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Assignment : Individual Coursework

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Task 1

I. Select a Data Structure for this scenario. Justify your answer

- Using queues with linked list data structure, the loan system application was implemented

Reasons to use queues with Linked List :

- Queues can be very useful data structures in cases like when only insertion and deletion happens or where there are rare modifications
- Linked lists are easier to implement if you have a structured memory allocation which means it doesn't need to have a size limit when storing data in the memory.
- It can also create a queue that can enlarge and contract. There's no capability of overflowing the heap until the memory is exhausted.
- Therefore with the use of queues with linked list it will be easy to add customer details one after another.

II. Implement the Data Structure

```
class loanSystem{
    QNode frontNode, rearNode;

    public loanSystem(){
        this.frontNode = this.rearNode = null;
    }
    //Method to add an key to the queue
    void enqueue(int NIC, int accountNumber, String loanType,
        String reasonOfLoanApplication, String
descriptionOfCollaterals){

        //Create a new LL node
        QNode loanApplicationSystem = new QNode(NIC, accountNumber, loanType,
            reasonOfLoanApplication, descriptionOfCollaterals);

        //If queue is empty, then the new node is front and rear both
        if(this.rearNode == null){
            this.frontNode = this.rearNode = loanApplicationSystem;
            return;
        }
        //Add the new node at the end of the queue and change rear
        this.rearNode.next = loanApplicationSystem;
        this.rearNode = loanApplicationSystem;
    }

    //Method to remove an key from queue
    void dequeue(){

        //If queue is empty, return null
        if(this.frontNode == null)
            return;

        //Store previous front and move front a=one node ahead
        QNode temp = this.frontNode;
        this.frontNode = this.frontNode.next;

        //If front becomes null, then change rear also as null
        if(this.frontNode == null)
            this.rearNode = null;
    }
}
```

III. Implement Loan system

loanSystemApplication.java :

```
package sample;

public class loanSystemApplication {
    loanSystemApplication.QNode fNode, rNode;

    public loanSystemApplication() {
        this.fNode = this.rNode = null;
    }

    // Creating a Method to add loan details to the queue
    void enqueue(String Name, int NIC, int accountNumber, String loanType,
String reasonForApplyingTheLoan, String descriptionOfCollateral) {

        // Creating a new Linked List node
        QNode loanAppSystem = new QNode(Name, NIC, accountNumber, loanType,
reasonForApplyingTheLoan, descriptionOfCollateral);

        // If queue is empty, then new node is front and rear both
        if (this.rNode == null) {
            this.fNode = this.rNode = loanAppSystem;
            return;
        }

        // Add the new node at the end of the queue and change rear
        this.rNode.next = loanAppSystem;
        this.rNode = loanAppSystem;
    }

    // Creating a Method to delete a loan application from queue.
    public void dequeue() {
        // If queue is empty, return Null
        if (this.fNode == null)
            return;

        // Store previous front and move front one node ahead
        QNode temp = this.fNode;
        this.fNode = this.fNode.next;

        // If front becomes nULL, then change rear also as NULL
        if (this.fNode == null)
            this.rNode = null;
    }

    public int displayDetailsFrontNode() {
        System.out.println("Customers Name: " + this.fNode.Name);
        System.out.println("Customers NIC No: " + this.fNode.NIC);
        System.out.println("Customers bank account No: " +
this.fNode.accountNumber);
        System.out.println("Type of the Loan: " + this.fNode.loanType);
        System.out.println("Reason for taking the loan: " +
this.fNode.reasonForApplyingTheLoan);
    }
}
```

```

        System.out.println("Description Collateral: " +
this.fNode.descriptionCollateral);
        return 0;
    }

    public void displayDetailsRearNode() {
        System.out.println("Customers NIC No: " + this.rNode.Name);
        System.out.println("Customers NIC No: " + this.rNode.NIC);
        System.out.println("Customers bank account No: " +
this.rNode.accountNumber);
        System.out.println("Type of the Loan: " + this.rNode.loanType);
        System.out.println("Reason for taking the loan: " +
this.rNode.reasonForApplyingTheLoan);
        System.out.println("Description Collateral: " +
this.rNode.descriptionCollateral);
    }

    // Creating a Linked list Node
    class QNode {
        String Name;
        int NIC;
        int accountNumber;
        String loanType;
        String reasonForApplyingTheLoan;
        String descriptionCollateral;
        QNode next;

        // Creating a constructor to create a new linked list node
        public QNode(String name, int NIC, int accNumber, String loanType,
String reasonForApplyingTheLoan, String descriptionCollateral) {
            this.Name = name;
            this.NIC = NIC;
            this.accountNumber = accNumber;
            this.loanType = loanType;
            this.reasonForApplyingTheLoan = reasonForApplyingTheLoan;
            this.descriptionCollateral = descriptionCollateral;
            this.next = null;
        }
    }
}

```

mainLoanSystemProgramme:

```
package sample;

import java.util.Scanner;

public class mainLoanSystemProgramme {
    public static void main(String[] args) {
        String enterChoice;
        String decision = "";
        int count= 1;
        Scanner sc = new Scanner(System.in);

        System.out.println(".....Welcome to Hatton National
Bank Loan Systems.....");
        System.out.print("Normal customer - [A] \nInner customer - [B]
\nHigh priority customer - [C] ");
        System.out.println("");
        System.out.println("");
        System.out.print("Select customer type: ");
        enterChoice = sc.next();

        if (enterChoice.equals("A")){
            normalCustomer();
        }else if(enterChoice.equals("B")){
            innerCircleCustomers();
        }else if(enterChoice.equals("C")){
            highPriorityCustomers();
        }else{
            System.out.println("Invalid Input!");
        }
    }

    public static void normalCustomer(){
        loanSystemApplication normalCustomers = new loanSystemApplication();
        System.out.println(".....Normal Customer's
Loans..... ");
        normalCustomers.enqueue("Sandushke De Alwis",
752148963,1034569893,"Personal loan","Debt consolidation", "The home or real
estate you purchase is often used as collateral when you take out a
mortgage");
        normalCustomers.enqueue("Imaya Perera", 795136595,1203654798,"Home
equity loan","Moving costs", "The vehicle you purchase is typically used as
collateral when you take out a car loan");
        normalCustomers.enqueue("Ishma
Perera",853126978,1031965378,"Mortgage","Alternative to a payday loan"," A
cash deposit is used as collateral for secured credit cards.");
        normalCustomers.enqueue("Hirushke De
Alwis",945783622,1023024589,"Auto loan","Home remodeling", "A valuable item
that the lender agrees to use as collateral, such as your home or your
savings account");
        String decision;
        int count = 1;
        Scanner sc = new Scanner(System.in);

        System.out.println("To enqueue you need to dequeue first");
```



```

        System.out.print("Do you want to enqueue: ");
        decision = sc.next();
        if (decision.equals("yes")){
            normalCustomers.dequeue();
            System.out.println("");
            System.out.println("Next Normal Customer's details: ");
            normalCustomers.displayDetailsFrontNode();
        }
        System.out.println("");
        System.out.print("Do you want to dequeue: ");
        decision = sc.next();
        if(decision.equals("yes")){
            System.out.println();
            System.out.println("Previous normal Customer's details: ");
            normalCustomers.displayDetailsRearNode();
        }else if(decision.equals("no")){
            System.out.println("");
        }
        else{
            System.out.println("Error!");
        }
    }

    public static int innerCircleCustomers(){
        loanSystemApplication innerCircleCustomers = new
loanSystemApplication ();
        System.out.println(".....Inner Circle Customer's
Loans..... ");
        innerCircleCustomers.enqueue("Ruwinika
Perera",876432169,2031265479,"Debt Consolidation loan","Vehicle Financing",
"The home or real estate you purchase is often used as collateral when you
take out a mortgage");
        innerCircleCustomers.enqueue("Shiran De
Alwis",953164789,1023456298,"Boat loan","Wedding Expenses", "The vehicle you
purchase is typically used as collateral when you take out a car loan");
        innerCircleCustomers.enqueue("Samantha
Perera",984626863,1023459233,"Payday loan","Emergency Expenses", "A cash
deposit is used as collateral for secured credit cards");
        innerCircleCustomers.enqueue("Ishani
Perera",789432692,2031697854,"Small business loan","Home Improvement and
Repairs", "A valuable item that the lender agrees to use as collateral, such
as your home or your savings account");
        innerCircleCustomers.enqueue("Shamika
Weudagedara",201345695,1110236549,"Title loan","Emergency Cash Assistance",
"A cash deposit is used as collateral for secured credit cards");
        innerCircleCustomers.dequeue();
        System.out.println("Next Inner circle Customer's details: ");
        innerCircleCustomers.displayDetailsFrontNode();
        innerCircleCustomers.dequeue();
        System.out.println("Next Inner circle Customer's details: ");
        System.out.println();
        System.out.println("Previous Inner circle Customer's details: ");
        innerCircleCustomers.displayDetailsRearNode();
        System.out.println("");
        System.out.println("Next Normal Customer's details: ");
        innerCircleCustomers.displayDetailsFrontNode();
    }

