PL/SQL EXERCISE:

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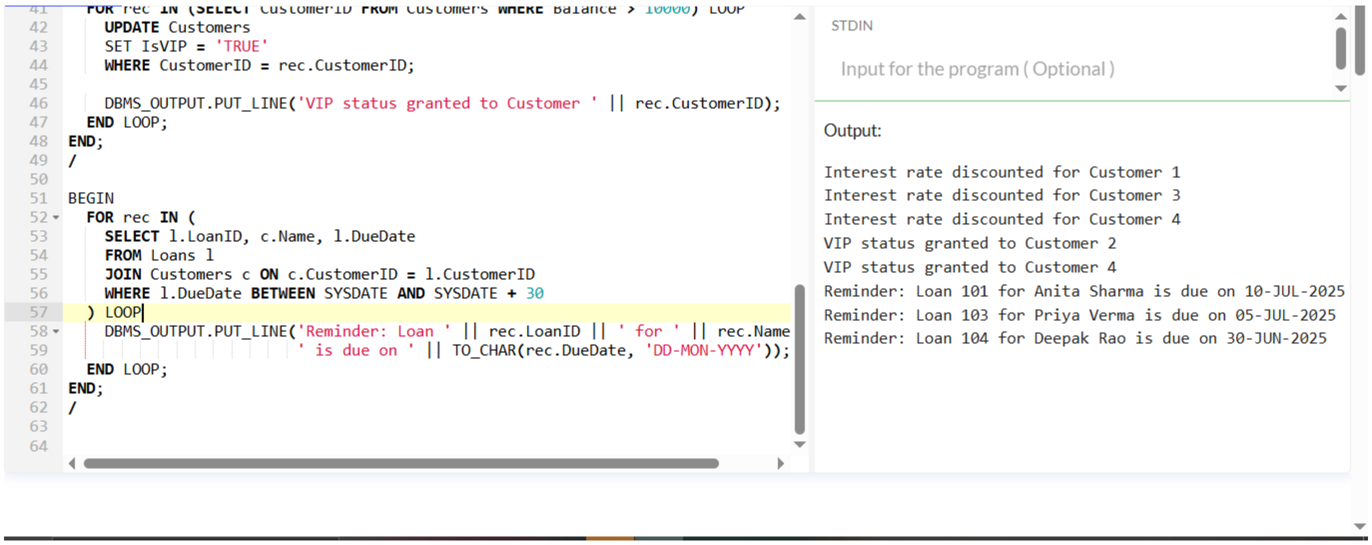
Exercise 1: Control Structures

```
-- Create Customers table

CREATE TABLE Customers (

  CustomerID NUMBER PRIMARY KEY,

  Name VARCHAR2(100),

  Age NUMBER,

  Balance NUMBER(10, 2),

  IsVIP VARCHAR2(5) DEFAULT 'FALSE'

);


-- Create Loans table

CREATE TABLE Loans (

  LoanID NUMBER PRIMARY KEY,

  CustomerID NUMBER REFERENCES Customers(CustomerID),

  InterestRate NUMBER(5, 2),

  DueDate DATE

);

-- Customers

INSERT INTO Customers VALUES (1, 'Anita Sharma', 65, 8500, 'FALSE');

INSERT INTO Customers VALUES (2, 'Rahul Mehta', 45, 12000, 'FALSE');

INSERT INTO Customers VALUES (3, 'Priya Verma', 70, 3000, 'FALSE');

INSERT INTO Customers VALUES (4, 'Deepak Rao', 61, 15000, 'FALSE');


-- Loans

INSERT INTO Loans VALUES (101, 1, 6.5, SYSDATE + 15);
INSERT INTO Loans VALUES (102, 2, 7.0, SYSDATE + 40);

INSERT INTO Loans VALUES (103, 3, 8.0, SYSDATE + 10);

INSERT INTO Loans VALUES (104, 4, 6.8, SYSDATE + 5);

COMMIT;


BEGIN

  FOR rec IN (SELECT CustomerID FROM Customers WHERE Age > 60) LOOP

    UPDATE Loans

    SET InterestRate = InterestRate - 1.0

    WHERE CustomerID = rec.CustomerID;


    DBMS_OUTPUT.PUT_LINE('Interest rate discounted for Customer ' || rec.CustomerID);

  END LOOP;

END;

/

BEGIN

  FOR rec IN (SELECT CustomerID FROM Customers WHERE Balance > 10000) LOOP

    UPDATE Customers

    SET IsVIP = 'TRUE'

    WHERE CustomerID = rec.CustomerID;


    DBMS_OUTPUT.PUT_LINE('VIP status granted to Customer ' || rec.CustomerID);

  END LOOP;

END;

/


BEGIN

  FOR rec IN (

    SELECT l.LoanID, c.Name, l.DueDate
    FROM Loans l
    JOIN Customers c ON c.CustomerID = l.CustomerID
    WHERE l.DueDate BETWEEN SYSDATE AND SYSDATE + 30
  ) LOOP
    DBMS_OUTPUT.PUT_LINE('Reminder: Loan ' || rec.LoanID || ' for ' || rec.Name ||
                         ' is due on ' || TO_CHAR(rec.DueDate, 'DD-MON-YYYY'));
  END LOOP;
END;
/
```

