

**Computer Engineering
CSE 222/505 - Spring 2023
Homework # Report**

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1. Introduction

Purpose of Document

This document is report for this project. The report is going to explain you what stages the homework was going through.

Purpose of Project

The aim of this project is to develop the project with different data structures by adding new features to the social media project we have done with java array in the first assignment.

2. Problem Solution Approach

I did this assignment using only java array in previous assignments so it wasn't hard to start this assignment. I finished the first two parts of the assignment by writing arraylist and linkedlist instead of java arrays in the first assignment. While making this transition, I additionally had to use the methods of arraylist and linklist structures.

In addition to the initial assignment, we needed to add some new features. These features are unlike, unblock, uncomment, unfollow and showing action history.

Since I made the likes in the Post class, I created the unlike feature in the Post class. My approach to the problem while adding this feature was: If there is a user who wants to unliked in the list of likes, remove her from the list of likes and reduce the number of likes of the post. I used the already existing remove function in the arraylist and linkedlist classes. In the example below, the this expression symbolizes the post class, while the likes

expression represents an arraylist containing objects belonging to the like class.

```
if (likes.get(i).accountId == idAccount)
{
    this.likes.remove(i);
}
```

Since I made the likes in the Post class, I created the unlike feature in the Post class. My approach to the problem while adding this feature was: If there is a user who wants to uncomment in the list of comment, remove her from the list of comments and reduce the number of comments of the post. I used the already existing remove function in the arraylist and linkedlist classes. In the example below, the this expression symbolizes the post class, while the comments expression represents an arraylist containing objects belonging to the comment class.

```
if (comments.get(i).accountId == idAccount)
{
    this.comments.remove(i);
}
```

Since I made the follow in the Account class, I created the unfollow feature in the same class. My approach to the problem while adding this feature was: If a user wants to unfollow a user, I first check if the user who wants to unfollow is following the other user. If he is following, I remove the name of the person who wants to unfollow from the list of followers of the other person, and I remove the name of the other person from the list of followers of the person who wants to unfollow. I will show the declaration of the method I wrote to unfollow below.

```
public void UnfollowPerson(Account person)
```

Since I made the block in the Account class, I created the unblock feature in the same class. My approach to the problem while adding this feature was: When a user wants to unblock another user, it is first checked to see if he has blocked them before. If he has blocked, then the person to be removed from the blocked list is removed with the remove function. I will show the declaration of the method I wrote to unblock below.

```
public void UnblockUsers(Account person)
```

I created actionHistory method for saving their action. Also I added a string variable to Account class. I saved operations users did in certain methods by using that string variable. Below you will see the example where I saved the operation done in the likePost method to the string.

```
person.history.add(this.GetName() + " liked your post. Post id: " +  
    person.posts.get(index).PostId());
```

And finally, I will talk about how I created my own linked list called LDLinkedList, which means Lazy Deleted Linked List. This was the most important part of this assignment. The difference of LDLinkedList from normal linked list is that the remove method works differently. LDLinkedList marks the node to be removed first and removes them together when there are 2 nodes that need to be removed.

I created a boolean variable called isMarked to understand whether the nodes are marked in the inner class which name is Node class. When the remove method is called, the specified index is visited and the value of the isMarked variable of that node is changed to true. If there are two marked nodes in the same node chain, the remove function calls the LazyRemove method to delete two nodes. In addition, the node marked in the other methods in the LDLinkedList class is considered to be deleted, but the deletion does not occur without the number of nodes that need to be deleted 2.

3. Running Command and Result

I will share TestClass1, TestClass2, TestClass3 and TestClass4 output.

```
[furkanekinci@Furkan-MacBook-Air 200104004063-hw3 % java ArrayList.TestClass3
1) An account with username gizemsungu has been created.
   An account with username sibelgulmez has been created.
   An account with username gokhankaya has been created.

2) Logging into an account (username: sibelgulmez) ...

3) Sharing two posts...

4) Following gizemsungu and gokhankaya

5) Logging out from account 'sibelgulmez'

6) Logging into another account (username: gokhankaya) ...

7) Viewing sibelgulmez's profile ...

User ID: 2
Username: sibelgulmez
Location: Istanbul
Birth Date: 10.03.1995
sibelgulmez is following 2 account(s) and has 0 follower(s)
sibelgulmez is following: gokhankaya, gizemsungu,
sibelgulmez has 2 post(s)
8) Viewing sibelgulmez's posts ...

(PostID: 1)  sibelgulmez: BESIKTAS
(PostID: 2)  sibelgulmez: LOVE

9) Liking a post of sibelgulmez ...

10) Adding a comment on a post of sibelgulmez...

11) Following sibelgulmez and gizemsungu...

12) Sending a message to gizemsungu...

13) Logging out from account 'gokhankaya'...

14) Logging into another account (username: gizemsungu)...

----- Checking outbox -----
There is/are 0 message(s) in the outbox.

----- Checking inbox -----
There is/are 1 message(s) in the inbox.
```

