Shri Ramdeobaba College of Engineering & Management Nagpur-13

Department of Computer Application

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Submission for

Course Name: Design Analysis and Algorithm Lab

Course Code: MCP546

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Class Roll No: 26

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Shift: 2

Batch: 2

Under the Guidance of

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Practical 3

Aim: Perform binary search on the output files of practical2 and sequential file of practical_0.

Display the time taken to search a key from these files occurring in the first, middle and last position / not found case.

Compare the time taken for all these cases.

For file 1 from Practical 0 (Sequential unrepeated numbers):

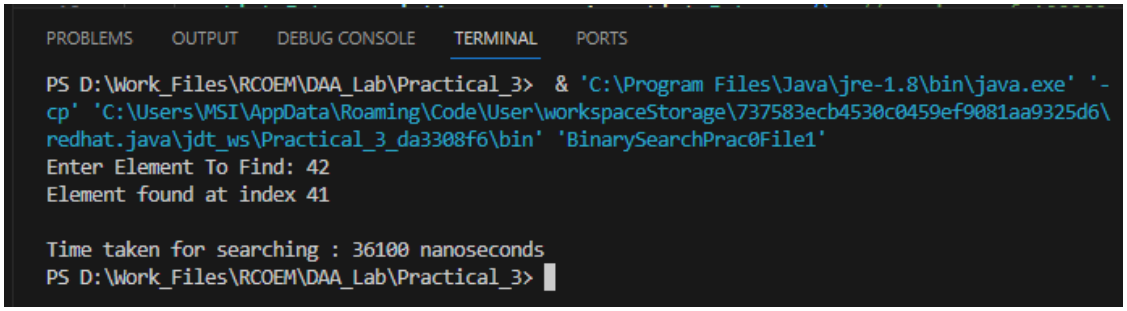
Code:

```
import java.io.*;
import java.util.ArrayList;
import java.util.List;
import java.util.Scanner;

public class BinarySearchPrac0File1 {
   public static void main(String[] args) throws IOException {
      Scanner scanner = new Scanner(System.in);
      FileReader f = new FileReader("./sequentialUnrepeatedNumbers.txt");

      Scanner fileScanner = new Scanner(f);
      List<Integer> intArray = new ArrayList<Integer>(); // maximum of 100000
                                                            elements in the file
      while (fileScanner.hasNextInt()) {
         intArray.add(fileScanner.nextInt());
      }
      fileScanner.close();

      System.out.print("Enter Element To Find: ");
      int elementToFind = scanner.nextInt();

      long start = System.nanoTime();
      int result=binarySearch(intArray, elementToFind);
      long finish = System.nanoTime();
      if (result == -1){
         System.out.println("Element not present");
      }
      else{
         System.out.println("Element found at index " + result);
      }

      long timeElapsed = finish - start;
      System.out.println("\nTime taken for searching : " + timeElapsed + "
nanoseconds");
```

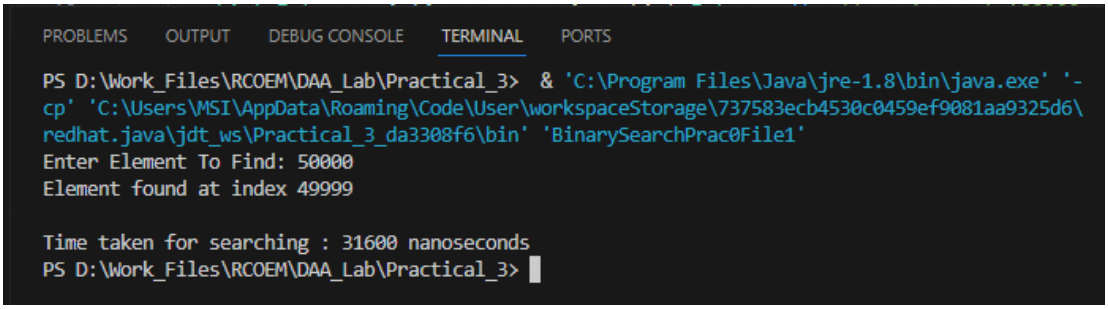
```
        scanner.close();
    }

    public static int binarySearch(List<Integer> intArray, int x){
        int startInt = 0;
        int endInt = intArray.size() - 1;
        while (startInt <= endInt) {
            int mid = (startInt + endInt) / 2;
            if (intArray.get(mid) == x) {
                return mid;
            } else if (intArray.get(mid) > x) {
                endInt = mid - 1;
            } else {
              startInt = mid + 1;
            }
        }
        return -1;
    }
}
```