OUTPUT:



```
  FOR rec IN (SELECT CustomerID FROM Customers WHERE Balance > 10000) LOOP
    UPDATE Customers
    SET IsVIP = 'TRUE'
    WHERE CustomerID = rec.CustomerID;

    DBMS_OUTPUT.PUT_LINE('VIP status granted to Customer ' || rec.CustomerID);
  END LOOP;
END;
/

BEGIN
  FOR rec IN (
    SELECT l.LoanID, c.Name, l.DueDate
    FROM Loans l
    JOIN Customers c ON c.CustomerID = l.CustomerID
    WHERE l.DueDate BETWEEN SYSDATE AND SYSDATE + 30
  ) LOOP
    DBMS_OUTPUT.PUT_LINE('Reminder: Loan ' || rec.LoanID || ' for ' || rec.Name
                         ' is due on ' || TO_CHAR(rec.DueDate, 'DD-MON-YYYY'));
  END LOOP;
END;
/
```

STDIN

Input for the program (Optional)

Output:

```
Interest rate discounted for Customer 1
Interest rate discounted for Customer 3
Interest rate discounted for Customer 4
VIP status granted to Customer 2
VIP status granted to Customer 4
Reminder: Loan 101 for Anita Sharma is due on 10-JUL-2025
Reminder: Loan 103 for Priya Verma is due on 05-JUL-2025
Reminder: Loan 104 for Deepak Rao is due on 30-JUN-2025
```