Viewing outbox

Viewing inbox

Message ID: 1
Message: Hi Gizem..
To: gizemsungu
From: gokhankaya

18) Viewing sibalgulmez's profile...

User ID: 2
Username: sibalgulmez
Location: Istanbul
Birth Date: 10.03.1995
sibalgulmez is following 2 account(s) and has 1 follower(s)
sibalgulmez is following: gokhankaya, gizemsungu,
The followers of sibalgulmez are: gokhankaya,
sibalgulmez has 2 post(s)

19) Viewing sibalgulmez's posts...

(PostID: 1) sibalgulmez: BESIKTAS
(PostID: 2) sibalgulmez: LOVE

20) Viewing sibalgulmez's posts' interactions...

(PostID: 1): BESIKTAS
The post was liked by the following account(s) : gokhankaya,
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'The club is really amazing...'

(PostID: 2): LOVE
The post has no likes.
The post has no comments.

21) Liking sibalgulmez's posts...

22) Viewing sibalgulmez's posts' interactions...

(PostID: 1): BESIKTAS
The post was liked by the following account(s) : gokhankaya, gizemsungu,
The post has 1 comment(s)...
Comment 1: 'gokhankaya' said 'The club is really amazing...'

(PostID: 2): LOVE
The post was liked by the following account(s) : gizemsungu,
The post has no comments.

```
-----  
23) Logging out from account 'gizemsungu'...  
24) Logging into another account 'gizemsungu'...  
25) Share two post from account of 'gizemsungu'  
26) Logging out from account of 'gizemsungu'  
27) Logging into another account 'sibelgulmez'  
28) Views post to account of 'gizemsungu'  
You can not this because you did not enter View Profile of gizemsungu!!!  
29) Views the profile of 'gizemsungu'  
  
User ID: 1  
Username: gizemsungu  
Location: Antalya  
Birth Date: 13.01.1993  
gizemsungu is following 0 account(s) and has 2 follower(s)  
The followers of gizemsungu are: sibelgulmez, gokhankaya,  
gizemsungu has 2 post(s)  
  
  
30) Like post which in account of 'gizemsungu'...  
You are not in gizemsungu's posts  
31) Views the posts of 'gizemsungu'  
  
(PostID: 1) gizemsungu: This homework is too easy...  
(PostID: 2) gizemsungu: I am sure that this homework is so nice..  
32) Like post which in account of 'gizemsungu'...  
33) Views the posts of 'gizemsungu'  
  
(PostID: 1) gizemsungu: This homework is too easy...  
(PostID: 2) gizemsungu: I am sure that this homework is so nice..  
  
  
34) Views theinteraction of posts of 'gizemsungu'  
  
(PostID: 1): This homework is too easy...  
The post was liked by the following account(s) : sibelgulmez,  
The post has no comments.  
-----  
  
(PostID: 2): I am sure that this homework is so nice..  
The post has no likes.  
The post has no comments.  
-----  
35) Logging out from account of 'sibelgulmez'  
36) Logging into account of 'gokhankaya'  
37) Views the profile of 'gizemsungu'
```

User ID: 1
Username: gizemsungu
Location: Antalya
Birth Date: 13.01.1993
gizemsungu is following 0 account(s) and has 2 follower(s)
The followers of gizemsungu are: sibelgulmez, gokhankaya,
gizemsungu has 2 post(s)

38) Comment post2 of 'gizemsungu'

You are not in gizemsungu's posts

39) Views the posts of 'gizemsungu'

(PostID: 1) gizemsungu: This homework is too easy...
(PostID: 2) gizemsungu: I am sure that this homework is so nice..