Output:

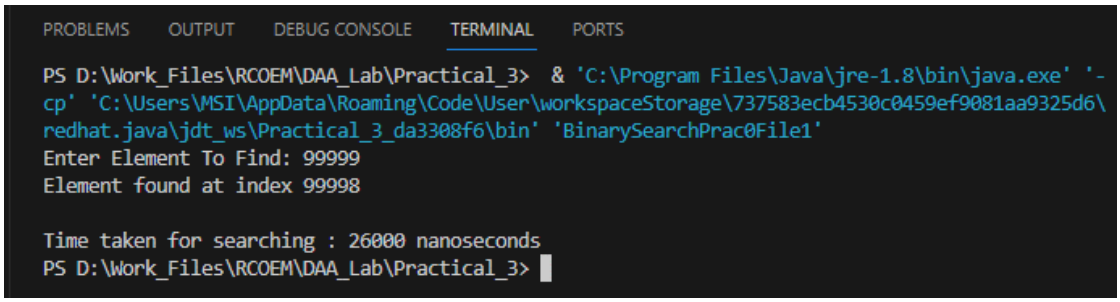
Element present at beginning:



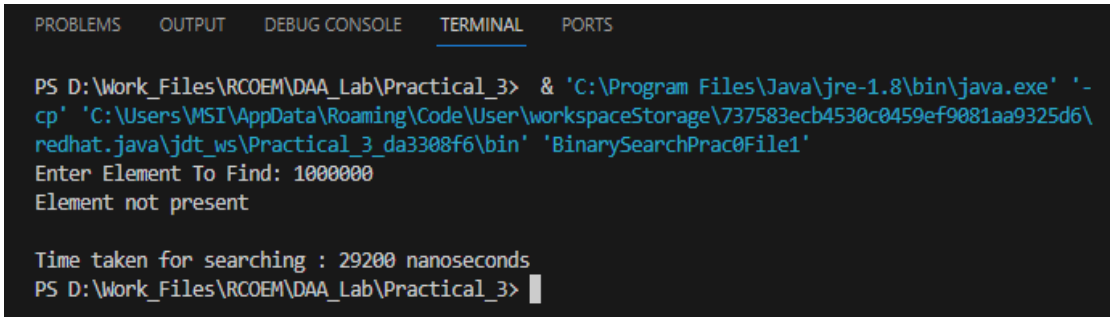
Element present at middle:



Element present at end:



Element not present**:**



For file 2 from Practical 2 (Random Unrepeated Numbers Sorted Output):

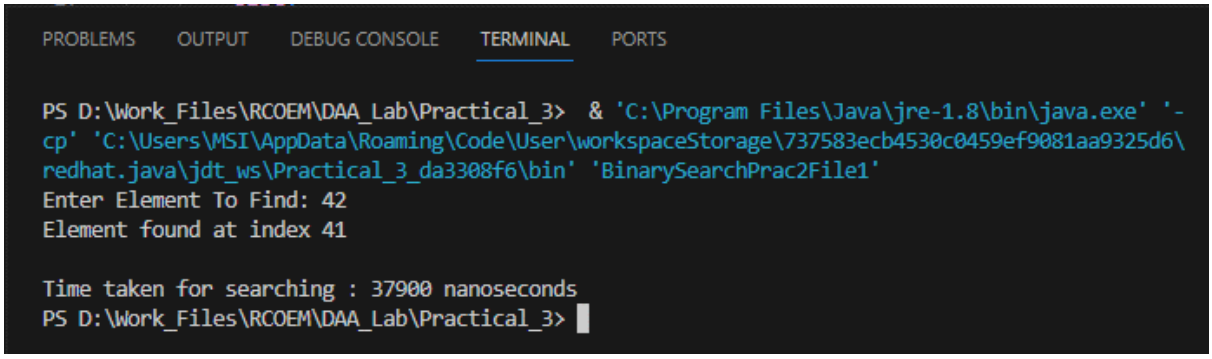
Code:

```
import java.io.*;
import java.util.ArrayList;
import java.util.List;
import java.util.Scanner;

public class BinarySearchPrac2File1 {
   public static void main(String[] args) throws IOException {
      Scanner scanner = new Scanner(System.in);
      FileReader f = new
  FileReader("./randomUnrepeatedNumbersSortedOutput.txt");

      Scanner fileScanner = new Scanner(f);
      List<Integer> intArray = new ArrayList<Integer>(); // maximum of 100000
                                                          elements in the file
      while (fileScanner.hasNextInt()) {
         intArray.add(fileScanner.nextInt());
      }
      fileScanner.close();

      System.out.print("Enter Element To Find: ");
      int elementToFind = scanner.nextInt();

      long start = System.nanoTime();
      int result=binarySearch(intArray, elementToFind);
      long finish = System.nanoTime();
      if (result == -1){
         System.out.println("Element not present");
      }
      else{
         System.out.println("Element found at index " + result);
      }

      long timeElapsed = finish - start;
      System.out.println("\nTime taken for searching : " + timeElapsed + "
  nanoseconds");

      scanner.close();
   }

   public static int binarySearch(List<Integer> intArray, int x){
      int startInt = 0;
      int endInt = intArray.size() - 1;
      while (startInt <= endInt) {
         int mid = (startInt + endInt) / 2;
         if (intArray.get(mid) == x) {
```