Exercise 3: Stored Procedures

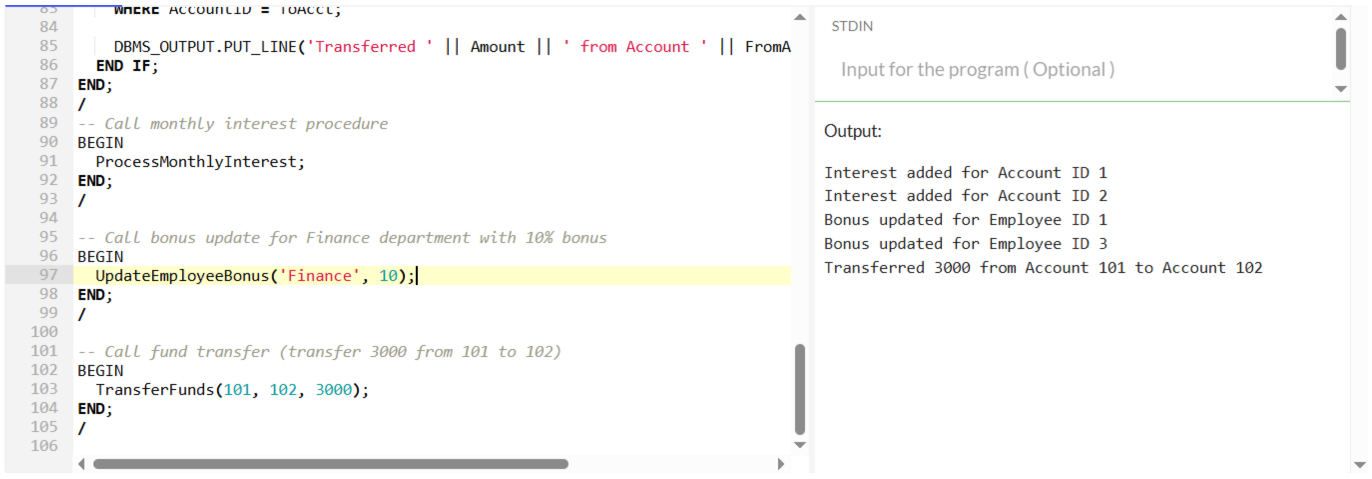
```
-- Enable DBMS output
SET SERVEROUTPUT ON;

-- Create SavingsAccounts table
CREATE TABLE SavingsAccounts (
  AccountID NUMBER PRIMARY KEY,
  CustomerName VARCHAR2(100),
  Balance NUMBER(12,2)
);

-- Create Employees table
CREATE TABLE Employees (
  EmpID NUMBER PRIMARY KEY,
  Name VARCHAR2(100),
  Department VARCHAR2(50),
  Salary NUMBER(10,2)
);

-- Create Accounts table for fund transfers
CREATE TABLE Accounts (
  AccountID NUMBER PRIMARY KEY,
  CustomerName VARCHAR2(100),
  Balance NUMBER(12,2)
);

-- Insert into SavingsAccounts
INSERT INTO SavingsAccounts VALUES (1, 'Anita Sharma', 10000);
INSERT INTO SavingsAccounts VALUES (2, 'Rahul Mehta', 25000);

-- Insert into Employees
INSERT INTO Employees VALUES (1, 'Suresh Kumar', 'Finance', 60000);
INSERT INTO Employees VALUES (2, 'Meena Iyer', 'HR', 55000);
INSERT INTO Employees VALUES (3, 'Ravi Das', 'Finance', 62000);

-- Insert into Accounts
```

```
INSERT INTO Accounts VALUES (101, 'Anita Sharma', 8000);

INSERT INTO Accounts VALUES (102, 'Rahul Mehta', 12000);


COMMIT;

CREATE OR REPLACE PROCEDURE ProcessMonthlyInterest IS

BEGIN

  FOR rec IN (SELECT AccountID, Balance FROM SavingsAccounts) LOOP

    UPDATE SavingsAccounts

    SET Balance = Balance + (rec.Balance * 0.01)

    WHERE AccountID = rec.AccountID;


    DBMS_OUTPUT.PUT_LINE('Interest added for Account ID ' || rec.AccountID);

  END LOOP;

END;

/

CREATE OR REPLACE PROCEDURE UpdateEmployeeBonus (

  DeptName IN VARCHAR2,

  BonusPct IN NUMBER

) IS

BEGIN

  FOR rec IN (SELECT EmpID, Salary FROM Employees WHERE Department = DeptName) LOOP

    UPDATE Employees

    SET Salary = Salary + (rec.Salary * BonusPct / 100)

    WHERE EmpID = rec.EmpID;


    DBMS_OUTPUT.PUT_LINE('Bonus updated for Employee ID ' || rec.EmpID);

  END LOOP;

END;

/
```

```
CREATE OR REPLACE PROCEDURE TransferFunds (

  FromAcct IN NUMBER,

  ToAcct IN NUMBER,

  Amount IN NUMBER

) IS

  v_balance NUMBER;

BEGIN

  SELECT Balance INTO v_balance FROM Accounts WHERE AccountID = FromAcct;


  IF v_balance < Amount THEN

    DBMS_OUTPUT.PUT_LINE('Insufficient balance to transfer.');

  ELSE

    UPDATE Accounts

    SET Balance = Balance - Amount

    WHERE AccountID = FromAcct;


    UPDATE Accounts

    SET Balance = Balance + Amount

    WHERE AccountID = ToAcct;


    DBMS_OUTPUT.PUT_LINE('Transferred ' || Amount || ' from Account ' || FromAcct || ' to Account ' || ToAcct);

  END IF;

END;

/

-- Call monthly interest procedure

BEGIN

  ProcessMonthlyInterest;

END;

/
```

```
-- Call bonus update for Finance department with 10% bonus

BEGIN

  UpdateEmployeeBonus('Finance', 10);

END;

/



-- Call fund transfer (transfer 3000 from 101 to 102)

BEGIN

  TransferFunds(101, 102, 3000);

END;

/
```

