

Step 1: Problem identification and Statement

Design a program for elementary school students that would test them in the areas of multiplication and integer division. The student should be able to choose between multiplication and integer division. The program should test the students by giving them exactly 10 questions with two random numbers that generate every line. The program should count how much correct and incorrect answers the students submit. At the end, if the student scored above 7 then the software should display a “Congratulations” message, while if the user score less than 7, the program should display “Please ask your teacher for help!” message.

Example:

1. Multiplication

2. Division

3. Exit the program

Please answer the following questions

$$5 \times 6 = 25$$

$$4 \times 3 = 12$$

$$4 \times 5 = 20$$

$$8 \times 9 = 72$$

$$8 \times 7 = 55$$

$$7 \times 4 = 28$$

$$4 \times 4 = 16$$

$$2 \times 6 = 12$$

$$6 \times 9 = 54$$

$$5 \times 3 = 15$$

You Scored 8/10

Congratulations!

Step 2: Gathering Information

The user needs to choose between arithmetic operations which are multiplication and integer division. When the user press one, he will need to solve 10 random multiplication question and when he presses 2, he will need to solve 10 random Integer Division questions. If the user wanted to exit the program, he will need to press 3.

To be able to make this program we gathered information about multiplication, division and certain type of function that we needed to code this program. For example, we used `srand` to randomize numbers, `switch` to make the user choose between three different options, and `for` loop inside the `switch` to make the program give the user 10 math equations. We also need to know the definition of Integer Division, which is the division of two numbers in a way that we will have an answer without a remainder as a final answer. For example, $4/3=1$ not 1.3.

Step 3: Test Case and Algorithm

A. Test Cases

Test Case 1: If the user choice is 1 and he gets 7 right answers or greater then the program would print his score and print congratulations.

Hello, Please choose one of the following options

1.Multiplication

2.Integer Division

3.Exit the program

1

Please answer the following questions

7x3=21

4x9=20

8x9=72

2x8=16

9x8=90

6x5=30

2x2=4

6x4=20

7x1=7

5x1=5

Congratulations!

You scored 7/10

Press any key to continue . . .

Test Case 2: If the user choice is 1 and he gets less than 7 right answers, then the program would print his score and print “Please ask your teacher for help”.

Hello, Please choose one of the following options

1.Multiplication

2.Integer Division

3.Exit the program

1

Please answer the following questions

6x3=18

7x3=21

5x4=20

4x7=28

$$6 \times 7 = 2$$

$$1 \times 1 = 1$$

$$9 \times 2 = 18$$

$$6 \times 2 = 0$$

$$8 \times 2 = 0$$

$$5 \times 6 = 0$$

Please ask your teacher for help!

You scored 6/10

Press any key to continue . . .

Test Case 3: If the user choice is 2 and he gets 7 right answers or greater, then the program would print his score and print congratulations.

Hello, Please choose one of the following options

1. Multiplication

2. Integer Division

3. Exit the program

2

Please answer the following questions

$$4/5 = 0$$

$$8/9 = 0$$

$$9/4 = 2$$

$$9/2 = 4$$

$$6/3 = 2$$

$$9/3 = 3$$

$$7/5 = 2$$

$$1/8 = 2$$

$$2/9 = 2$$

$$9/6 = 1$$

Congratulations!

You scored 7/10

Press any key to continue . . .

Test Case 4: If the user choice is 2 and he gets less than 7 right answers, then the program would print his score and print “Please ask your teacher for help”.

Hello, Please choose one of the following options

1.Multiplication

2.Integer Division

3.Exit the program

2

Please answer the following questions

3/1=3

5/1=5

1/9=0

4/3=1

6/7=0

7/4=1

3/5=2

4/2=1

8/6=3

9/3=5

Please ask your teacher for help!

You scored 6/10

Press any key to continue . . .

Test Case 5: If the user choice is 3, the program will end.

Hello, Please choose one of the following options

1.Multiplication

2.Integer Division

3.Exit the program

3

Exiting Program!

Press any key to continue . . .

Test Case 6: If the user input any number greater than 3, the program will show invalid input and will exit the program.

Hello, Please choose one of the following options

1.Multiplication

2.Integer Division

3.Exit the program

5

Invalid input.

Press any key to continue . . .