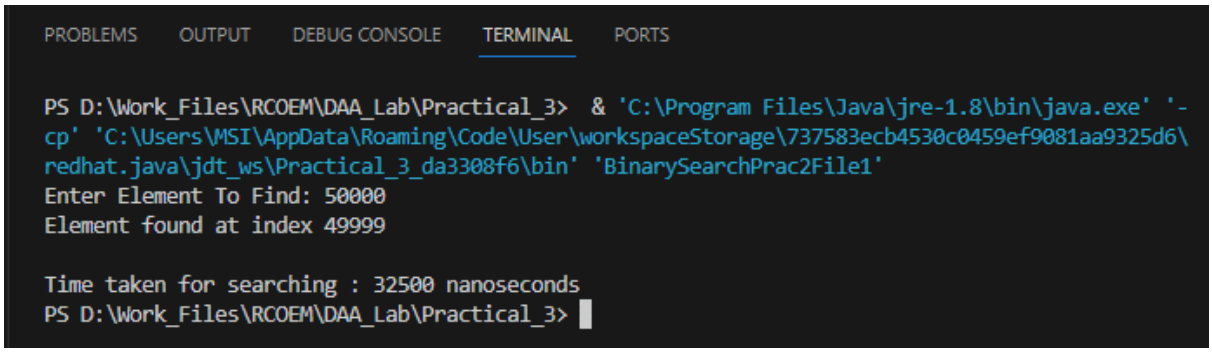
```
                return mid;
            } else if (intArray.get(mid) > x) {
                endInt = mid - 1;
            } else {
              startInt = mid + 1;
            }
        }
        return -1;
    }
}
```

Output:

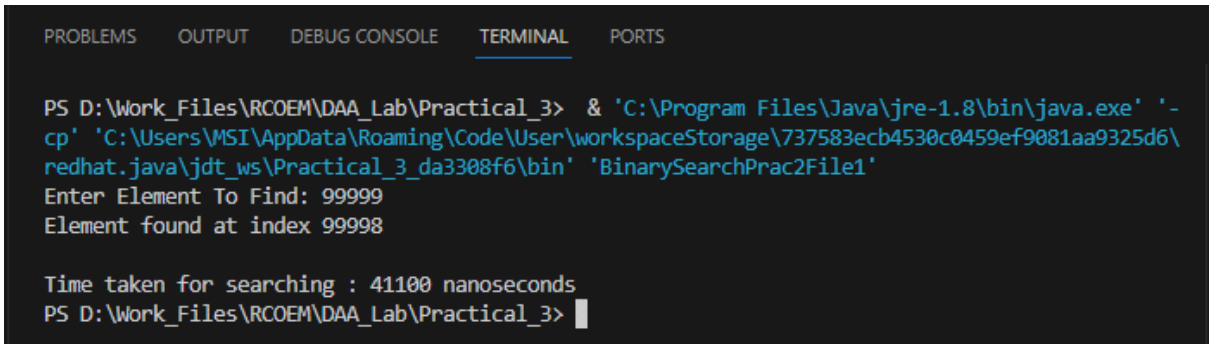
Element present at beginning:



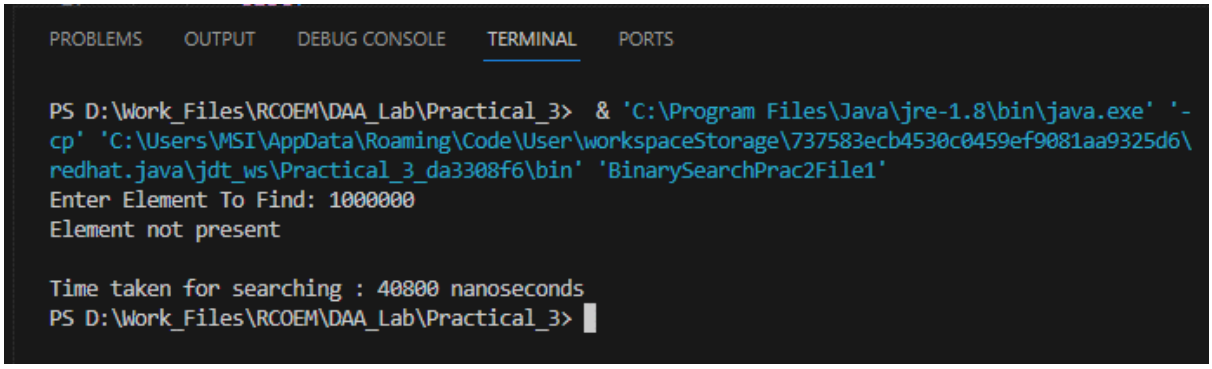
Element present at middle:



Element present at end:



Element not present:



For file 3 from Practical 2 (Random Repeated Numbers Sorted Output):

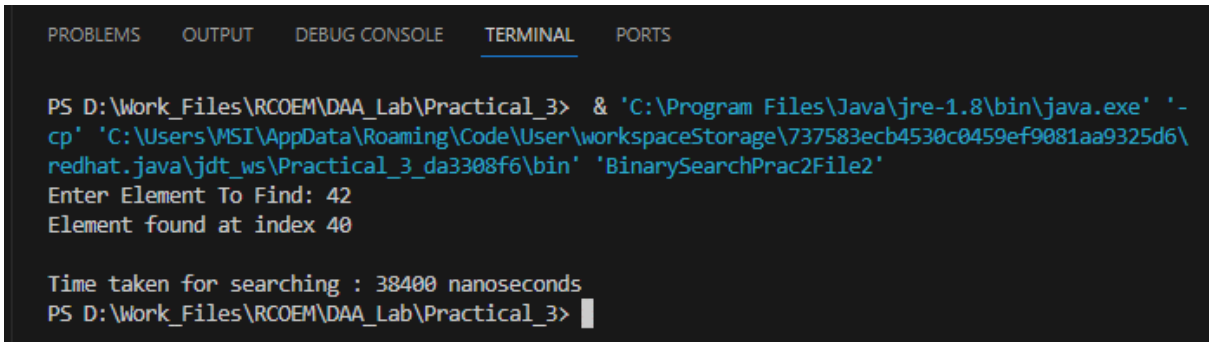
Code:

```
import java.io.*;
import java.util.ArrayList;
import java.util.List;
import java.util.Scanner;

public class BinarySearchPrac2File2 {
   public static void main(String[] args) throws IOException {
      Scanner scanner = new Scanner(System.in);
      FileReader f = new
FileReader("./randomRepeatedNumbersSortedOutput.txt");

      Scanner fileScanner = new Scanner(f);
      List<Integer> intArray = new ArrayList<Integer>(); // maximum of 100000
                                                          elements in the file
      while (fileScanner.hasNextInt()) {
         intArray.add(fileScanner.nextInt());
      }
      fileScanner.close();

      System.out.print("Enter Element To Find: ");
      int elementToFind = scanner.nextInt();

      long start = System.nanoTime();
      int result=binarySearch(intArray, elementToFind);
      long finish = System.nanoTime();
      if (result == -1){
         System.out.println("Element not present");
      }
      else{
         System.out.println("Element found at index " + result);
      }

      long timeElapsed = finish - start;
      System.out.println("\nTime taken for searching : " + timeElapsed + "
nanoseconds");

      scanner.close();
   }

   public static int binarySearch(List<Integer> intArray, int x){
      int startInt = 0;
      int endInt = intArray.size() - 1;
      while (startInt <= endInt) {
         int mid = (startInt + endInt) / 2;
         if (intArray.get(mid) == x) {
```