OUTPUT:



```
    WHERE AccountID = ToAcct;

    DBMS_OUTPUT.PUT_LINE('Transferred ' || Amount || ' from Account ' || FromA
  END IF;
END;
/
-- Call monthly interest procedure
BEGIN
  ProcessMonthlyInterest;
END;
/

-- Call bonus update for Finance department with 10% bonus
BEGIN
  UpdateEmployeeBonus('Finance', 10);
END;
/

-- Call fund transfer (transfer 3000 from 101 to 102)
BEGIN
  TransferFunds(101, 102, 3000);
END;
/
```

STDIN

Input for the program (Optional)

Output:

```
Interest added for Account ID 1
Interest added for Account ID 2
Bonus updated for Employee ID 1
Bonus updated for Employee ID 3
Transferred 3000 from Account 101 to Account 102
```

JUnit_Basic Testing Exercises:

Exercise 1: Setting Up JUnit

Calculator.java (in src/main/java)

```java
public class Calculator {
    public int add(int a, int b) {
        return a + b;
    }
}
```

CalculatorTest.java (in src/test/java)

```java
import static org.junit.jupiter.api.Assertions.assertEquals;
import org.junit.jupiter.api.Test;

public class CalculatorTest {

    @Test
    void testAdd() {
        Calculator calculator = new Calculator();
        int result = calculator.add(2, 3);
        assertEquals(5, result);
    }
}
```

pom.xml

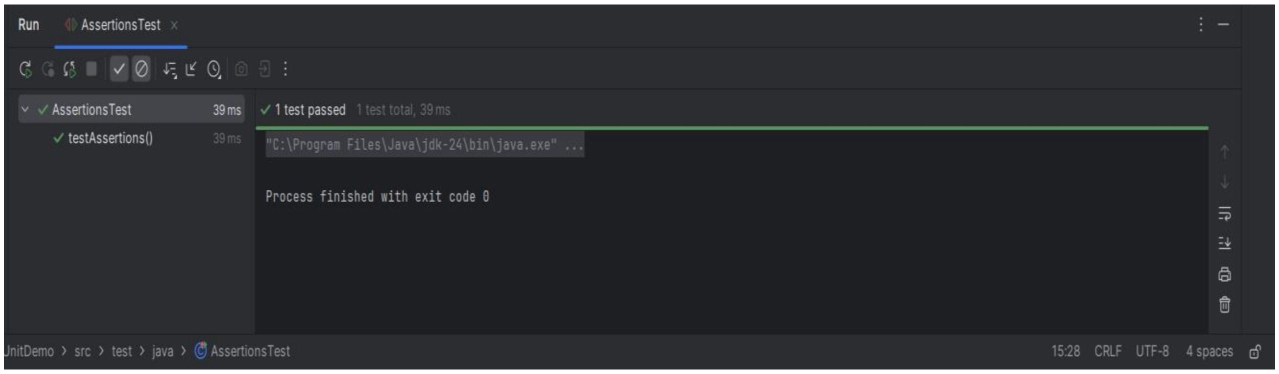
```xml
<dependencies>
    <dependency>
        <groupId>org.junit.jupiter</groupId>
        <artifactId>junit-jupiter</artifactId>
        <version>5.10.0</version>
        <scope>test</scope>
    </dependency>
</dependencies>
```