B. Algorithm Design:

- Declare a, b, answer, and results as variables.
- Assign 0 to result
- Generate Random Number
-
- Print "Hello, please choose one of the following options" << endl;
- Print "1.Multiplication"
- Print "2.Integer Division"
- Print "3.Exit the program"
- Assign user input to choice.
 - If user choice is 1:
 - Print "Please answer the following questions"
 - Assign 0 to i and Loop i from 0-10
 - Assign a random number from 1-9 to the variable a.
 - Assign a random number from 1-9 to the variable b.
 - Print "axb="
 - store input into answer
 - If answer is equal to axb, increment result.
 - ENDIF
 - End Loop
 - Else if user choice is 2:
 - Print "Please answer the following questions"
 - Assign 0 to i and Loop i from 0-10
 - Assign a random number from 1-9 to the variable a.
 - Assign a random number from 1-9 to the variable b.
 - Print "a/b="

- store input into answer
- If answer is equal to a/b, increment result.
- ENDIF

- End Loop

- Else if user choice is 3, print “Exiting Program”, pause the program, then exit.

- Else if choice is greater than 3, print “Invalid input”, pause the program, then exit.

- If result is greater than 7, print “Congratulations”, else print “Please ask your teacher for help”
- Print “You scored” result “/10”

Step 4: Code or implementation

```
#include <iostream>
#include <cstdlib>
#include <time.h>
using namespace std;

int main() {
    int choice;
    // Declare a variable
    int a, b, answer, result = 0;
    //using this function to get random numbers
    srand(time(NULL));
    cout << "Hello, Please choose one of the following options" << endl;
    cout << "1.Multiplication" << endl;
    cout << "2.Integer Division" << endl;
    cout << "3.Exit the program" << endl;
    cin >> choice;

    switch (choice) {
    case 1: {
        cout << "Please answer the following questions" << endl;
        //using for loop for the multiplication operation
        for (int i = 0; i < 10; i++) {
            // Assigning random numbers from 1-10 for a and b.
            a = (rand() % 9) + 1;
            b = (rand() % 9) + 1;
            // axb=answer
            cout << a << "x" << b << "=";
            cin >> answer;
            if (answer == a*b) {
                result++;
            }
        }
        break;
    }
    case 2: {
        cout << "Please answer the following questions" << endl;
        for (int i = 0; i < 10; i++) {
            // Assigning random numbers from 1-10 for a and b.
            a = (rand() % 9) + 1;
            b = (rand() % 9) + 1;
            // a/b=answer
            cout << a << "/" << b << "=";
            cin >> answer;
            if (answer == a / b) {
                result++;
            }
        }
        break;
    }
    case 3:
        cout << "Exiting Program! \n";
        system("pause");
        // program will pause then exit.
    }
```



```

        exit(1);
        break;
    default:
        cout << "Invalid input. \n";
        system("pause");
        // program will pause then exit.
        exit(1);
    }

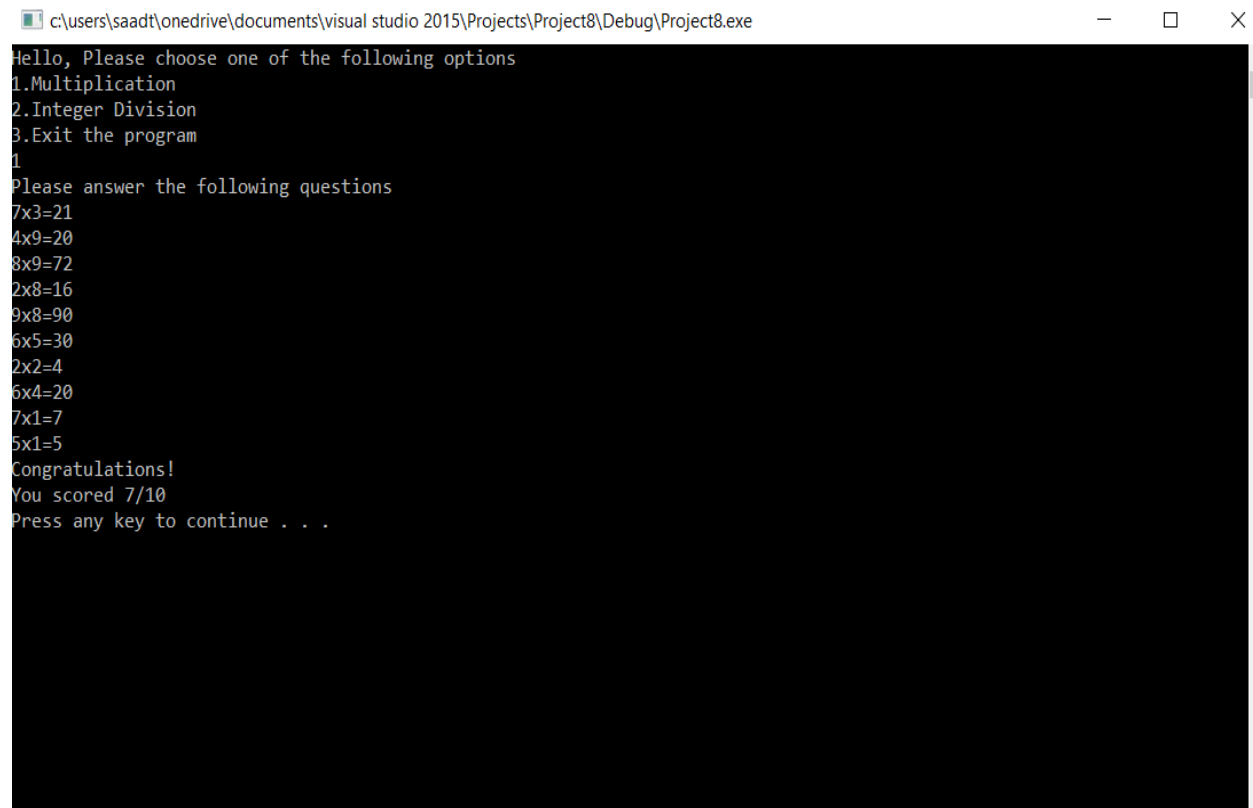
    if (result >= 7) {
        cout << "Congratulations! " << endl;
    }
    else {
        cout << "Please ask your teacher for help!" << endl;
    }

    cout << "You scored " << result << "/10" << endl;
    // score "(correct answer)/10"
    system("pause");
    return(0);
}