```

```

        System.out.println();
    }

    public static void highPriorityCustomers(){
        loanSystemApplication highPriorityCustomers = new
loanSystemApplication();
        System.out.println(".....High Priority Customer's
Loans.....");
        highPriorityCustomers.enqueue("Irushi
Perera",935387624,203126578,"Recreational vehicle Loan","Vacation costs", "A
valuable item that the lender agrees to use as collateral, such as your home
or your savings account");
        highPriorityCustomers.enqueue("Chryshall
Fonseka",543125978,251345632,"Gold loan","Purchasing of a Land", "The vehicle
you purchase is typically used as collateral when you take out a car loan");
        highPriorityCustomers.enqueue("Rushealie
Fonseka",726459835,201236546,"Family loan","Relocation to a New City", "A
cash deposit is used as collateral for secured credit cards");
        highPriorityCustomers.enqueue("Rushinie
Ranasinghe",726459835,201236546,"Family loan","Relocation to a New City", "A
cash deposit is used as collateral for secured credit cards");
        highPriorityCustomers.dequeue();
        System.out.println("Next high priority Customer's details: ");
        highPriorityCustomers.displayDetailsFrontNode();
        System.out.println();
        System.out.println("Previous high priority Customer's details: ");
        highPriorityCustomers.displayDetailsRearNode();
        System.out.println("");
        System.out.println("Next Normal Customer's details: ");
        highPriorityCustomers.displayDetailsFrontNode();
    }
}

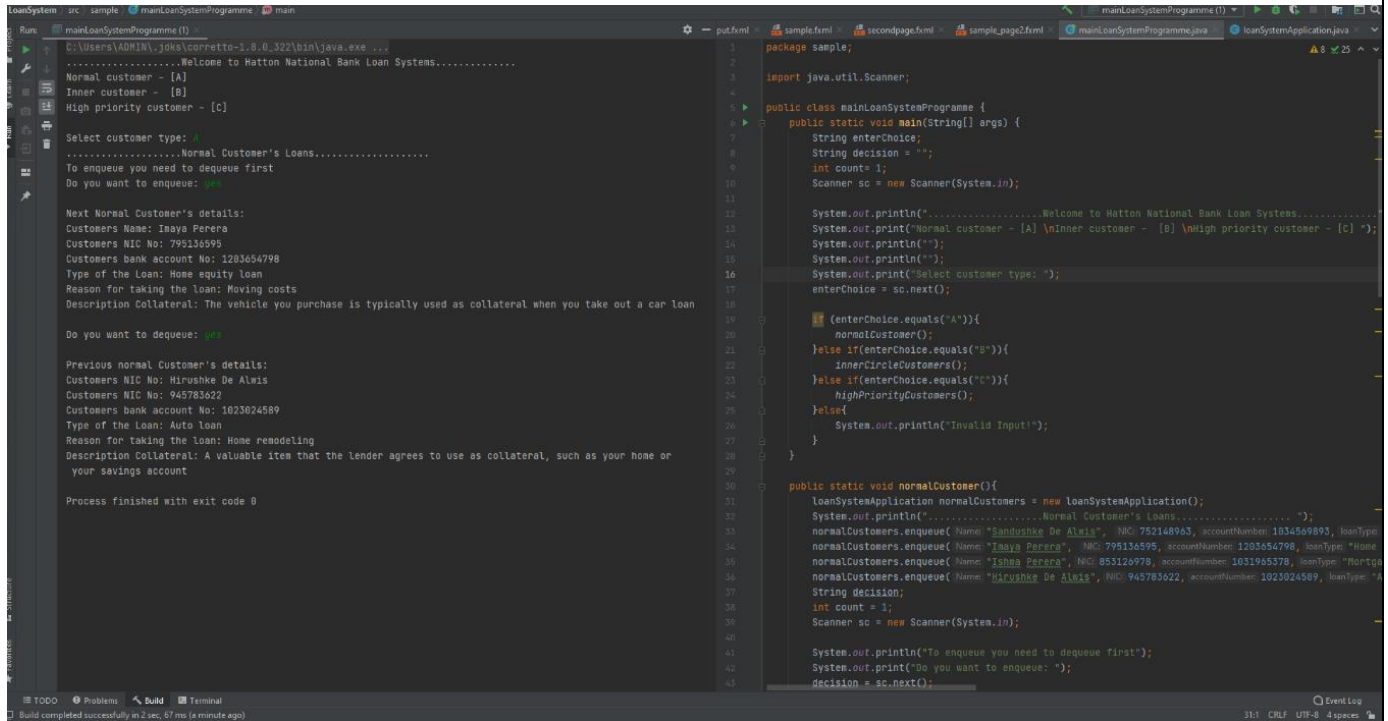
```

Explanation: The inputs are being hardcoded in the loan system application which will enqueue and dequeue and gives the output once the user selects the customer type.

Note: In the above loan system application code the output results of A(normalcustomers) is different than B(innercirclecustomers) and C(highprioritycustomers). In scenario [A] it asks for enqueueing or dequeuing from user while in B and C it straight away displays all enqueue and dequeue results at once

Screenshots of outputs

Output 1



```
LoanSystem | src | sample | mainLoanSystemProgramme | main
Run | mainLoanSystemProgramme (1) |
C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...
.....Welcome to Matton National Bank Loan Systems.....
Normal customer - [A]
Inner customer - [B]
High priority customer - [C]

Select customer type: A
.....Normal Customer's Loans.....
To enqueue you need to dequeue first
Do you want to enqueue: yes

Next Normal Customer's details:
Customers Name: Inaya Perera
Customers NIC No: 795116595
Customers bank account No: 1203654798
Type of the Loan: Home equity loan
Reason for taking the loan: Moving costs
Description Collateral: The vehicle you purchase is typically used as collateral when you take out a car loan

Do you want to enqueue: yes

Previous normal Customer's details:
Customers NIC No: Hirushka De Alwis
Customers NIC No: 945783622
Customers bank account No: 1023024589
Type of the Loan: Auto loan
Reason for taking the loan: Home remodeling
Description Collateral: A valuable item that the lender agrees to use as collateral, such as your home or your savings account

Process finished with exit code 0

package sample;

import java.util.Scanner;

public class mainLoanSystemProgramme {

    public static void main(String[] args) {
        String enterChoice;
        String decision = "";
        int count = 1;
        Scanner sc = new Scanner(System.in);

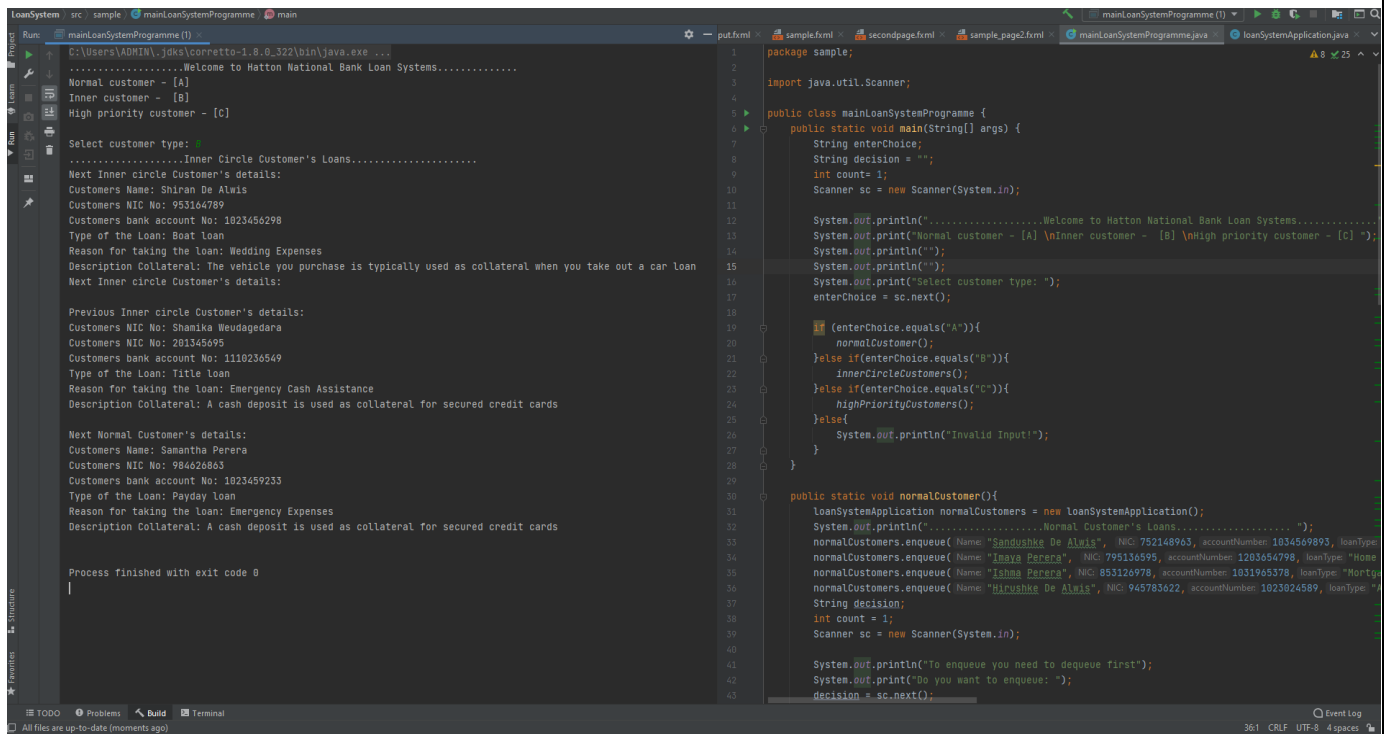
        System.out.println(".....Welcome to Matton National Bank Loan Systems.....");
        System.out.print("Normal customer - [A] \nInner customer - [B] \nHigh priority customer - [C] ");
        System.out.println("");
        System.out.print("Select customer type: ");
        enterChoice = sc.next();

        if (enterChoice.equals("A")){
            normalCustomer();
        }else if(enterChoice.equals("B")){
            innerCircleCustomers();
        }else if(enterChoice.equals("C")){
            highPriorityCustomers();
        }else{
            System.out.println("Invalid Input!");
        }
    }

    public static void normalCustomer(){
        loanSystemApplication normalCustomers = new loanSystemApplication();
        System.out.println(".....Normal Customer's Loans.....");
        normalCustomers.enqueue( Name: "Sandunika De Alwis", NIC: 752148963, accountNumber: 1034569893, loanType: "Home
        normalCustomers.enqueue( Name: "Inaya Perera", NIC: 795116595, accountNumber: 1203654798, loanType: "Home
        normalCustomers.enqueue( Name: "Ishna Perera", NIC: 853126978, accountNumber: 1031965378, loanType: "Mortga
        normalCustomers.enqueue( Name: "Hirushka De Alwis", NIC: 945783622, accountNumber: 1023024589, loanType: "A
        String decision;
        int count = 1;
        Scanner sc = new Scanner(System.in);

        System.out.println("To enqueue you need to dequeue first");
        System.out.print("Do you want to enqueue: ");
        decision = sc.next();
    }
}
```