Exercise 3: Assertions in JUnit

AssertionsTest.java

```java
import org.junit.jupiter.api.Test;

import static org.junit.jupiter.api.Assertions.*;

public class AssertionsTest {

    @Test

    public void testAssertions() {

        // Assert equals

        assertEquals(5, 2 + 3);

        // Assert true

        assertTrue(5 > 3);
        // Assert false
        assertFalse(5 < 3);
        // Assert null
        assertNull(null);
        // Assert not null
        assertNotNull(new Object());
    }
}
```

Output:



Run
AssertionsTest
AssertionsTest 39 ms
testAssertions() 39 ms
✓ 1 test passed 1 test total, 39 ms
UnitDemo › src › test › java › AssertionsTest
15:28 CRLF UTF-8 4 spaces

```
"C:\Program Files\Java\jdk-24\bin\java.exe" ...

Process finished with exit code 0
```

Exercise 4: Arrange-Act-Assert (AAA) Pattern, Test Fixtures, Setup and Teardown Methods in JUnit

Scenario: Testing a Calculator with AAA Pattern and Setup/Teardown

Calculator.java

```
public class Calculator {
    public int add(int a, int b) {
        return a + b;
    }
 public int subtract(int a, int b) {
        return a - b;
    }
}
```

CalculatorTest.java (JUnit 5 test with AAA + Setup/Teardown)

```
import static org.junit.jupiter.api.Assertions.assertEquals;

import org.junit.jupiter.api.*;

public class CalculatorTest {

private Calculator calculator;

@BeforeEach

   void setUp() {

      // Setup: runs before each test

      calculator = new Calculator();

      System.out.println("Setup complete");

   }

@AfterEach

   void tearDown() {

      // Teardown: runs after each test

      System.out.println("Teardown complete");

   }

@Test

   void testAddition() {

      int a = 5;

      int b = 3;

      int result = calculator.add(a, b);

 assertEquals(8, result);

   } @Test

   void testSubtraction() {

      int a = 10;

      int b = 4;

      int result = calculator.subtract(a, b);
```

```
        assertEquals(6, result);

    }

}
```

3. Mockito exercises

Exercise 1: Mocking and Stubbing

Pom.xml:

```
<?xml version="1.0" encoding="UTF-8"?>


<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"

  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">

  <modelVersion>4.0.0</modelVersion>


  <groupId>com.example</groupId>

  <artifactId>mockitomockingandstubbing</artifactId>

  <version>1.0-SNAPSHOT</version>


  <name>mockitomockingandstubbing</name>

  <!-- FIXME change it to the project's website -->

  <url>http://www.example.com</url>


  <properties>

    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>

    <maven.compiler.source>1.8</maven.compiler.source>

    <maven.compiler.target>1.8</maven.compiler.target>

  </properties>
  <dependencies>
    <dependency>
      <groupId>junit</groupId>
      <artifactId>junit</artifactId>
      <version>4.11</version>
      <scope>test</scope>
    </dependency>
     <dependency>
        <groupId>org.junit.jupiter</groupId>
        <artifactId>junit-jupiter</artifactId>
        <version>5.10.0</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.mockito</groupId>
        <artifactId>mockito-core</artifactId>
        <version>5.7.0</version>
        <scope>test</scope>
    </dependency>
  </dependencies>
```

ExternalApi.java

```
package com.example;
public interface ExternalApi {
    String getData();
}
```

```
}
```