```

Test Cases:

Test Case 1:

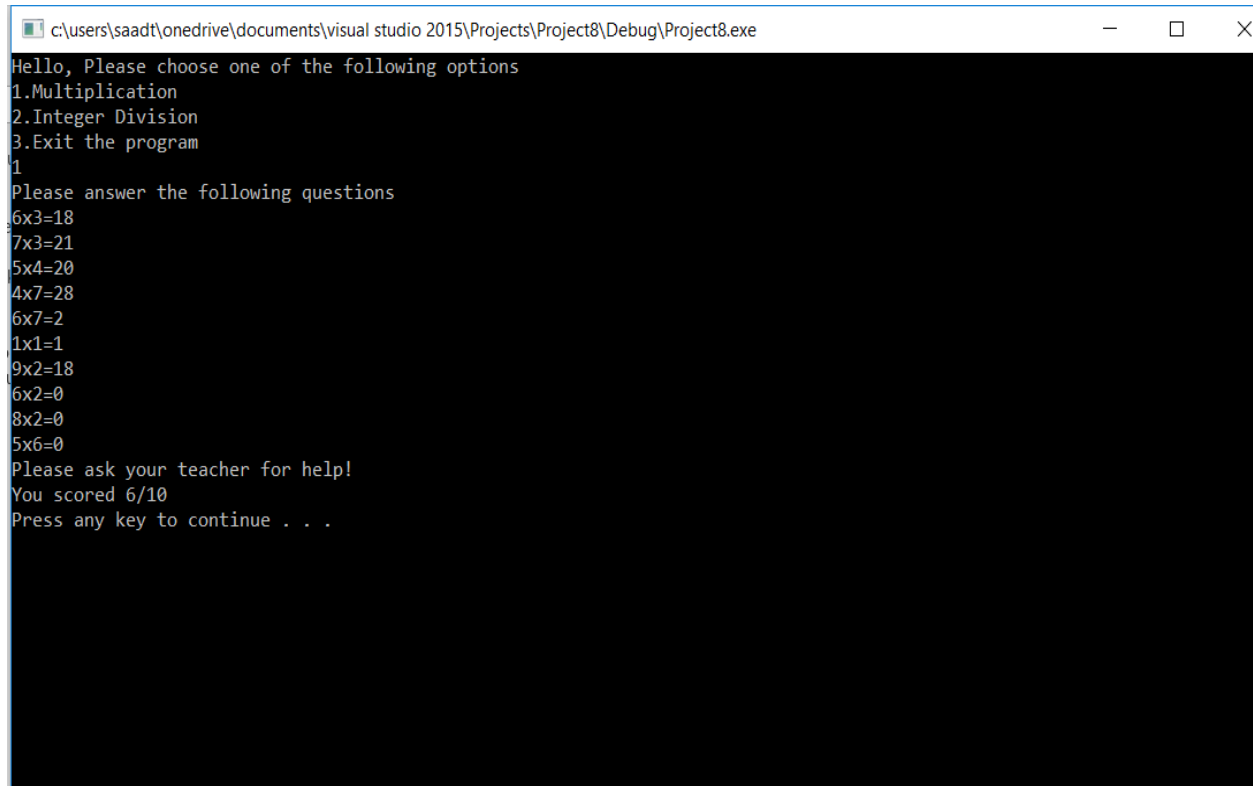


```

c:\users\saadt\onedrive\documents\visual studio 2015\Projects\Project8\Debug\Project8.exe
Hello, Please choose one of the following options
1.Multiplication
2.Integer Division
3.Exit the program
1
Please answer the following questions
7x3=21
4x9=20
8x9=72
2x8=16
9x8=90
6x5=30
2x2=4
6x4=20
7x1=7
5x1=5
Congratulations!
You scored 7/10
Press any key to continue . . .