Output 2



```
LoanSystem | src | sample | mainLoanSystemProgramme | main
Run | mainLoanSystemProgramme (1) |
C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...
.....Welcome to Matton National Bank Loan Systems.....
Normal customer - [A]
Inner customer - [B]
High priority customer - [C]

Select customer type: B
.....Inner Circle Customer's Loans.....
Next Inner circle Customer's details:
Customers Name: Shiran De Alwis
Customers NIC No: 953164789
Customers bank account No: 1023456298
Type of the Loan: Boat loan
Reason for taking the Loan: Wedding Expenses
Description Collateral: The vehicle you purchase is typically used as collateral when you take out a car loan
Next Inner circle Customer's details:

Previous Inner circle Customer's details:
Customers NIC No: Shamika Weudagedara
Customers NIC No: 201145695
Customers bank account No: 1110236549
Type of the Loan: Title loan
Reason for taking the Loan: Emergency Cash Assistance
Description Collateral: A cash deposit is used as collateral for secured credit cards

Next Normal Customer's details:
Customers Name: Samantha Perera
Customers NIC No: 984626863
Customers bank account No: 1023459233
Type of the Loan: Payday loan
Reason for taking the Loan: Emergency Expenses
Description Collateral: A cash deposit is used as collateral for secured credit cards

Process finished with exit code 0

package sample;

import java.util.Scanner;

public class mainLoanSystemProgramme {

    public static void main(String[] args) {
        String enterChoice;
        String decision = "";
        int count = 1;
        Scanner sc = new Scanner(System.in);

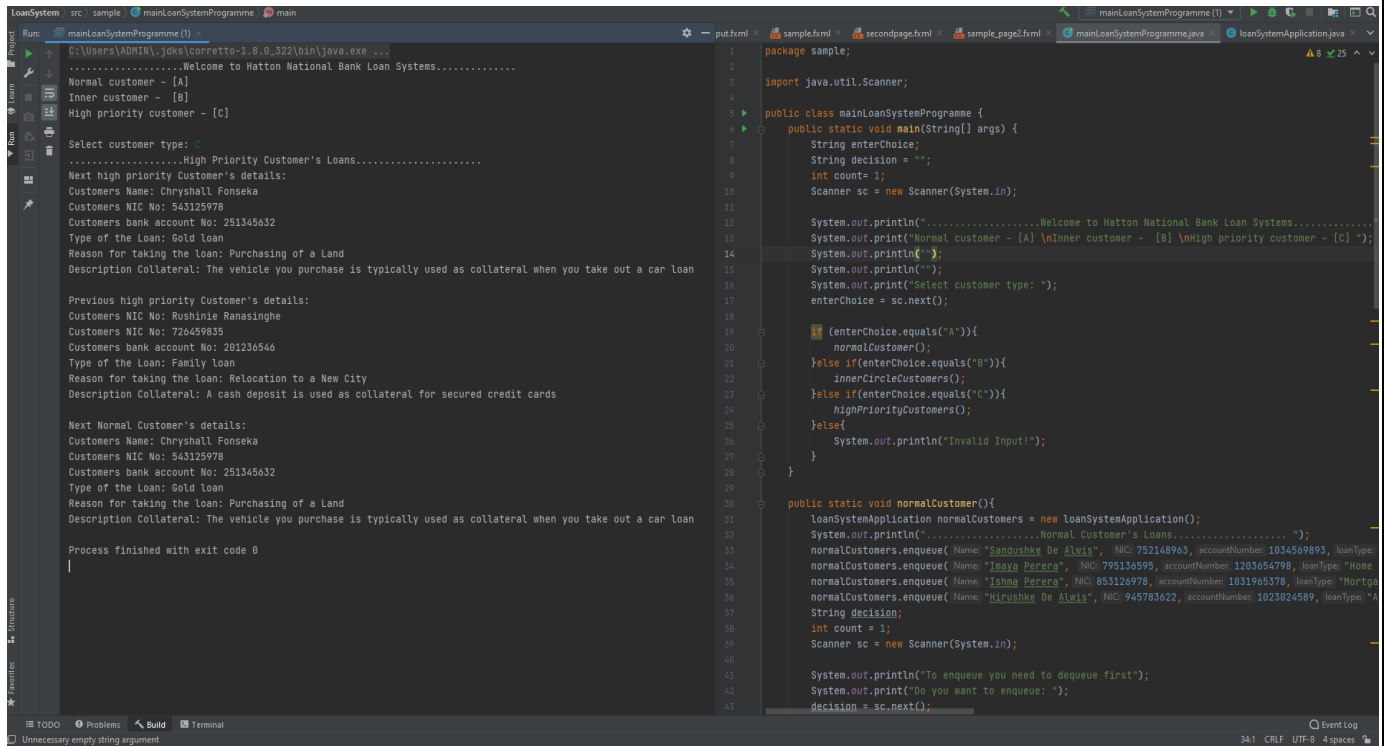
        System.out.println(".....Welcome to Matton National Bank Loan Systems.....");
        System.out.print("Normal customer - [A] \nInner customer - [B] \nHigh priority customer - [C] ");
        System.out.println("");
        System.out.print("Select customer type: ");
        enterChoice = sc.next();

        if (enterChoice.equals("A")){
            normalCustomer();
        }else if(enterChoice.equals("B")){
            innerCircleCustomers();
        }else if(enterChoice.equals("C")){
            highPriorityCustomers();
        }else{
            System.out.println("Invalid Input!");
        }
    }

    public static void normalCustomer(){
        loanSystemApplication normalCustomers = new loanSystemApplication();
        System.out.println(".....Normal Customer's Loans.....");
        normalCustomers.enqueue( Name: "Sandunika De Alwis", NIC: 752148963, accountNumber: 1034569893, loanType: "Home
        normalCustomers.enqueue( Name: "Inaya Perera", NIC: 795116595, accountNumber: 1203654798, loanType: "Home
        normalCustomers.enqueue( Name: "Ishna Perera", NIC: 853126978, accountNumber: 1031965378, loanType: "Mortga
        normalCustomers.enqueue( Name: "Hirushka De Alwis", NIC: 945783622, accountNumber: 1023024589, loanType: "A
        String decision;
        int count = 1;
        Scanner sc = new Scanner(System.in);

        System.out.println("To enqueue you need to dequeue first");
        System.out.print("Do you want to enqueue: ");
        decision = sc.next();
    }
}
```

Output 3



The screenshot displays an IDE with two panels. The left panel shows the output of a Java program named `mainLoanSystemProgramme()`. The output includes a welcome message, a selection of customer type (Normal, Inner, or High priority), and detailed information for selected customers, including their names, NIC numbers, bank account numbers, loan types, reasons for taking the loan, and descriptions of collateral. The process finished with exit code 0.

```
mainLoanSystemProgramme()
C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...
Welcome to Hatton National Bank Loan Systems.....
Normal customer - [A]
Inner customer - [B]
High priority customer - [C]

Select customer type:
.....High Priority Customer's Loans.....
Next high priority Customer's details:
Customers Name: Chryshall Fonseka
Customers NIC No: 543125978
Customers bank account No: 251345632
Type of the Loan: Gold loan
Reason for taking the loan: Purchasing of a Land
Description Collateral: The vehicle you purchase is typically used as collateral when you take out a car loan

Previous high priority Customer's details:
Customers NIC No: Rushinie Ranasinghe
Customers NIC No: 726459835
Customers bank account No: 201236546
Type of the Loan: Family loan
Reason for taking the loan: Relocation to a New City
Description Collateral: A cash deposit is used as collateral for secured credit cards

Next Normal Customer's details:
Customers Name: Chryshall Fonseka
Customers NIC No: 543125978
Customers bank account No: 251345632
Type of the Loan: Gold loan
Reason for taking the loan: Purchasing of a Land
Description Collateral: The vehicle you purchase is typically used as collateral when you take out a car loan

Process finished with exit code 0
```