40) Comment post2 of 'gizemsungu'

41) View the interactions of gizemsungu's posts...

(PostID: 1): This homework is too easy...

The post was liked by the following account(s) : sibelgulmez,

The post has no comments.

(PostID: 2): I am sure that this homework is so nice..

The post has no likes.

The post has 1 comment(s)...

Comment 1: 'gokhankaya' said 'Yess, you should grade as 120 :)'

42) Send a message to 'gizemsungu'

43) Logging out from account of 'gokhankaya'

44) Logging into 'gizemsungu' account..

45) View the profile of 'gizemsungu'

User ID: 1

Username: gizemsungu

Location: Antalya

Birth Date: 13.01.1993

gizemsungu is following 0 account(s) and has 2 follower(s)

The followers of gizemsungu are: sibelgulmez, gokhankaya,

gizemsungu has 2 post(s)

46) Check inbox and outbox..

----- Checking outbox -----

There is/are 0 message(s) in the outbox.

----- Checking inbox -----

There is/are 2 message(s) in the inbox.

47) View inbox and outbox..

Viewing outbox

Viewing inbox

Message ID: 1

Message: Hi Gizem..

To: gizemsungu

From: gokhankaya

Message ID: 2

Message: Please be understanding when checking homework..

To: gizemsungu

From: gokhankaya

48) Logging out from account of 'gizemsungu'

49) Logging into account of 'gizemsungu'

50) Block 'sibelgulmez'...

51) Logging out from account of 'gizemsungu'

52) Logging into account of 'sibelgulmez'

53) Try to enter view the profile of 'gizemsungu'

This account is blocked...

54) Try to send message to 'gizemsungu'

This account is blocked...

```
55) Try to logging to another account..  
You can not Login because There is another account now...  
56) Logging out from account of 'sibelgulmez'
```

These are the outputs of TestClass1, TestClass2 and TestClass3.
I will share some parts of TestClass4's output.

```
1) An acoount with username furkan has been created.  
2) An acoount with username gizem has been created.  
3) An acoount with username fatih has been created.  
4) An acoount with username tugba has been created.  
5) An acoount with username ahmet has been created.  
6) An acoount with username fevzi has been created.  
7) An acoount with username gamze has been created.  
8) An acoount with username faruk has been created.  
9) An acoount with username sena has been created.  
10) An acoount with username yetgin has been created.  
  
11) (username: furkan) is logging into the account  
12) furkan shared a post  
13) furkan followed tugba  
14) furkan followed gizem  
15) furkan followed yetgin  
16) furkan sended a message to tugba  
17) furkan is trying to send a message to fevzi  
You did not follow this account so you can not send a message.!!!  
18) furkan sended a message to yetgin  
19) (username: furkan) is logging out from the account  
20) (username: gizem) is logging into the account  
21) gizem shared a post  
22) gizem followed tugba  
23) gizem followed furkan  
24) gizem followed fevzi
```

```
25) gizem followed sena
26) gizem followed ahmet
27) gizem followed yetgin
28) gizem shared another post
29) gizem sended a message to furkan
30) gizem sended a message to tugba
31) (username: gizem) is logging out from the account
32) (username: fatih) is logging into the account
33) fatih followed furkan
34) fatih followed yetgin
35) fatih followed gizem
36) fatih viewed profile of furkan
```

User ID: 1

Username: furkan

Location: Erzincan

Birth Date: 28.06.2001

furkan is following 3 account(s) and has 2 follower(s)

furkan is following: tugba, gizem, yetgin,

The followers of furkan are: gizem, fatih,

furkan has 1 post(s)

```
37) fatih tried to like post of furkan
```

You are not in furkan's posts

```
38) fatih viewed posts of furkan
```

(PostID: 1) furkan: Weather is so good today..

39) fatih like post of furkan

40) fatih viewed interactions of furkan's posts

(PostID: 1): Weather is so good today..

The post was liked by the following account(s) : fatih,

The post has no comments.

41) yetgin tried to logging into the account

You can not Login because There is another account now...

