

Implementation Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Basic Array Structure (HW1)	0.016sn	0.015sn	0.0sn	Not available
Array List Structure (a)	0.015sn	0.016sn	0.015sn	0.016sn
Linked List Structure (b)	0.016sn	0.015sn	0.0sn	0.031sn
LD Linked List Structure (c)	0.016sn	0.0sn	0.0sn	0.031sn

Basic Array Structure

Test1

```

TestClass1 x
(PostID: 1) : I like Java.
The post was liked by the following account(s): gokhankaya, gizemsungu,
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'me too!'

-----
(PostID: 2) : Java the coffee...
The post was liked by the following account(s): gizemsungu,
The post has no comments.
Execution Time: 0.016

Process finished with exit code 0

```

Test2

```

TestClass2 x
↑ The post has no likes.
↓ The post has 1 comment(s)...
↻ Comment 1: 'gokhankaya' said 'Nice!'
⌵
🖨 Step 18...There is/are 0 message(s) in the inbox.
🗑 Step 19...Viewing inbox...
You don't have any messages to show in your inbox yet!
Execution Time: 0.015

Process finished with exit code 0

```

Test3

```
TestClass3 x
sibeloulmez.follow(gizemsungu):

Step 10 try view profile's gizemsungu...
You cannot view profile this user!
You have been blocked by : gizemsungu

Step 11 try view post profile's gizemsungu...
You cannot view posts this user!
You have been blocked by : gizemsungu

Step 12 try send message gizemsungu...
You must follow gizemsungu account to send message!
Execution Time: 0.0

Process finished with exit code 0
```

ArrayList

Test1

```
TestClass1 x

(PostID: 1) : I like Java.
The post was liked by the following account(s): gokhankaya, gizemsungu,
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'me too!'

-----
(PostID: 2) : Java the coffee...
The post was liked by the following account(s): gizemsungu,
The post has no comments.
Execution Time: 0.015

Process finished with exit code 0
```

Test2

```
TestClass2 x

(PostID: 2) : Java the coffee...
The post has no likes.
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'Nice!'

Step 18...There is/are 0 message(s) in the inbox.

Step 19...Viewing inbox...
You don't have any messages to show in your inbox yet!
Execution Time: 0.016

Process finished with exit code 0
```

Test3

```
TestClass3 x
↑ You cannot view profile this user!
↓ You have been blocked by : gizemsungu
:~:
Step 11 try view post profile's gizemsungu...
You cannot view posts this user!
You have been blocked by : gizemsungu
Step 12 try send message gizemsungu...
You must follow gizemsungu account to send message!
Execution Time: 0.015

Process finished with exit code 0
```

Test4

```
TestClass4 x
↑ The post has no likes.
↓ The post has no comments.
-----
(PostID: 2) : Java the coffee...
The post has no likes.
The post has no comments.
Step 40...
Logging out from account 'mehmetturan'...
Execution Time: 0.016

Process finished with exit code 0
```

Linked List

Test1

```
TestClass1 x
Comment 1: 'gokhankaya' said 'me too!'

-----
(PostID: 2) : Java the coffee...
The post was liked by the following account(s): gizemsungu,
The post has no comments.
Execution Time: 0.016

Process finished with exit code 0
```

Test2

```
TestClass2 x
(PostID: 2) : Java the coffee...
The post has no likes.
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'Nice!'

Step 18...There is/are 0 message(s) in the inbox.

Step 19...Viewing inbox...
You don't have any messages to show in your inbox yet!
Execution Time: 0.015

Process finished with exit code 0
```

Test3

```
TestClass3 x

Step 10 try view profile's gizemsungu...
You cannot view profile this user!
You have been blocked by : gizemsungu

Step 11 try view post profile's gizemsungu...
You cannot view posts this user!
You have been blocked by : gizemsungu

Step 12 try send message gizemsungu...
You must follow gizemsungu account to send message!
Execution Time: 0.0

Process finished with exit code 0
```

Test4

```
Message 251 * This method checks if an account
Post 252 * @param accounts An Account array

TestClass4 x

↑ (PostID: 1) : I like Java.
↓ The post has no likes.
  The post has no comments.
  -----
  (PostID: 2) : Java the coffee...
  The post has no likes.
  The post has no comments.

Step 40...
Logging out from account 'mehmetturan'...
Execution Time: 0.031

Process finished with exit code 0
```