The right panel shows the source code of the `mainLoanSystemProgramme` class, which implements the logic for customer selection and data retrieval.

```
package sample;

import java.util.Scanner;

public class mainLoanSystemProgramme {
    public static void main(String[] args) {
        String enterChoice;
        String decision = "";
        int count = 1;
        Scanner sc = new Scanner(System.in);

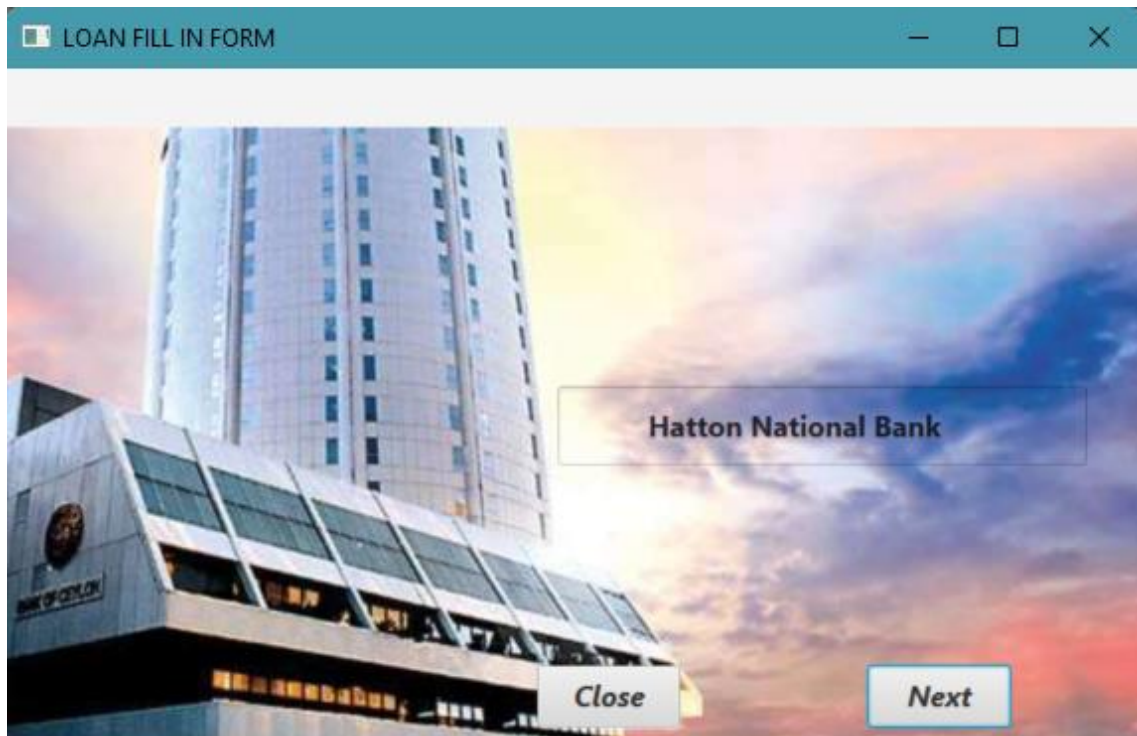
        System.out.println(".....Welcome to Hatton National Bank Loan Systems.....");
        System.out.print("Normal customer - [A] \nInner customer - [B] \nHigh priority customer - [C] ");
        System.out.println("");
        System.out.print("Select customer type: ");
        enterChoice = sc.next();

        if (enterChoice.equals("A")){
            normalCustomer();
        } else if (enterChoice.equals("B")){
            innerCircleCustomers();
        } else if (enterChoice.equals("C")){
            highPriorityCustomers();
        } else{
            System.out.println("Invalid Input!");
        }
    }


    public static void normalCustomer(){
        loanSystemApplication normalCustomers = new loanSystemApplication();
        System.out.println(".....Normal Customer's Loans.....");
        normalCustomers.enqueue( Name: "Sandushka De Alwis", NIC: 752148963, accountNumber: 1034569893, loanType: "Mortgage");
        normalCustomers.enqueue( Name: "Ishma Perera", NIC: 795136595, accountNumber: 1205854798, loanType: "Mortgage");
        normalCustomers.enqueue( Name: "Ishma Perera", NIC: 853126978, accountNumber: 1031965378, loanType: "Mortgage");
        normalCustomers.enqueue( Name: "Harushka De Alwis", NIC: 945783622, accountNumber: 1023024589, loanType: "Mortgage");
        int count = 1;
        Scanner sc = new Scanner(System.in);

        System.out.println("To enqueue you need to dequeue first");
        System.out.print("Do you want to enqueue: ");
        decision = sc.next();
    }
}
```

Screenshot Outputs of the GUI interfaces



Customer Type Form



Normal Customer

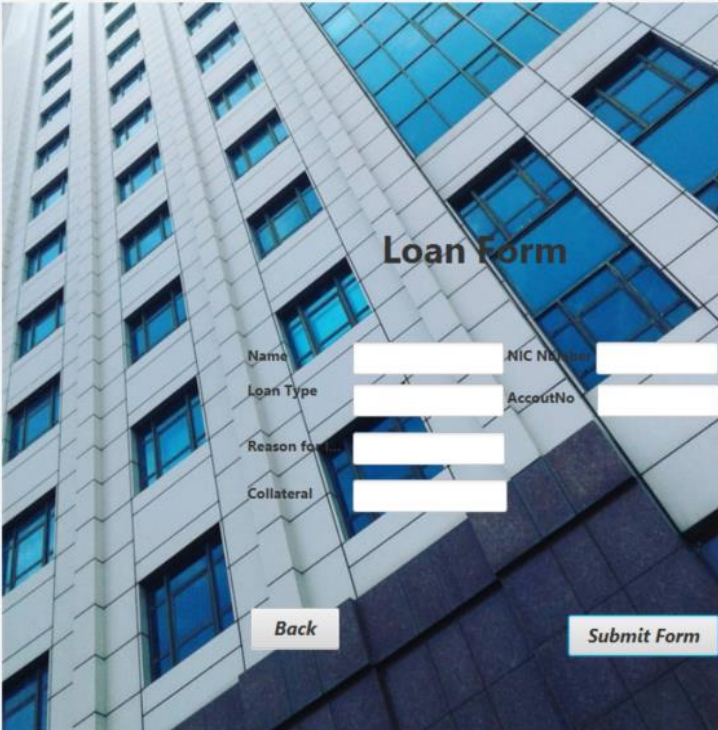
Inner Customer

High priority Customer

Back

The image shows a web application window titled "Customer Type Form". The background is a photograph of a Mandiri Bank branch with its logo and name visible. Overlaid on the image are four buttons: "Normal Customer", "Inner Customer", "High priority Customer", and "Back".

Loan Form Page



Loan Form

Name NIC Number

Loan Type AccountNo

Reason for loan

Collateral

Back Submit Form

The image shows a web application window titled "Loan Form Page". The background is a photograph of a modern building with many windows. Overlaid on the image is a "Loan Form" with the following fields: "Name", "NIC Number", "Loan Type", "AccountNo", "Reason for loan", and "Collateral". There are also "Back" and "Submit Form" buttons at the bottom.

Note: I haven't implemented the loan system using GUI interfaces. Everything in the loan system runs through the command line. It's just a couple of interfaces I made to show how the loan system will look like with the interfaces.

Task 2

a) Explain Fibonacci number

- A Fibonacci number is a sequence of numbers which starts from zero and then followed by one then based on a rule each number gets equal to the sum of preceding two numbers.

b) Discuss the application of Fibonacci numbers:

- Fibonacci numbers are used when implementing computer algorithms, when heap data structures.
- Fibonacci sequences are used in graphs called Fibonacci cubes for interconnecting parallel and distributed systems