```

Test Case 2:



```
c:\users\saadt\onedrive\documents\visual studio 2015\Projects\Project8\Debug\Project8.exe
Hello, Please choose one of the following options
1.Multiplication
2.Integer Division
3.Exit the program
1
Please answer the following questions
6x3=18
7x3=21
5x4=20
4x7=28
6x7=2
1x1=1
9x2=18
6x2=0
8x2=0
5x6=0
Please ask your teacher for help!
You scored 6/10
Press any key to continue . . .
```

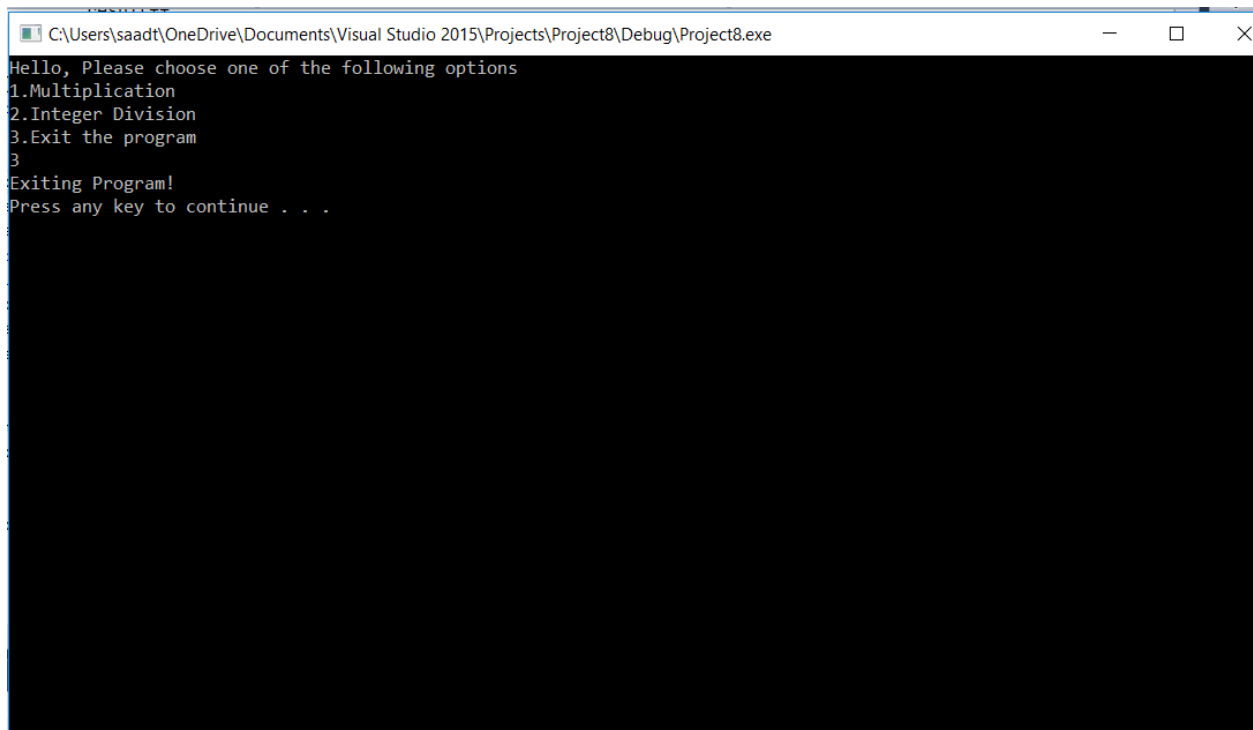
Test Case 3:

```
c:\users\saadt\onedrive\documents\visual studio 2015\Projects\Project8\Debug\Project8.exe
Hello, Please choose one of the following options
1.Multiplication
2.Integer Division
3.Exit the program
2
Please answer the following questions
4/5=0
8/9=0
9/4=2
9/2=4
6/3=2
9/3=3
7/5=2
1/8=2
2/9=2
9/6=1
Congratulations!
You scored 7/10
Press any key to continue . . .
```