42) fatih unfollowed furkan

43) fatih viewed profile of furkan

User ID: 1

Username: furkan

Location: Erzincan

Birth Date: 28.06.2001

furkan is following 3 account(s) and has 1 follower(s)

furkan is following: tugba, gizem, yetgin,

The followers of furkan are: gizem,

furkan has 1 post(s)

44) fatih tried to unlike post of furkan

You are not in furkan's posts

45) fatih viewed posts of furkan

(PostID: 1) furkan: Weather is so good today..

46) fatih unlike post of furkan

47) fatih viewed interactions of furkan's posts

(PostID: 1): Weather is so good today..

The post has no likes.

The post has no comments.

48) fatih liked post of furkan again

49) fatih viewed interactions of furkan's posts

(PostID: 1): Weather is so good today..

The post was liked by the following account(s) : fatih,
The post has no comments.

50) fatih made a comment to post of furkan

51) fatih viewed interactions of furkan's posts

(PostID: 1): Weather is so good today..

The post was liked by the following account(s) : fatih,
The post has 1 comment(s)...

Comment 1: 'fatih' said 'Sorry, I just wanted to see if
'

52) (username: fatih) is logging out from the account

53) (username: tugba) is logging into the account

54) tugba followed furkan

55) tugba followed gamze

56) tugba followed faruk

57) tugba followed gizem

58) tugba followed yetgin

59) tugba sent a message to furkan

60) tugba viewed profile of furkan

User ID: 1

Username: furkan

Location: Erzincan

Birth Date: 28.06.2001

```
furkan is following 3 account(s) and has 2 follower(s)
furkan is following: tugba, gizem, yetgin,
The followers of furkan are: gizem, tugba,
furkan has 1 post(s)
```

61) tugba viewed posts of furkan

(PostID: 1) furkan: Weather is so good today..

62) tugba liked post of furkan

63) tugba made a comment to post of furkan

64) tugba viewed interactions of furkan's posts

(PostID: 1): Weather is so good today..

The post was liked by the following account(s) : fatih, tugba,

The post has 2 comment(s)...

Comment 1: 'fatih' said 'Sorry, I just wanted to see if i could
'

Comment 2: 'tugba' said 'Yepp, weather is really good..'.

65) tugba showed your own past moves

You are followed by furkan

You are followed by gizem

You followed furkan

You followed gamze

You followed faruk

You followed gizem

You followed yetgin

You liked furkan's post id: 1

You commented furkan's post id: 1

66) (username: tugba) is logging out from the account

67) (username: ahmet) is logging into the account

```
68) ahmet followed furkan  
69) ahmet followed yetgin  
70) ahmet followed fatih  
71) ahmet followed gizem  
72) ahmet viewed profile of gizem
```

User ID: 2
Username: gizem
Location: Antalya
Birth Date: 13.01.1993
gizem is following 6 account(s) and has 4 follower(s)
gizem is following: tugba, furkan, fevzi, sena, ahmet, yetgin,
The followers of gizem are: furkan, fatih, tugba, ahmet,
gizem has 2 post(s)

```
73) ahmet viewed posts of gizem
```

(PostID: 1) gizem: This homework is exhausting...
(PostID: 2) gizem: I am so tired to teach new information to students

```
74) ahmet liked post of gizem
```

```
75) ahmet liked post of gizem
```

76) ahmet viewed interactions of gizem's posts
(PostID: 1): This homework is exhausting...
The post was liked by the following account(s) : ahmet,
The post has no comments.

(PostID: 2): I am so tired to teach new information to students...
The post was liked by the following account(s) : ahmet,
The post has no comments.

```
77) ahmet commented to post of gizem
```

```
78) ahmet viewed interactions of gizem's posts
```

(PostID: 1): This homework is exhausting...
The post was liked by the following account(s) : ahmet,
The post has 1 comment(s)...
Comment 1: 'ahmet' said 'Yeah, really it is..'