c) Implement a program to calculate the Fibonacci value of a given number using loops. Test the solution implemented with sample inputs

```
a) import java.util.Scanner;

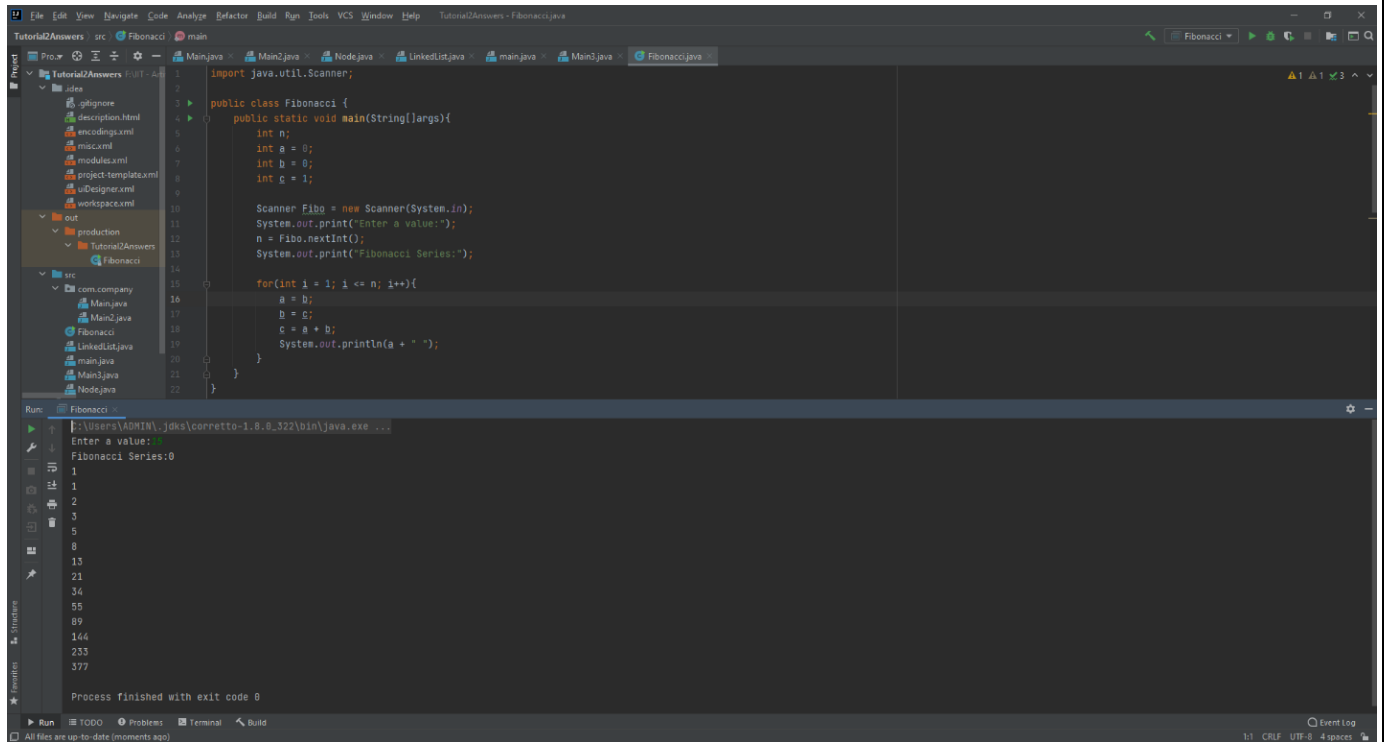
public class Fibonacci {
    public static void main(String[] args) {
        int n;
        int a = 0;
        int b = 0;
        int c = 1;

        Scanner Fibo = new Scanner(System.in);
        System.out.println("Enter a value:");
        n = Fibo.nextInt();
        System.out.println("Fibonacci Series:");

        for(int i = 1; i <= n; i++){
            a = b;
            b = c;
            c = a + b;
            System.out.println(a + " ");
        }
    }
}
```


Explanation: The codes represents the Fibonacci series using loops. When the user inputs a value it prints all the Fibonacci numbers up to that number. And always in every Fibonacci series, the starting number will be zero while the next value is one.

Output 1:



The screenshot displays an IDE with a Java project named 'Tutorial2Answers'. The 'Fibonacci.java' file is open, showing the following code:

```
import java.util.Scanner;

public class Fibonacci {
    public static void main(String[] args){
        int n;
        int a = 0;
        int b = 0;
        int c = 1;

        Scanner Fibbo = new Scanner(System.in);
        System.out.print("Enter a value:");
        n = Fibbo.nextInt();
        System.out.print("Fibonacci Series:");

        for(int i = 1; i <= n; i++){
            a = b;
            b = c;
            c = a + b;
            System.out.println(a + " ");
        }
    }
}
```

The 'Run' console at the bottom shows the execution of the program. It prompts 'Enter a value:' and displays the output 'Fibonacci Series:0 1 1 2 3 5 8 13 21 34 55 89 144 233 377'. The process finished with exit code 0.

Output 2:

```
1 import java.util.Scanner;
2
3 public class Fibonacci {
4     public static void main(String[] args){
5         int n;
6         int a = 0;
7         int b = 0;
8         int c = 1;
9
10        Scanner Fibor = new Scanner(System.in);
11        System.out.print("Enter a value:");
12        n = Fibor.nextInt();
13
14
15        for(int i = 1; i <= n; i++){
16            a = b;
17            b = c;
18            c = a + b;
19            System.out.println(a + " ");
20        }
21    }
22 }
```

Run: Fibonacci

C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...

Enter a value: 10

0

1

1

2

3

5

8

13

21

Process finished with exit code 0

Build completed successfully in 2 sec, 133 ms (moments ago)

Output 3:

```
1 import java.util.Scanner;
2
3 public class Fibonacci {
4     public static void main(String[] args){
5         int n;
6         int a = 0;
7         int b = 0;
8         int c = 1;
9
10        Scanner Fibor = new Scanner(System.in);
11        System.out.print("Enter a value:");
12        n = Fibor.nextInt();
13
14
15        for(int i = 1; i <= n; i++){
16            a = b;
17            b = c;
18            c = a + b;
19            System.out.println(a + " ");
20        }
21    }
22 }
```

Run: Fibonacci

C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...

Enter a value: 20

0

1

1

2

3

5

8

13

21

34

55

89

Process finished with exit code 0

Build completed successfully in 2 sec, 390 ms (moments ago)

Output 4:

The screenshot shows an IDE with a project named 'Tutorial2Answers'. The 'Fibonacci.java' file is open, displaying the following code:

```
import java.util.Scanner;

public class Fibonacci {
    public static void main(String[] args){
        int n;
        int a = 0;
        int b = 0;
        int c = 1;

        Scanner Fibon = new Scanner(System.in);
        System.out.print("Enter a value:");
        n = Fibon.nextInt();

        for(int i = 1; i <= n; i++){
            a = b;
            b = c;
            c = a + b;
            System.out.println(a + " ");
        }
    }
}
```

The 'Run' window shows the output of the program for the input value 17:

```
Enter a value:17
0
1
1
2
3
5
8
13
21
34
55
89
144
233
377
610
987
```

The process finished with exit code 0.

Output 5:

The screenshot shows the same IDE with the 'Fibonacci.java' file open. The 'Run' window shows the output of the program for the input value 25:

```
Enter a value:25
0
1
1
2
3
5
8
13
21
34
55
89
144
233
377
610
987
1597
2584
4181
6765
10946
17711
28657
46368
```

The status bar at the bottom indicates the file encoding is UTF-8 with 4 spaces.

Test Case	userInput	Expected outcome	Actual outcome	Pass/ Fail
Test 1	15	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377	Pass
Test 2	9	0, 1, 1, 2, 3, 5, 8, 13, 21	0, 1, 1, 2, 3, 5, 8, 13, 21	Pass
Test 3	12	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89	Pass
Test 4	17	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987	Pass
Test 5	25	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368	Pass

d) Implement a program to calculate the Fibonacci value of a given number using Recursion. Test the solution implemented with the sample inputs

```
import java.util.Scanner;

public class Fibonacci{
    public static void main(String[]args){
        Scanner Fibo = new Scanner(System.in);

        System.out.println("Enter your value:");
        int value = Fibo.nextInt();

        for(int x = 1; x<= value; i++){
            System.out.println(fibonacci(x)+ " ");
        }
    }
    private static int fibonacci(int value){
        if(value == 1){
            return 0;
        }
        else if(value == 2){
```

```

        return 1;
    }
    else{
        return fibonacci(value -2) + fibonacci(value -1);
    }
}
}

```

Explanation: The codes represents the Fibonacci series using loops. When the user inputs a value it prints all the Fibonacci numbers up to that number. And always in every Fibonacci series, the starting number will be zero while the next value is one.

Output 1:

The screenshot shows an IDE with the following code in `Fibonacci.java`:

```

public class Fibonacci{
    public static void main(String[] args){
        Scanner Fibb = new Scanner(System.in);

        System.out.print("Enter your value:");
        int n = Fibb.nextInt();

        for(int i = 1; i<= n; i++){
            System.out.println(fibonacci(i)+ " ");
        }
    }

    private static int fibonacci(int n){
        if(n == 1){
            return 0;
        }
        else if(n == 2){
            return 1;
        }
        else{
            return fibonacci(n-2) + fibonacci(n-1);
        }
    }
}

```

The Run console shows the following output:

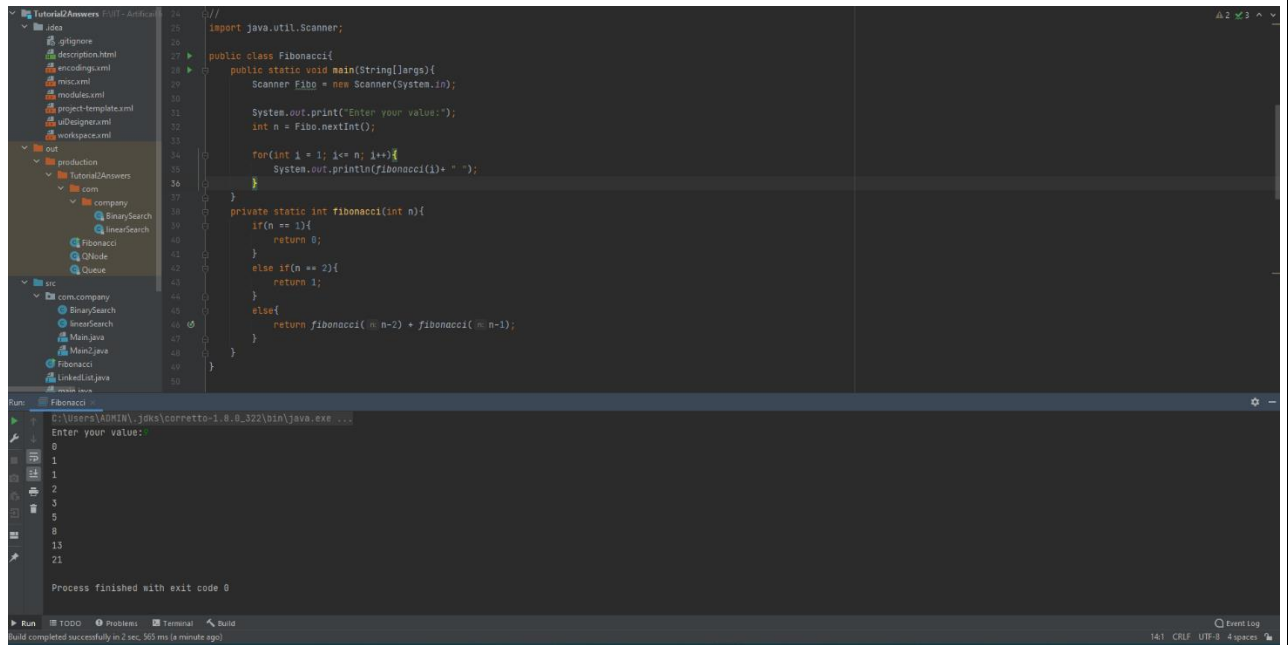
```

Enter your value:
0
1
1
2
3
5
8
13
21
34
55
89
144
233
377

```

The status bar at the bottom indicates: "Process finished with exit code 0", "Build completed successfully in 1 sec, 968 ms (4 minutes ago)", and "201 CRLF UTF-8 4 spaces".

Output 2:



The screenshot shows an IDE with a project named 'Tutorial2Answers'. The 'src' folder contains a package 'com.company' with files 'BinarySearch.java', 'LinearSearch.java', 'Main.java', 'Main2.java', 'Fibonacci.java', and 'LinkedList.java'. The 'Fibonacci.java' file is open, showing the following code:

```
//
import java.util.Scanner;

public class Fibonacci{
    public static void main(String[] args){
        Scanner fibo = new Scanner(System.in);

        System.out.print("Enter your value:");
        int n = fibo.nextInt();

        for(int i = 1; i<= n; i++){
            System.out.println(fibonacci(i)+ " ");
        }
    }

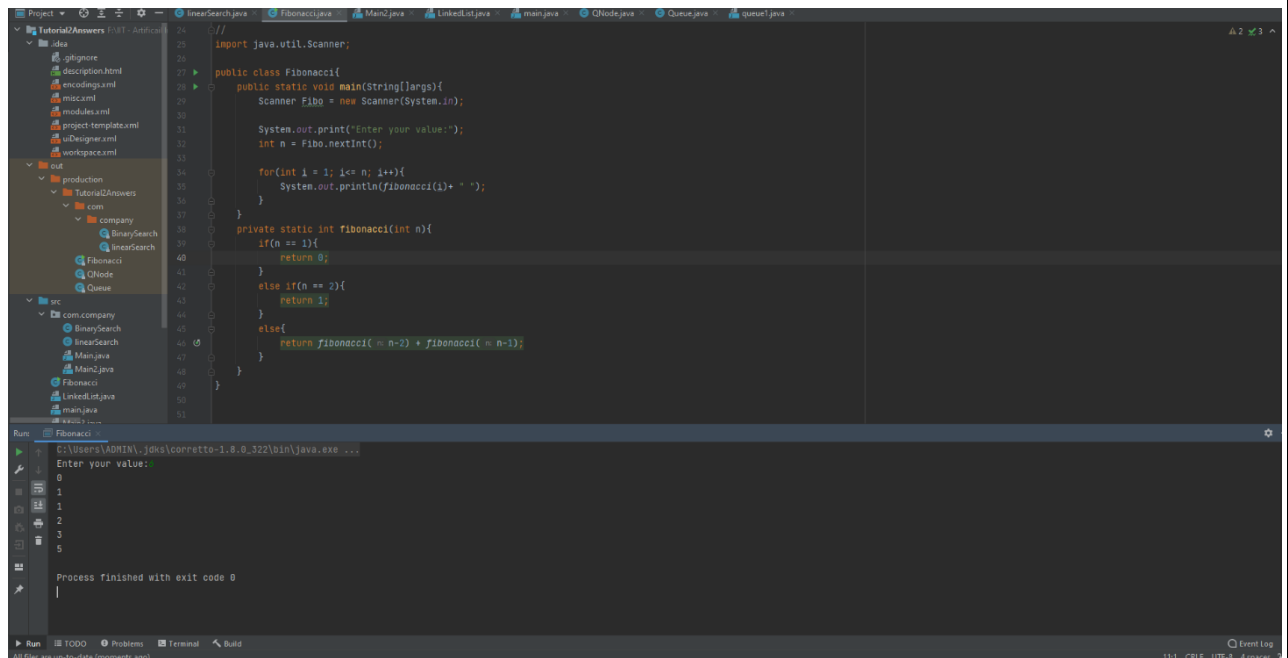
    private static int fibonacci(int n){
        if(n == 1){
            return 0;
        }
        else if(n == 2){
            return 1;
        }
        else{
            return fibonacci(n-2) + fibonacci(n-1);
        }
    }
}
```

The 'Run' window shows the execution of the program. The command is 'C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...'. The output is:

```
Enter your value:
0
1
1
2
3
5
8
13
21

Process finished with exit code 0
```

Output 3:

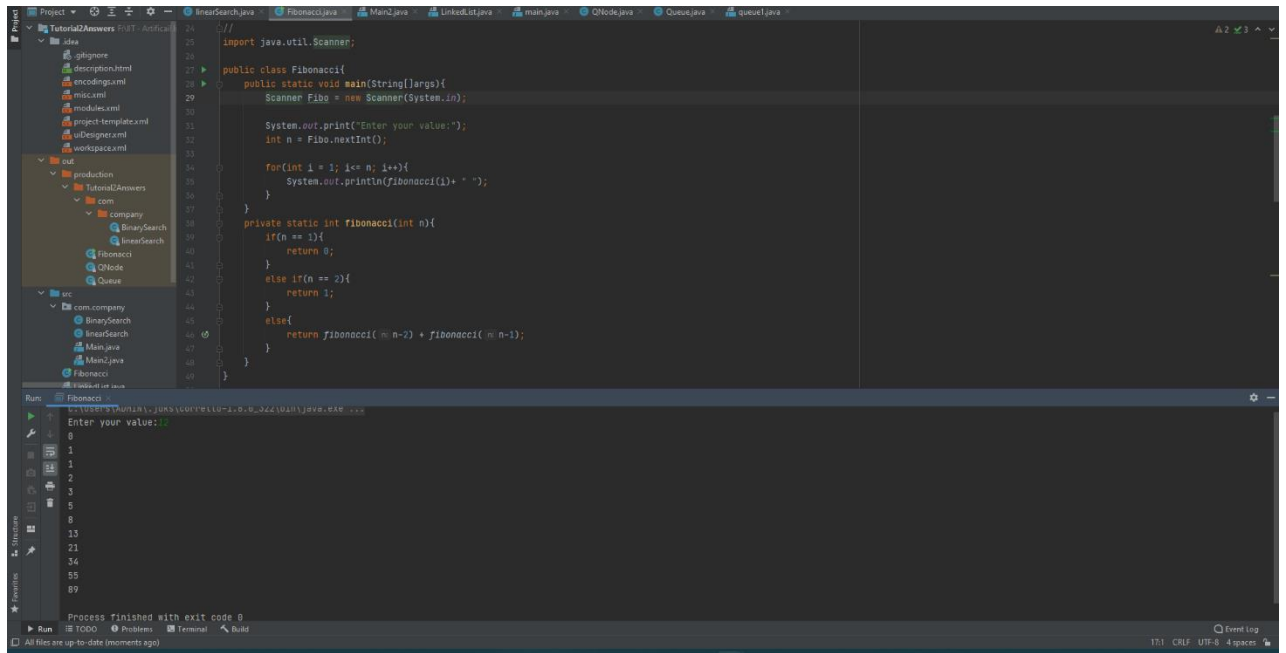


The screenshot shows the same IDE as in Output 2, but with the 'Fibonacci.java' file open. The code is the same as in Output 2. The 'Run' window shows the execution of the program. The command is 'C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...'. The output is:

```
Enter your value:
0
1
1
2
3
5

Process finished with exit code 0
```