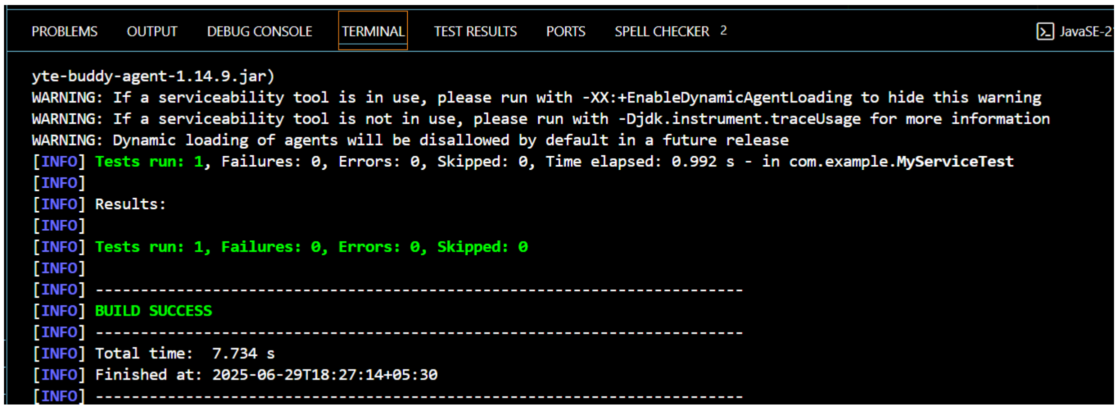
MyService.java

```
package com.example;

public class MyService {

    private ExternalApi api;

    public MyService(ExternalApi api) {

        this.api = api;

    }


    public String fetchData() {

        return api.getData();

    }

}
```

MyServiceTest.java

```
package com.example;

import static org.junit.jupiter.api.Assertions.*;

import static org.mockito.Mockito.*;

import org.junit.jupiter.api.Test;

public class MyServiceTest {

    @Test

    public void testExternalApi() {

        ExternalApi mockApi = mock(ExternalApi.class);

        when(mockApi.getData()).thenReturn("Mock Data");

        MyService service = new MyService(mockApi);

        String result = service.fetchData();

        assertEquals("Mock Data", result);

    }

}
```

Output:



```
yte-buddy-agent-1.14.9.jar)
WARNING: If a serviceability tool is in use, please run with -XX:+EnableDynamicAgentLoading to hide this warning
WARNING: If a serviceability tool is not in use, please run with -Djdk.instrument.traceUsage for more information
WARNING: Dynamic loading of agents will be disallowed by default in a future release
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.992 s - in com.example.MyServiceTest
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  7.734 s
[INFO] Finished at: 2025-06-29T18:27:14+05:30
[INFO] ------------------------------------------------------------------------
```

Exercise 2: Verifying Interactions

Pom.xml

```
<?xml version="1.0" encoding="UTF-8"?>

<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"

  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">

  <modelVersion>4.0.0</modelVersion>



  <groupId>com.example</groupId>

  <artifactId>verifyinginteractions</artifactId>

  <version>1.0-SNAPSHOT</version>



  <name>verifyinginteractions</name>

  <!-- FIXME change it to the project's website -->

  <url>http://www.example.com</url>



  <properties>

    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>

    <maven.compiler.source>1.8</maven.compiler.source>

    <maven.compiler.target>1.8</maven.compiler.target>
  </properties>

}

  <dependencies>
    <dependency>
      <groupId>junit</groupId>
      <artifactId>junit</artifactId>
      <version>4.11</version>
      <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.junit.jupiter</groupId>
        <artifactId>junit-jupiter</artifactId>
        <version>5.10.0</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.mockito</groupId>
        <artifactId>mockito-core</artifactId>
        <version>5.7.0</version>
        <scope>test</scope>
    </dependency>
  </dependencies>
```

ExternalApi.java

```
package com.example;
public interface ExternalApi {
    String getData();
}
```

```
}
```