(PostID: 2): I am so tired to teach new information to students...

```
The post was liked by the following account(s) : ahmet,  
The post has no comments.
```

```
79) ahmet uncommented from post of gizem
```

```
80) ahmet viewed interactions of gizem's posts
```

```
(PostID: 1): This homework is exhausting...
```

```
The post was liked by the following account(s) : ahmet,  
The post has no comments.
```

```
(PostID: 2): I am so tired to teach new information to students...
```

```
The post was liked by the following account(s) : ahmet,
```

```
The post has no comments.
```

```
81) ahmet showed your own past moves
```

```
You are followed by gizem
```

```
You followed furkan
```

```
You followed yetgin
```

```
You followed fatih
```

```
You followed gizem
```

```
You liked gizem's post id: 1
```

```
You liked gizem's post id: 2
```

```
You commented gizem's post id: 1
```

```
You uncommented gizem's post id: 1
```

4. Time Complexity

Methods	Basic Array	ArrayList	LinkedList	LDLinkedList
Login	$O(n)$	$O(n)$	$O(n^2)$	$O(n^2)$
Logout	$O(1)$	$O(1)$	$O(1)$	$O(1)$
SharePost	$O(n)$	$O(n)$	$O(n)$	$O(n)$
CommentPost	$O(n)$	$O(n)$	$O(n^2)$	$O(n^2)$
UnCommentPost	---	$O(n)$	$O(n^2)$	$O(n^2)$
LikePost	$O(n)$	$O(n)$	$O(n^2)$	$O(n^2)$
UnlikePost	---	$O(n)$	$O(n^2)$	$O(n^2)$
FollowPerson	$O(n)$	$O(n)$	$O(n)$	$O(n)$
UnfollowPerson	---	$O(n^2)$	$O(n^2)$	$O(n^2)$
BlockUsers	$O(n^2)$	$O(n^2)$	$O(n^3)$	$O(n^3)$
UnblockUsers	---	$O(n^2)$	$O(n^3)$	$O(n^3)$
ActionHistory	---	$O(n)$	$O(n^2)$	$O(n^2)$

Login

```
public void Login(Account[] people, int index)
```

Since the content of the people variable is checked in this method, time complexity is $O(n)$ in the use of basic array and ArrayList. But both LinkedList and LDLinkdeList are time complexity $O(n^2)$. Because the time complexity of the get method inside these classes is $O(n)$.

```
for (int i = 0; i < index; i++) //Che
{
    if (people.get(i).control == true)
    {
        flagControl++;
    }
}
```

SharePost

The time complexity for all classes is $O(n)$ because the time complexity of the add method of all classes is $O(n)$.

CommentPost

Since the time complexity of the add method of all classes is $O(n)$, all of them must have a time complexity of at least $O(n)$. But the time complexity for the LinkedList and LDLinkedList classes is $O(n^2)$.

Because the time complexity of their get function is also $O(n)$.

```
person.posts.get(index).ForComment(numberComments, this.accountId,
    person.posts.get(index).PostId(), content);
```

BlockUsers

The time complexity for ArrayList and basic array is $O(n^2)$ because the time complexity of their get method is $O(1)$. but the time complexity of LinkedList and LDLinkedList is $O(n^3)$ because the time complexity of their get method is $O(n)$. The code image of the explanation is on the bottom page.

```

for (int i = 0; i < person.followers.size(); i++)
{
    if (person.followers.get(i) == this.GetName())
    {
        person.followers.remove(i);
        break;
    }
}

```

5.Experimental Running Time Analysis Table

Implementation Type	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Basic Array Structure(HW1)	"30,1432"	"31,6708"	"31,9535"	<i>Not available</i>
Array List Structure (a)	"30,6622"	"31,7485"	"32,5634"	"35,1346"
Linked List Sstructure (b)	"30,3102"	"31,9480"	"32,3435"	"36,6946"
LD Linked List Structure (c)	"31,1460"	"31,9152"	"33,3321"	"36,4742"

The most important issue in this assignment is undoubtedly the Lazy Deleted system that we have implemented in the LDLinkedList class. I didn't know about this method before and I hadn't thought of anything like this, but it does offer a difference that can make an incredibly big difference in larger projects.

We need to navigate over the nodes to find the index we will remove in LinkedList. However, if the node that needs to be removed is marked instead of removing it, and if that node is treated as if it does not exist, and if more than one node is deleted at the same time, a very serious profit will be made in terms of time.

Other than that, I would expect the ArrayList class to be faster than the LinkedList class because we don't have to go through the whole array to reach a certain index.

I thought that the basic array should run the fastest, which is how it happened. Because the ArrayList class actually operates with the basic array in it, but it does this without showing us, thanks to certain

optimization and certain methods in the background. As a result, it should be faster for the program to operate directly using basic arrays without using any tools or methods.