Output 4:



```
//
import java.util.Scanner;

public class Fibonacci{
    public static void main(String[] args){
        Scanner Fibo = new Scanner(System.in);

        System.out.print("Enter your value:");
        int n = Fibo.nextInt();

        for(int i = 1; i<= n; i++){
            System.out.println(fibonacci(i)+ " ");
        }

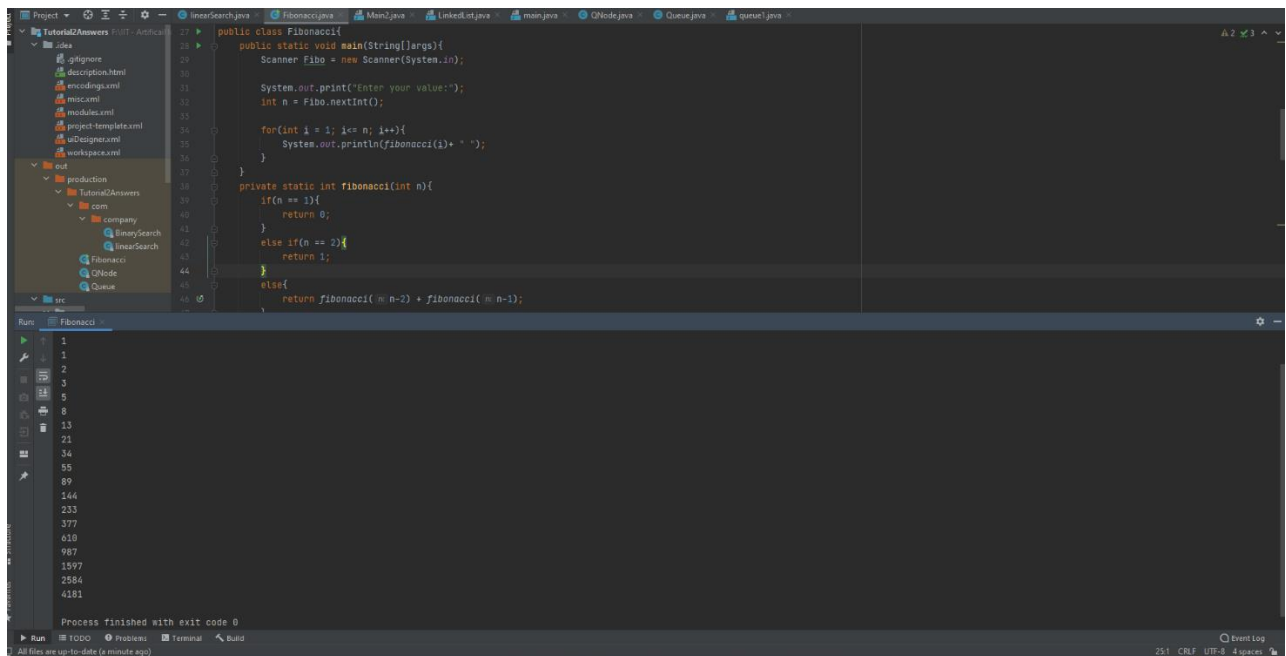
        private static int fibonacci(int n){
            if(n == 1){
                return 0;
            }
            else if(n == 2){
                return 1;
            }
            else{
                return fibonacci(n-2) + fibonacci(n-1);
            }
        }
    }
}
```

Enter your value:10

0
1
1
2
3
5
8
13
21
34
55
89

Process finished with exit code 0

Output 5:



```
//
import java.util.Scanner;

public class Fibonacci{
    public static void main(String[] args){
        Scanner Fibo = new Scanner(System.in);

        System.out.print("Enter your value:");
        int n = Fibo.nextInt();

        for(int i = 1; i<= n; i++){
            System.out.println(fibonacci(i)+ " ");
        }

        private static int fibonacci(int n){
            if(n == 1){
                return 0;
            }
            else if(n == 2){
                return 1;
            }
            else{
                return fibonacci(n-2) + fibonacci(n-1);
            }
        }
    }
}
```

Enter your value:10

0
1
1
2
3
5
8
13
21
34
55
89
144
233
377
610
987
1597
2584
4181

Process finished with exit code 0

Test Case	userInput	Expected outcome	Actual outcome	Pass/ Fail
Test 1	15	0, 1, 1, 2 ,3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377	0, 1, 1, 2 ,3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377	Pass
Test 2	9	0, 1, 1, 2, 3, 5, 8, 13, 21	0, 1, 1, 2, 3, 5, 8, 13, 21	Pass
Test 3	6	0, 1, 1, 2, 3, 5	0, 1, 1, 2, 3, 5	Pass
Test 4	12	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89	Pass
Test 5	30	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368, 75025, 121393, 196418, 317811, 514229	0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368, 75025, 121393, 196418, 317811, 514229	Pass

e) Implement linear search and binary search algorithms

Linear Search:

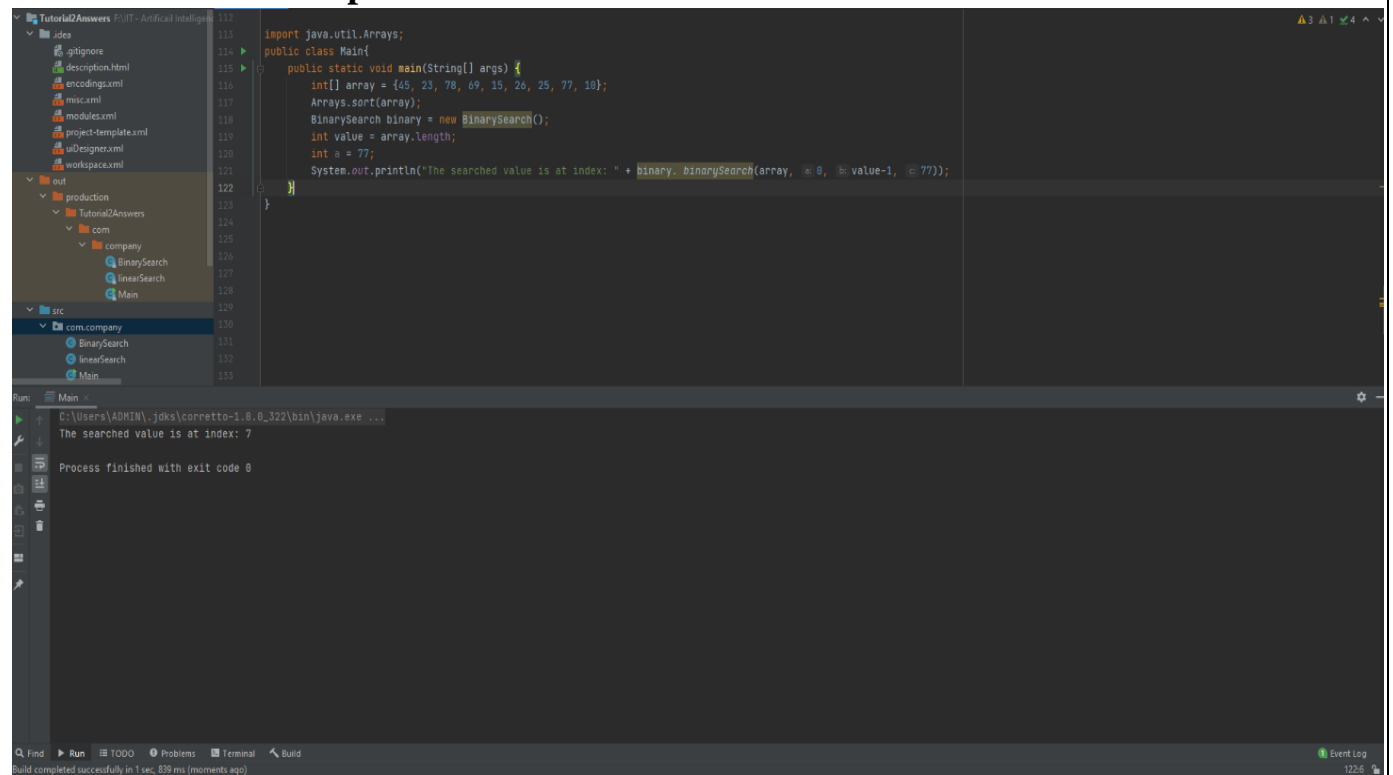
```
package com.company;

public class linearSearch {
    public static int search(int array[], int a) {
        int x = array.length;
        for(int i = 0; i < x; i++){
            if(array[i] == a){
                return i;
            }
        }
        return -1;
    }
}
```

```
public class Main{
    public static void main(String[] args) {
        int[] array = {45,23,78,69,15,26,25,77,10};
        int value = 25;
        System.out.println(value + " is in index number: " +
linearSearch.search(array, value));
    }
}
```

Explanation: In linear search algorithm the sequence of array numbers are sorted one by one over the time. Once the item is found and matched, it will returned or else it will keep contuing until the end of the array.