Test Case 4:

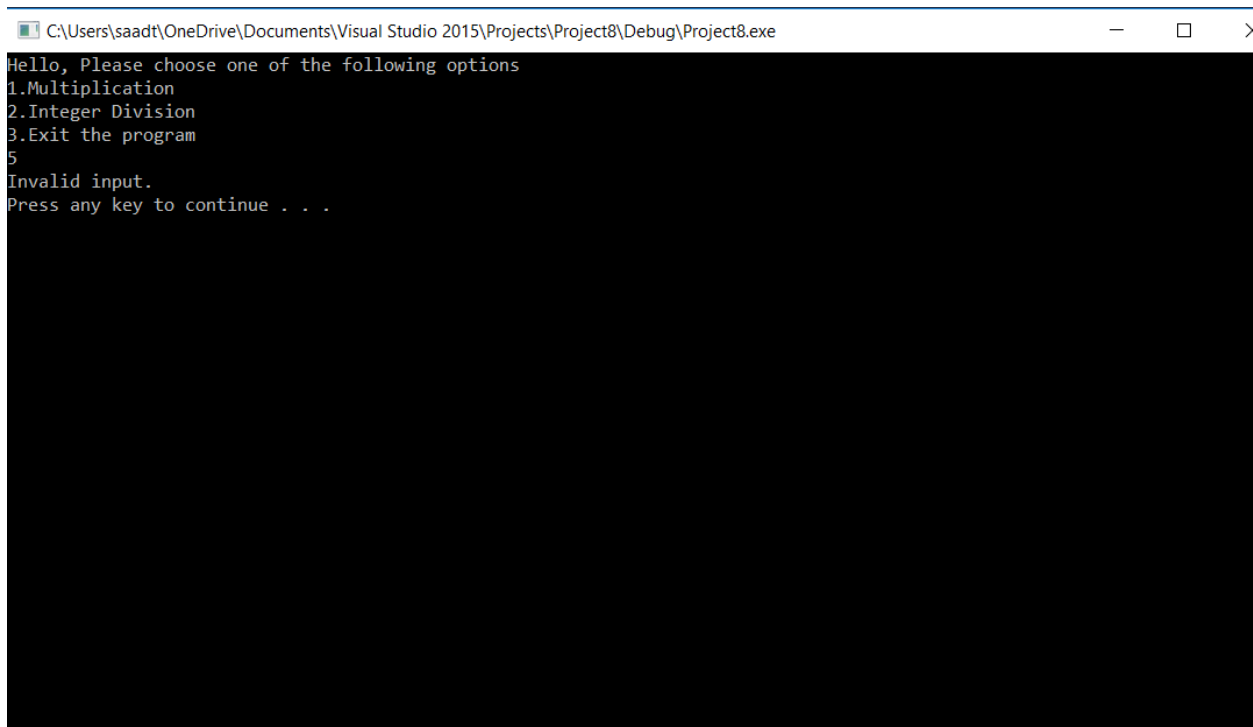
```
c:\users\saadt\onedrive\documents\visual studio 2015\Projects\Project8\Debug\Project8.exe
Hello, Please choose one of the following options
1.Multiplication
2.Integer Division
3.Exit the program
2
Please answer the following questions
3/1=3
5/1=5
1/9=0
4/3=1
6/7=0
7/4=1
3/5=2
4/2=1
8/6=3
9/3=5
Please ask your teacher for help!
You scored 6/10
Press any key to continue . . .
```

Test Case 5:



```
C:\Users\saadt\OneDrive\Documents\Visual Studio 2015\Projects\Project8\Debug\Project8.exe
Hello, Please choose one of the following options
1.Multiplication
2.Integer Division
3.Exit the program
3
Exiting Program!
Press any key to continue . . .
```

Test Case 6:



```
C:\Users\saadt\OneDrive\Documents\Visual Studio 2015\Projects\Project8\Debug\Project8.exe
Hello, Please choose one of the following options
1.Multiplication
2.Integer Division
3.Exit the program
5
Invalid input.
Press any key to continue . . .
```