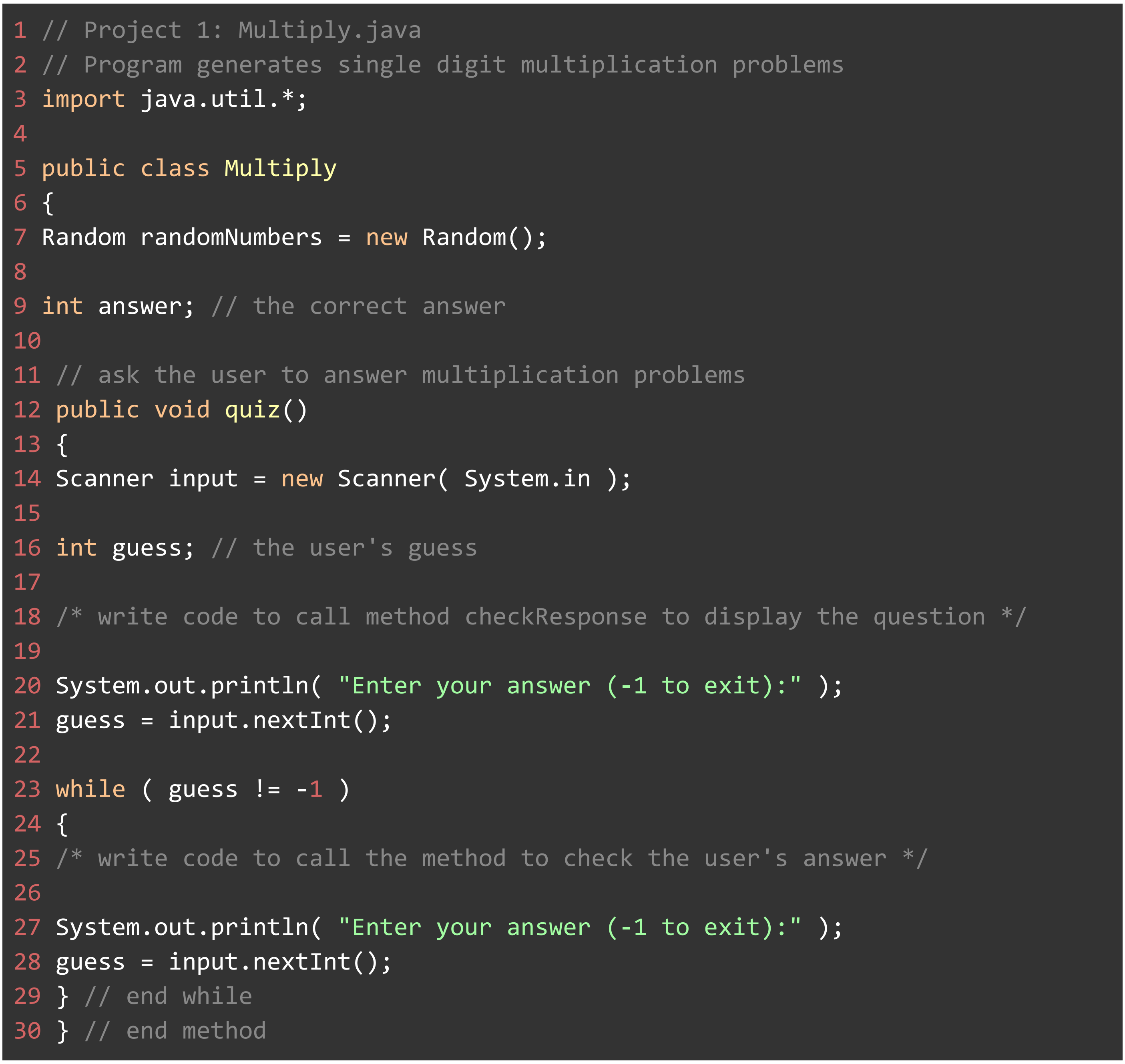
3 - Sample Output:



```
How much is 0 times 8?
Enter your answer (-1 to exit):
0
Very Good!
How much is 3 times 9?
Enter your answer (-1 to exit):
21
No. Please try again.
Enter your answer (-1 to exit):
27
Very Good!
How much is 8 times 1?
Enter your answer (-1 to exit):
-1
```