Screenshot of the output of the code:



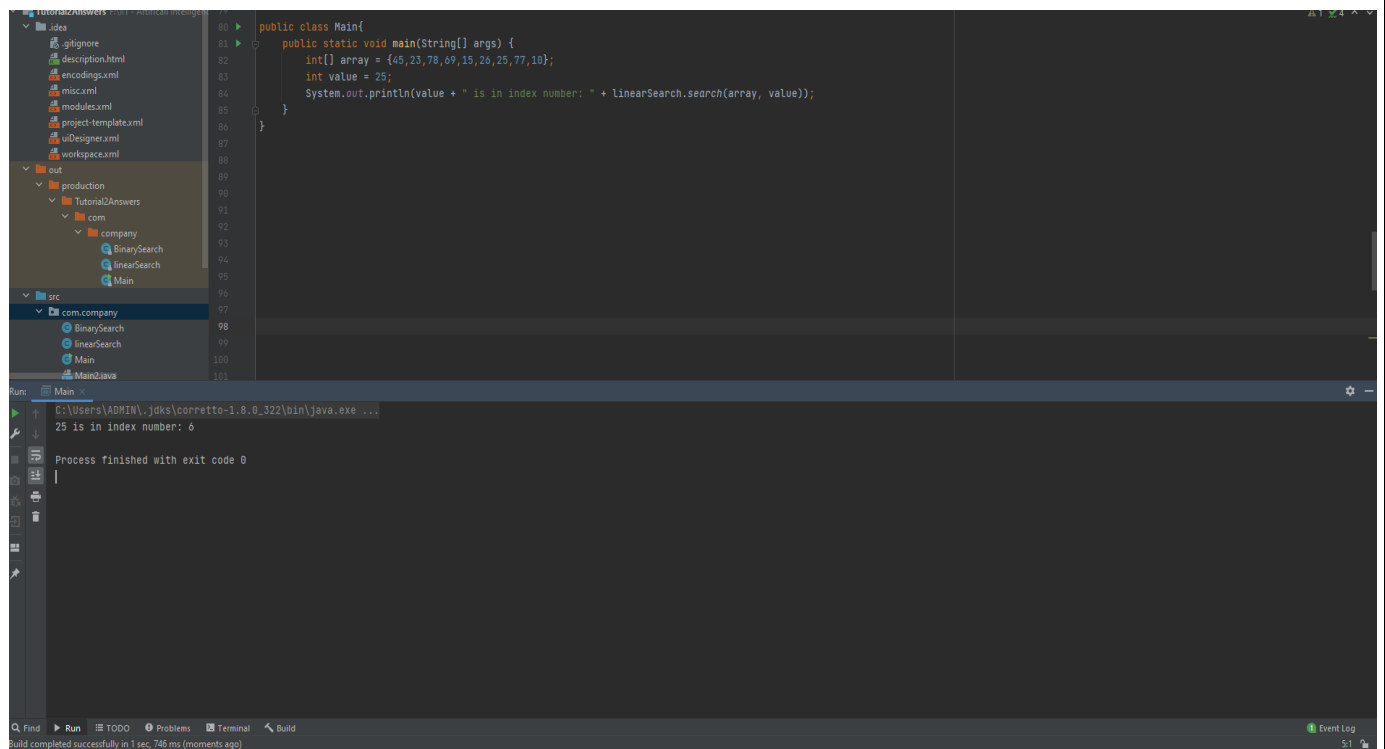
The screenshot displays an IDE with a project named 'Tutorial2Answers'. The code editor shows a Java file with the following content:

```
112  
113 import java.util.Arrays;  
114 public class Main{  
115     public static void main(String[] args) {  
116         int[] array = {45, 23, 78, 69, 15, 26, 25, 77, 18};  
117         Arrays.sort(array);  
118         BinarySearch binary = new BinarySearch();  
119         int value = array.length;  
120         int a = 77;  
121         System.out.println("The searched value is at index: " + binary.binarySearch(array, 0, value-1, a));  
122     }  
123 }  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133
```

The Run window shows the output of the program:

```
Run: Main  
C:\Users\ADMIN\jdk\corretto-1.8.0_322\bin\java.exe ...  
The searched value is at index: 7  
Process finished with exit code 0
```

The status bar at the bottom indicates: Build completed successfully in 1 sec, 836 ms (moments ago).



Binary Search:

```
package com.company;

public class BinarySearch {
    static int binarySearch(int array[], int a, int b, int c){
        if(b >= a){
            int midVal = (a + b) /2;
            if(array[midVal] == c){
                return midVal;
            }
            if(array[midVal] > c){
                return binarySearch(array, a, midVal -1, c);
            }
            return binarySearch(array, midVal + 1, b, c);
        }else{
            return -1;
        }
    }
}
```



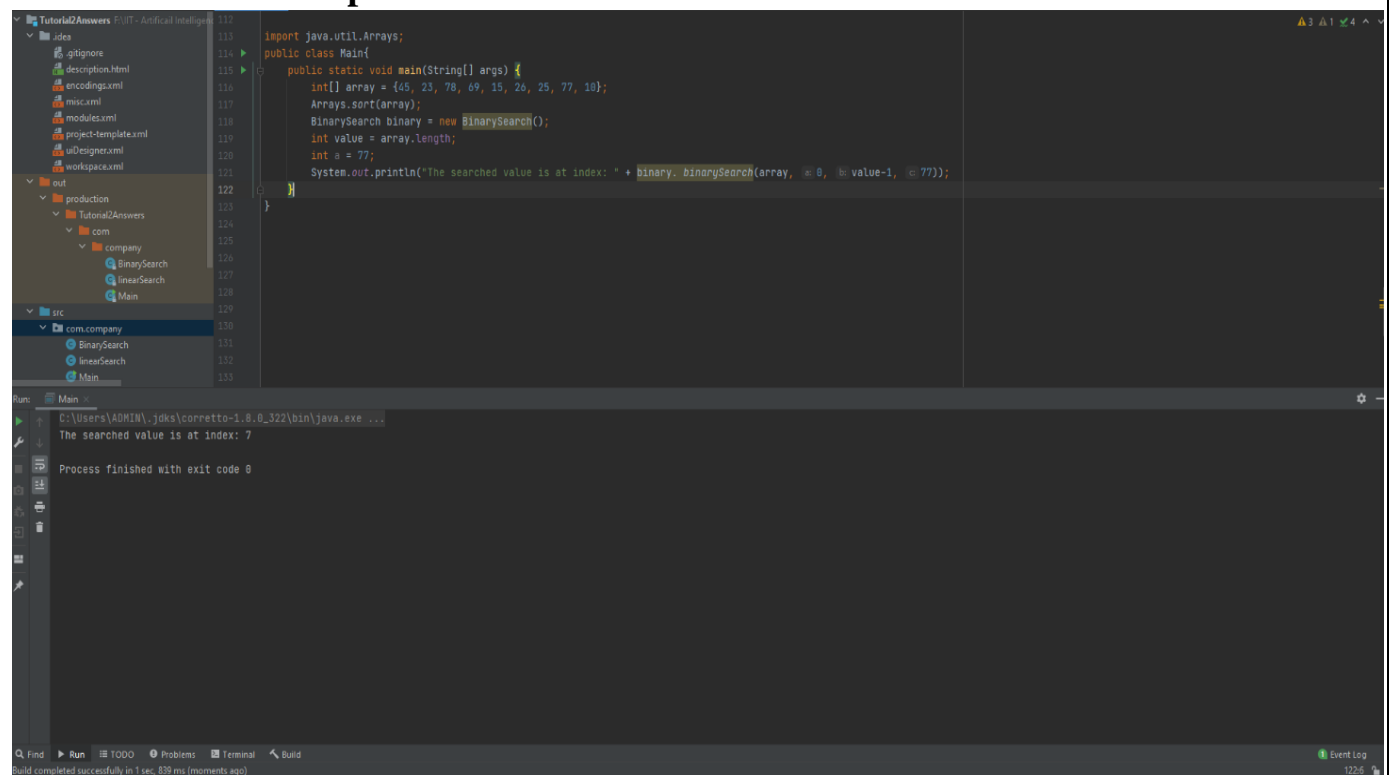
```

import java.util.Arrays;
public class Main{
    public static void main(String[] args) {
        int[] array = {45, 23, 78, 69, 15, 26, 25, 77, 10};
        Arrays.sort(array);
        BinarySearch binary = new BinarySearch();
        int value = array.length;
        int a = 77;
        System.out.println("The searched value is at index: " + binary.
        binarySearch(array, 0, value-1, 77));
    }
}

```

Explanation: Binary search algorithm is used in sorted arrays which divides the search interval by half. This algorithm method is used to get information of the array and reduce time complexity $O(\log n)$

Screenshot of the output of the code:



**f) Compare the performance of the two algorithms you implemented in Task 2
Part a)**

Linear Search	Binary Search
<ul style="list-style-type: none">• Linear search is preferred to use for small sized data sets because it is less efficient in handling large data sets	<ul style="list-style-type: none">• Binary search is preferred to use for use large size data sets because it has more efficiency in handling it than small sized data sets
<ul style="list-style-type: none">• Linear search can be implemented for both single are multidimensional array	<ul style="list-style-type: none">• Binary search can be implemented only for a multidimensional array
<ul style="list-style-type: none">• Linear search is iterative which uses sequential approach for its functionalities	<ul style="list-style-type: none">• Binary search make use of divide and get the best approach in its functionalities
<ul style="list-style-type: none">• Time complexity of linear search is $O(n)$ which is not that efficient	<ul style="list-style-type: none">• Time complexity of binary search is $O(\log_2 n)$ which is efficient than linear search

References:

Sanfoundry. 2022. *Java Program to Generate Fibonacci Numbers - Sanfoundry*. [online] Available at: <<https://www.sanfoundry.com/java-program-generate-fibonacci-numbers/>> [Accessed 3 April 2022].

Pencil Programmer. 2022. *Java Program for Fibonacci Series [Loop, Recursion]*. [online] Available at: <<https://pencilprogrammer.com/java-programs/fibonacci-series/>> [Accessed 3 April 2022].

GeeksforGeeks. 2022. *Binary Search - GeeksforGeeks*. [online] Available at: <<https://www.geeksforgeeks.org/binary-search/>> [Accessed 3 April 2022].

GeeksforGeeks. 2022. *Binary Search - GeeksforGeeks*. [online] Available at: <<https://www.geeksforgeeks.org/binary-search/>> [Accessed 3 April 2022].