LDLinkedList

Test1

```
TestClass1 <
Step 21...Liking sibelgulmez's posts...

Step 22...Viewing sibelgulmez's posts' interactions...
-----
(PostID: 1) : I like Java.
The post was liked by the following account(s): gokhankaya, gizemsungu,
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'me too!'

-----
(PostID: 2) : Java the coffee...
The post was liked by the following account(s): gizemsungu,
The post has no comments.
Execution Time: 0.016

Process finished with exit code 0
```

Test2

```
TestClass2 <
(PostID: 1) : I like Java.
The post was liked by the following account(s): sibelgulmez,
The post has no comments.
-----
(PostID: 2) : Java the coffee...
The post has no likes.
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'Nice!'

Step 18...There is/are 0 message(s) in the inbox.

Step 19...Viewing inbox...
You don't have any messages to show in your inbox yet!
Execution Time: 0.0
```

Test3

```
TestClass3 x
Step 9 try follow profile's gizemsungu...
You cannot follow this user!
You have been blocked by : gizemsungu

Step 10 try view profile's gizemsungu...
You cannot view profile this user!
You have been blocked by : gizemsungu

Step 11 try view post profile's gizemsungu...
You cannot view posts this user!
You have been blocked by : gizemsungu

Step 12 try send message gizemsungu...
You must follow gizemsungu account to send message!
Execution Time: 0.0

Process finished with exit code 0
```

Test4

```
TestClass4 x
(PostID: 2) : Java the coffee...
The post has no likes.
The post has 2 comment(s)...
Comment 1: 'mehmetturan' said 'Good look picture!'

The post has 2 comment(s)...
Comment display error!

Step 40...
Logging out from account 'mehmetturan'...
Execution Time: 0.031

Process finished with exit code 0
```

Operation	ArrayList	LinkedList	Basic array
Adding elements	$O(n)$	$O(1)$	$O(n)$
Element deletion	$O(n)$	$O(1)$	$O(n)$
Element search	$O(1)$	$O(n)$	$O(1)$

ArrayList has a structure similar to a dynamic array. It uses an array in the background and data items are stored in that array. Adding or deleting data items may require changing the size of the array, so

the time complexity of these operations is usually $O(n)$. However, searching for an element can be done in constant time ($O(1)$).

A LinkedList stores it not as an array, but as a linked list, where each element has a unique address. Therefore, element insertions or deletions can be done in constant time ($O(1)$). However, searching for an element may require scanning the entire list, so the time complexity of this operation is $O(n)$.

Basic array is the simplest data structure. They store data items directly in memory. Therefore, searching for an element can be done in constant time ($O(1)$). However, adding or deleting elements may require creating a new array from memory, so the time complexity of these operations is $O(n)$.

In summary, ArrayList and basic array stand out with their ability to search for elements in constant time. LinkedList is more suitable for adding or deleting elements. Which data structure should be used depends on the requirements of the application and the usage patterns of the data items.

The main difference between Lazy Delete and the regular Link List is the time complexity of the deletion. While in normal Link List deletion has $O(n)$ time complexity, in Lazy Delete deletion has $O(1)$ time complexity. However, Lazy Delete may use extra memory as an extra pointer or flag is used to delete elements.

Lazy Deletion LinkedList

It extends the Java LinkedList class and overrides the remove method to implement a lazy deletion algorithm. The Lazy Deletion is a technique that delays the actual removal of an item from the list until a certain number of delete requests are received.

The class has two variables - lazy_Deletion and lazyDeletionCount - to track the state of the lazy deletion algorithm. If lazyDeletionCount is 0, it means that no deletion has been made yet, so the method increments lazyDeletionCount and sets lazy_Deletion to 1. If lazyDeletionCount is 1, it means that the previous delete request has been made, so the method searches for the requested object in the list. If it finds the object, it checks the lazy_Deletion value. If it's 1, it removes the object at the previous index and resets the variables to 0. If it's 0, it sets lazy_Deletion to 1. If it doesn't find the object, it resets the variables to 0.