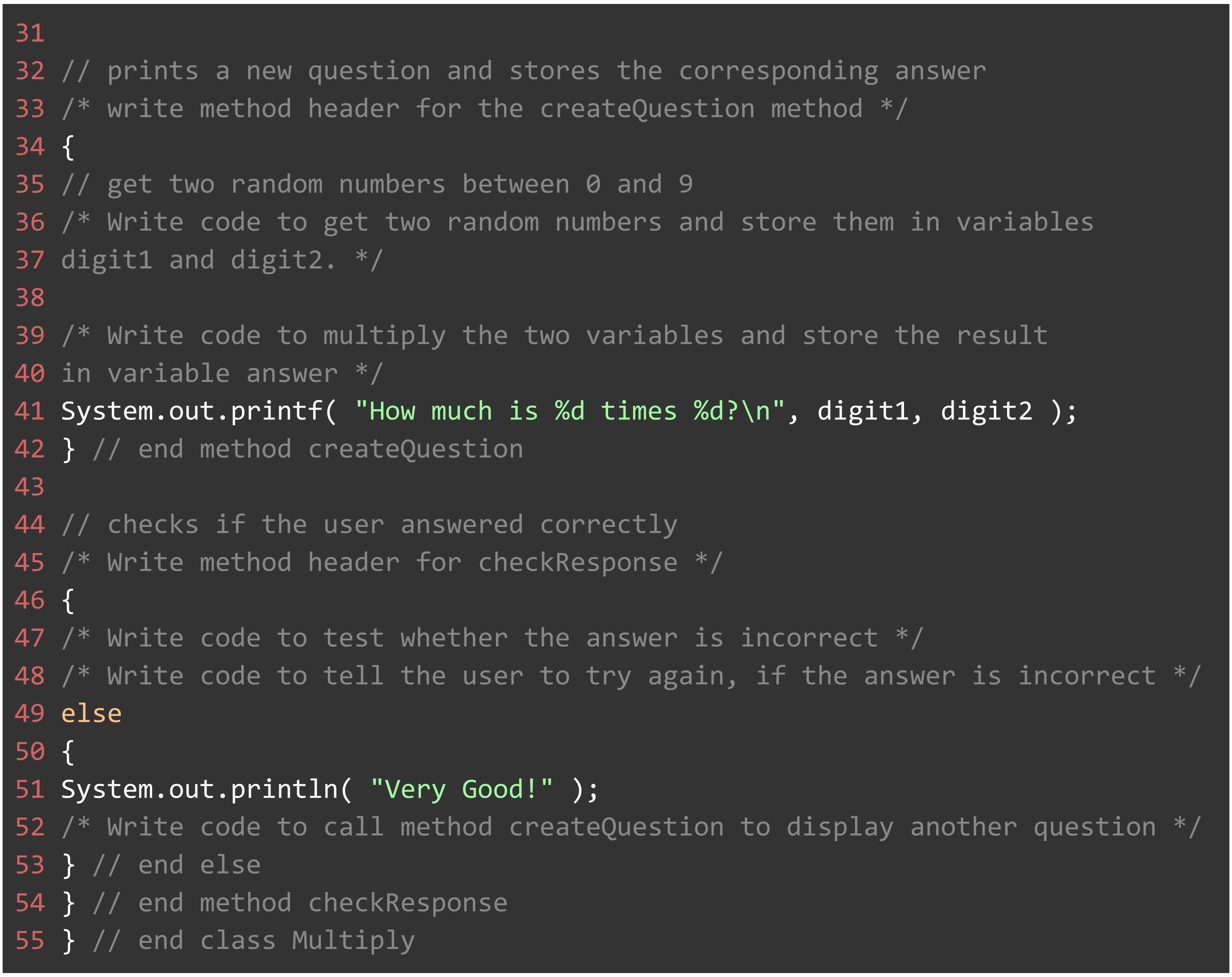
4 - Program Template:

The program template is a fully functioning Java program with placeholders (indicated by comments) where you need to insert your code. Begin by reading the problem description and reviewing the sample output. Then, analyze the template code and use the problem-solving tips to replace the comment placeholders with Java code. Compile and run the program, comparing your output to the provided sample. Finally, answer the follow-up questions.



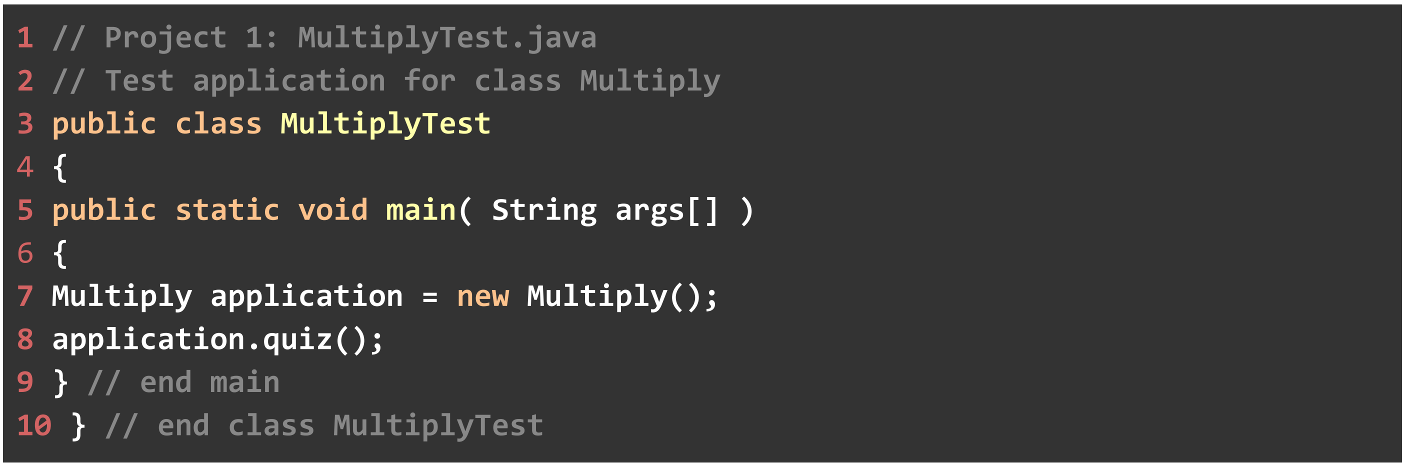
```java
// Project 1: Multiply.java
// Program generates single digit multiplication problems
import java.util.*;

public class Multiply
{
Random randomNumbers = new Random();

int answer; // the correct answer

// ask the user to answer multiplication problems
public void quiz()
{
Scanner input = new Scanner( System.in );

int guess; // the user's guess

/* write code to call method checkResponse to display the question */

System.out.println( "Enter your answer (-1 to exit):" );
guess = input.nextInt();

while ( guess != -1 )
{
/* write code to call the method to check the user's answer */

System.out.println( "Enter your answer (-1 to exit):" );
guess = input.nextInt();
} // end while
} // end method
```