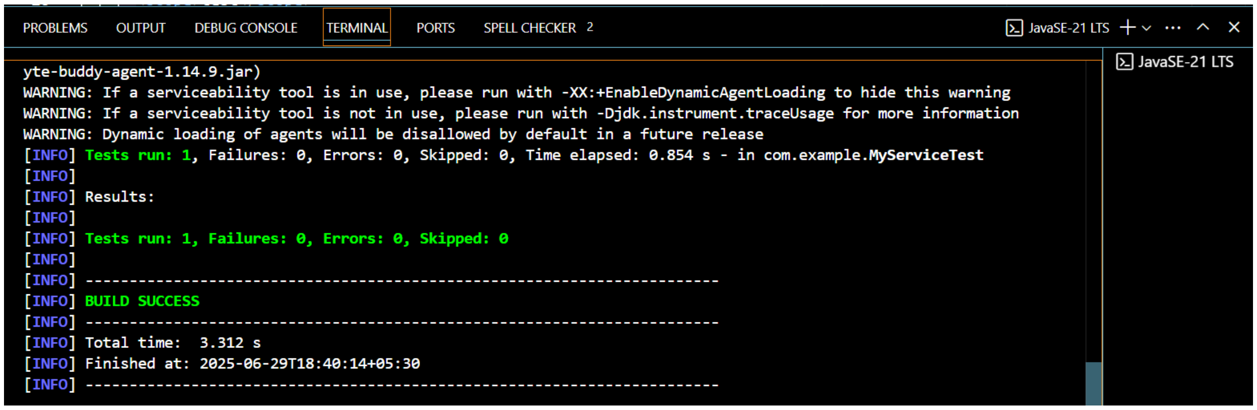
MyService.java

```
package com.example;

public class MyService {

    private ExternalApi api;

    public MyService(ExternalApi api) {

        this.api = api;

    }


    public String fetchData() {

        return api.getData();

    }

}
```

MyServiceTest.java

```
package com.example;

import org.junit.jupiter.api.Test;

import static org.mockito.Mockito.*;

public class MyServiceTest {

    @Test

    public void testVerifyInteraction() {

        ExternalApi mockApi = mock(ExternalApi.class);

        MyService service = new MyService(mockApi);

        service.fetchData();

        verify(mockApi).getData();

    }

}
```

Output:



```
yte-buddy-agent-1.14.9.jar)
WARNING: If a serviceability tool is in use, please run with -XX:+EnableDynamicAgentLoading to hide this warning
WARNING: If a serviceability tool is not in use, please run with -Djdk.instrument.traceUsage for more information
WARNING: Dynamic loading of agents will be disallowed by default in a future release
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.854 s - in com.example.MyServiceTest
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  3.312 s
[INFO] Finished at: 2025-06-29T18:40:14+05:30
[INFO] ------------------------------------------------------------------------
```

6. SL4J Logging exercises

Exercise 1: Logging Error Messages and Warning Levels

Pom.xml

```
<?xml version="1.0" encoding="UTF-8"?>


<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-
4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>


  <groupId>com.example</groupId>
  <artifactId>logging</artifactId>
  <version>1.0-SNAPSHOT</version>


  <name>logging</name>
  <!-- FIXME change it to the project's website -->
  <url>http://www.example.com</url>
  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
    <maven.compiler.source>1.8</maven.compiler.source>
    <maven.compiler.target>1.8</maven.compiler.target>
  </properties>

  <dependencies>
    <dependency>
      <groupId>junit</groupId>
      <artifactId>junit</artifactId>
      <version>4.11</version>
      <scope>test</scope>
    </dependency>
    <dependency>
    <groupId>org.slf4j</groupId>
    <artifactId>slf4j-api</artifactId>
    <version>1.7.30</version>
</dependency>
<dependency>
    <groupId>ch.qos.logback</groupId>
    <artifactId>logback-classic</artifactId>
    <version>1.2.3</version>
</dependency>
  </dependencies>
```

LoggingExample.java

```
package com.example;


import org.slf4j.Logger;

import org.slf4j.LoggerFactory;


public class LoggingExample {

    private static final Logger logger = LoggerFactory.getLogger(LoggingExample.class);


    public static void main(String[] args) {

        logger.error("This is an error message");

        logger.warn("This is a warning message");

    }

}
```