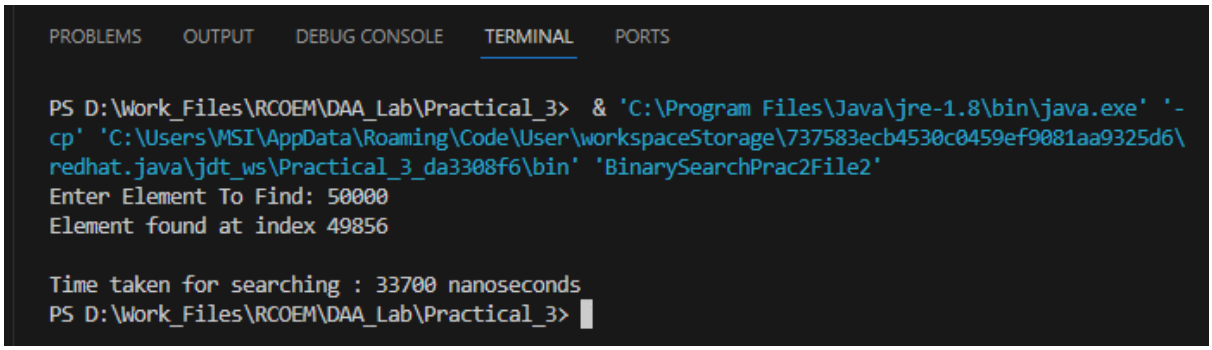
```
                return mid;
            } else if (intArray.get(mid) > x) {
                endInt = mid - 1;
            } else {
              startInt = mid + 1;
            }
        }
        return -1;
    }
}
```

Output:

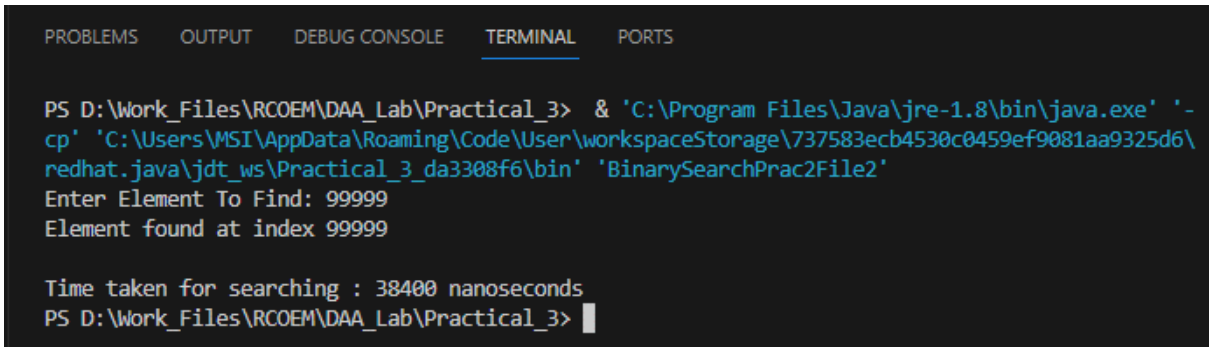
Element present at beginning:



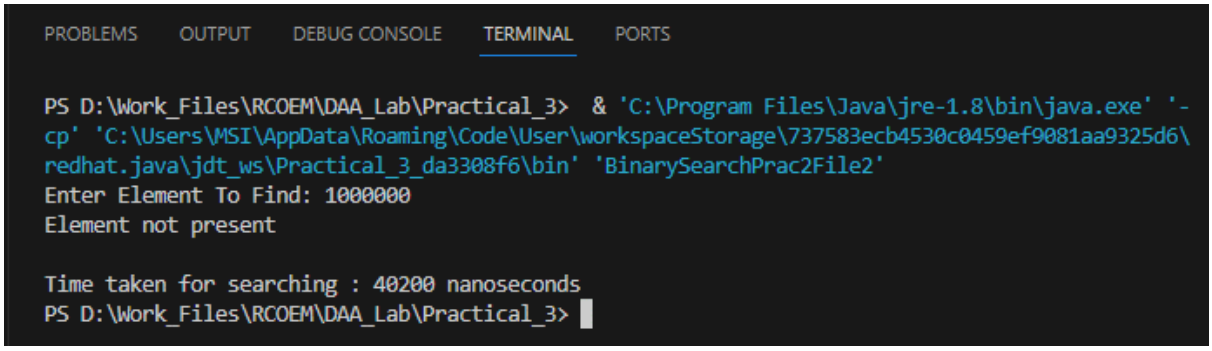
Element present at middle:



Element present at end:



Element not present:



Comparison between times taken:

File	Element At	Element	Found At Index	Time Taken (in nanoseconds)
File 1 From Practical 0 (Sequential unrepeated numbers)	Start	42	41	36100
	Middle	50000	49999	31600
	End	99999	99998	26000
	Not Found	1000000	-	29200
File 2 From Practical 2 (Random Unrepeated Numbers Sorted Output)	Start	42	41	37900
	Middle	50000	49999	32500
	End	99999	99998	41100
	Not Found	1000000	-	40800
File 3 From Practical 2 (Random Repeated Numbers Sorted Output)	Start	42	40	38400
	Middle	50000	49856	33700
	End	99999	99999	38400
	Not Found	1000000	-	40200