Fig. 1 | Multiply.java. **(Part 1 of 2.)**



```

// prints a new question and stores the corresponding answer
/* write method header for the createQuestion method */
{
// get two random numbers between 0 and 9
/* Write code to get two random numbers and store them in variables
digit1 and digit2. */

/* Write code to multiply the two variables and store the result
in variable answer */
System.out.printf( "How much is %d times %d?\n", digit1, digit2 );
} // end method createQuestion

// checks if the user answered correctly
/* Write method header for checkResponse */
{
/* Write code to test whether the answer is incorrect */
/* Write code to tell the user to try again, if the answer is incorrect */
else
{
System.out.println( "Very Good!" );
/* Write code to call method createQuestion to display another question */
} // end else
} // end method checkResponse
} // end class Multiply
```

Fig. 2 | Multiply.java. (Part 2 of 2.)



```
// Project 1: MultiplyTest.java
// Test application for class Multiply
public class MultiplyTest
{
public static void main( String args[] )
{
Multiply application = new Multiply();
application.quiz();
} // end main
} // end class MultiplyTest
```

Fig. 3 | MultiplyTest.java

5- Problem-Solving Tips:

1. The **createQuestion** method should take no parameters and return no value.
2. Use the **Random** method **nextInt** to get a random number.
3. The **checkResponse** method should take a single int parameter and compare it to answer to determine.
4. whether the answer is correct. This method should output the result of the comparison.
5. Be sure to follow the spacing and indentation conventions mentioned in the text (Search for the **format** option in your IDE to help you automate this).
6. If you have any questions as you proceed, ask for assistance.
7. Read the problem statements carefully.
8. Comment your code to explain your logic and the purpose of significant sections.
9. Test your code thoroughly with various inputs to ensure its correctness.

6 - Follow-Up Questions and Activities (10 marks total):

1. Modify the program to vary the comments that are displayed for each correct answer and each incorrect answer. The response to a correct answer should be chosen from (**5 marks**):

```
Very good!
Excellent!
Nice work!
Keep up the good work!
```

The response to an incorrect answer should be chosen from:

```
No. Please try again.
Wrong. Try once more.
Don't give up!
No. Keep trying.
```

Use random-number generation to choose a number from 1 to 4 that will be used to select an appropriate response to each answer. Use a switch statement to issue the responses.

2. Modify the program to count the number of correct and incorrect responses typed by the student. After the student types 10 answers, your program should calculate the percentage of correct responses. If the percent- age is lower than 75%, display Please ask your instructor for extra help and reset the program so an- other student can try it (**5 marks**).

```
How much is 7 times 5?
Enter your answer (-1 to exit):
35
Nice work!
How much is 3 times 4?
Enter your answer (-1 to exit):
12
Keep up the good work!
How much is 1 times 8?
Enter your answer (-1 to exit):
8
Very Good!
How much is 2 times 7?
Enter your answer (-1 to exit):
14
Keep up the good work!
How much is 8 times 7?
Enter your answer (-1 to exit):
56
Keep up the good work!
How much is 6 times 8?
Enter your answer (-1 to exit):
48
Keep up the good work!
How much is 3 times 0?
Enter your answer (-1 to exit):
0
Excellent!
How much is 2 times 7?
Enter your answer (-1 to exit):
14
Excellent!
How much is 4 times 8?
Enter your answer (-1 to exit):
32
Nice work!
How much is 6 times 6?
Enter your answer (-1 to exit):
36
Excellent!
You scored a 100

How much is 5 times 5?
Enter your answer (-1 to exit):
-1
```

7- Submission:

- Submit all your Java source code files in a ZIP archive.
- Include a PDF report with screenshots of your program outputs and explanations of your solutions.

8- Evaluation Criteria:

- **Correctness**: Does the code produce the correct output?
- **Readability**: Is the code well-organized and commented?
- **Efficiency**: Is the code efficient and avoids unnecessary computations?
- **Documentation**: Are the code and report well-documented and clear?

Good luck with your midterm project!