WIA1002 Data Structure
Lab 9: Searching

1. Write a Java program to generate N*N matrix. The matrix contains the random number (10-19). Then, perform the following using **Linear Search** (modify the SortTest.java):
    a. A method that returns true if the element can be found.
    b. A method that returns the number of occurrence for the element.
    c. A method that returns a list of (row and column) for the element.

    Example output:

```
Enter N : 5
The matrix are :
12  13  13  15  14
16  15  13  19  10
11  15  19  12  19
11  13  15  11  12
11  17  11  11  19

Linear Search
Enter a number to search: 18
18 is not found


Enter N : 5
The matrix are :
18  11  14  15  12
17  14  17  15  16
17  19  10  11  11
10  17  12  11  13
11  19  12  12  13

Linear Search
Enter a number to search: 11
11 is found
The number of 11 in the matrix is 5
The location of 11 are : [0,1][2,3][2,4][3,3][4,0]
```

2. Write a program that generates 10 random integers (0-20) and insert into the Linked-List. Then, perform the following using **Linear Search** (modify the LinkedList.java)
    a. A method that returns true if the element can be found.
    b. A method that returns the number of occurrence for the element.
    c. A method that returns true if the elements can be found. (search by range)
    d. A method that returns the number of occurrence for the elements. (search by range)

Example output:

```
The random integers are : 20 --> 19 --> 13 --> 9 --> 1 --> 13 --> 4 --> 14 --> 11 --> 9 -->
Linear Search
Enter a number to search: 5
5 is not found
Enter two numbers to search (begin end) : 15 18
No integer can be found in between 15 and 18


The random integers are : 19 --> 4 --> 15 --> 7 --> 4 --> 5 --> 1 --> 3 --> 7 --> 2 -->
Linear Search
Enter a number to search: 4
4 is found
The number of 4 in the data set is 2
Enter two numbers to search (begin end) : 7 16
The integer can be found in between 7 and 16
The number of the elements in between 7 and 16 in the data set is 3
```

3. Create an ADT HashTable named ArrayHashTable. The ADT consists of the following method and the maximum size of the ADT is 20. The ADT consists of the following method
    a. Constructor
    b. isEmpty
    c. isFull
    d. getSize
    e. clear
    f. showHashTable
    g. containsKey
    h. containsValue
    i. get
    j. put
    k. remove

    Insert the table below into the ArrayMap

Code	Name
100-101	ICND 1
200-101	ICND 2
200-120	CCNA Routing and Switching
210-260	CCNA Security

    After that, insert a new map entry 300-101 ROUTE and modify the 210-260 as CCNA RS Security. Then, remove the 200-101. Finally, enter a code to search.

    Example output:

```
The number of course is 4
100-101 : ICND1 | 200-101 : ICND2 | 200-120 : CCNA Routing and Switching | 210-260 : CCNA Security |
Adding a new course
The number of course is 5
100-101 : ICND1 | 200-101 : ICND2 | 200-120 : CCNA Routing and Switching | 210-260 : CCNA Security | 300-101 : ROUTE  |
Modifying 210-260
The number of course is 5
100-101 : ICND1 | 200-101 : ICND2 | 200-120 : CCNA Routing and Switching | 210-260 : CCNA RS Security | 300-101 : ROUTE  |
Remove the course 200-101
The number of course is 4
100-101 : ICND1 | 300-101 : ROUTE  | 200-120 : CCNA Routing and Switching | 210-260 : CCNA RS Security |
Enter a course code to search : 210-260
Course 210-260 : CCNA RS Security
```

4. Create a program to read the products from a text file (**lab9Q4.txt**). The product consists of PID and Description. Store the products in a class ArrayHashTableHashing. (Modify the ArrayHashTable created in Q3). Create the hash method that hashes the key by modulus the array size. Use linear probing if Collision occurs. Then, perform the following
    a. A method that returns the value of the element if the element can be found.
    b. A method that returns the location of the element if the element can be found.

    Example output:

```
The data set from the File
10203 : Musang King
10425 : Golden Phoenix
10311 : XO
10403 : D24
10719 : Red Prawn
10714 : Green Bamboo
10863 : Black Pearl
10643 : D101
The Hash Table size is 8
Enter a PID to search : 10544
Product ID 10544 cannot be found

The data set from the File
10203 : Musang King
10425 : Golden Phoenix
10311 : XO
10403 : D24
10719 : Red Prawn
10714 : Green Bamboo
10863 : Black Pearl
10643 : D101
The Hash Table size is 8
Enter a PID to search : 10863
Product ID : 10863  Black Pearl
Location : 6
```

5. Modify Q4 by using hash chain. Then, perform the following
    a. A method that returns the value of the element if the element can be found.
    b. A method that returns all the elements in the same location if the element can be found.

Example output:

```
The data set from the File
10203 : Musang King
10425 : Golden Phoenix
10311 : XO
10403 : D24
10719 : Red Prawn
10714 : Green Bamboo
10863 : Black Pearl
10643 : D101
Hash Table using Hash Chain
The Hash Table size is 8
Enter a PID to search : 10354
Product ID 10354 cannot be found

The data set from the File
10203 : Musang King
10425 : Golden Phoenix
10311 : XO
10403 : D24
10719 : Red Prawn
10714 : Green Bamboo
10863 : Black Pearl
10643 : D101
Hash Table using Hash Chain
The Hash Table size is 8
Enter a PID to search : 10863
Product ID : 10863  Black Pearl
The elements in the same location are :
10203 : Musang King --> 10403 : D24 --> 10643 : D101 --> 10863 : Black Pearl -->
```