

# Lab#15

## OPEN ENDED

The objective of this program is to create a **Math Quiz Game** for Kids that helps children practice basic math operations in a fun way. It also demonstrates the use of **multithreading, synchronization, and exception handling** in Java.

```
1 package interface1;
2 - import java.util.Random;
3 import java.util.Scanner;
4 import java.util.concurrent.locks.Lock;
5 import java.util.concurrent.locks.ReentrantLock;
6
7 // ----- Base Class (Inheritance) -----
8 abstract class Question {
9     int a, b;
10    char operator;
11
12    Question(int a, int b, char operator) {
13        this.a = a;
14        this.b = b;
15        this.operator = operator;
16    }
17
18    abstract int getAnswer();
19
20    void displayQuestion() {
21        System.out.println("Question: " + a + " " + operator +
22    }
23 }
24
25 // ----- Child Classes -----
26 class Addition extends Question {
27    Addition(int a, int b) {
28        super(a, b, '+');
29    }
30
31    int getAnswer() {
32        return a + b;
33    }
34 }
35
36 class Subtraction extends Question {
37    Subtraction(int a, int b) {
38        super(a, b, '-');
39    }
40
41    int getAnswer() {
42        return a - b;
43    }
44 }
45
46 class Multiplication extends Question {
47    Multiplication(int a, int b) {
48        super(a, b, '*');
49    }
50
51    int getAnswer() {
52        return a * b;
53    }
54 }
55
56 class Division extends Question {
57    Division(int a, int b) {
58        super(a, b, '/');
59    }
60
61    int getAnswer() {
62        return a / b;
63    }
64 }
65
66 // ----- Score (Shared Resource) -----
67 class Score {
68     private int score = 0;
69     Lock lock = new ReentrantLock();
```

```

70
71     void increase() {
72         lock.lock();
73         try {
74             score++;
75         } finally {
76             lock.unlock();
77         }
78     }
79
80     int getScore() {
81         return score;
82     }
83 }
84
85 // ----- Thread Class -----
86 class QuizThread extends Thread {
87
88     Question question;
89     Score score;
90     Scanner sc;
91
92     QuizThread(Question question, Score score, Scanner sc) {
93         this.question = question;
94         this.score = score;
95         this.sc = sc;
96     }
97
98     public void run() {
99         try {
100             question.displayQuestion();
101             Thread.sleep(500);
102
103             System.out.print("Your Answer: ");
104             int userAnswer = sc.nextInt();
105
106             if (userAnswer == question.getAnswer()) {
107                 System.out.println("Correct ✅");
108                 score.increase();
109             } else {
110                 System.out.println("Wrong ❌ Correct Answer is: " + question.getAnswer());
111             }
112
113         } catch (ArithmaticException e) {
114             System.out.println("Error: Division by zero not allowed!");
115         } catch (Exception e) {
116             System.out.println("Invalid input! Please enter numbers only.");
117             sc.nextLine();
118         }
119     }
120 }
121
122 // ----- Main Class -----
123 public class Main {
124
125     public static void main(String[] args) {
126
127         Scanner sc = new Scanner(System.in);
128         Random rand = new Random();
129         Score score = new Score();
130
131         System.out.println(">Welcome to Math Quiz Game for Kids 😊\n");
132
133         for (int i = 1; i <= 5; i++) {
134
135             int a = rand.nextInt(10) + 1;
136             int b = rand.nextInt(10) + 1;
137             int type = rand.nextInt(4);
138
139             Question q;
140
141             switch (type) {
142                 case 0:
143                     q = new Addition(a, b);
144                     break;
145                 case 1:
146                     q = new Subtraction(a, b);
147                     break;
148                 case 2:
149                     q = new Multiplication(a, b);
150                     break;
151                 default:
152                     if (b == 0) b = 1;
153                     q = new Division(a, b);
154             }
155
156             QuizThread qt = new QuizThread(q, score, sc);
157             qt.start();
158
159             try {
160                 qt.join(); // wait for thread
161             } catch (InterruptedException e) {
162                 System.out.println("Thread interrupted");
163             }
164
165             System.out.println();
166         }
167
168         System.out.println(">@ Final Score: " + score.getScore() + "/5");
169         System.out.println("Game Over 😊");
170         sc.close();
171     }
172 }

```

**Output:**

```
>Welcome to Math Quiz Game for Kids
```

```
Question: 10 - 6 = ?
```

```
Your Answer: 4
```

```
Correct ✓
```

```
Question: 3 + 7 = ?
```

```
Your Answer: 15
```

```
Wrong ✗ Correct Answer is: 10
```

```
Question: 9 / 1 = ?
```

```
Your Answer: 4
```

```
Wrong ✗ Correct Answer is: 9
```

**GitHub:**