# **Analysis of Algorithms**

Spring 2020

# **Members Details**

Group ID	CS311-G22
Registration Number of Group Members	2018-CS-124 2018-CS-131
Section	С

# **Project Details**

Project	
Project Title	Plagiarism Checking Tool
Executive Summary	Project is about plagiarism checking between two texts. Such that it checks, how much of the content is same. It gives you the same content of text, number of match words and the percentage of plagiarism. Text, to check plagiarism, may be enter by user (in two text boxes) or may user add in the form of two text files.if user want to add text directly than two boxes are there on one page, or if it wants to add files than there is another option of check plagiarism between files if user clicks on it, another page will open having two options of "add file1" and "add file2". Aftert entring text user click on "check plagiarism" button after clicking on that button a new page open which shoes the result of plagiarism of that texts. Working principle is such that, code take one line from the 1st file and then compare that line with each line of second file and find the LCS (long common substring) if the LCS of that line is greater than LCS of that line with the new line of second file, it store that line in a separate string. In other words we store that line of second file with which LCS of each line is greater. Then we move to next line of 1st file and repeat the process for that new line. After the whole processing we get a result array which contain the matching words of file one and file two.  Code also work for cpp files or text but conditions are different for text files and cpp files. ".cpp" file give the output of plagiarism on the bases of percentage of plagiarism. This is because many of us implement the same algorithm and use same name that are in algorithm and also key words like (for, while, if, else,etc) would be same in the coding file, so we consider that if percentage is

	more than 20% than text is copied or plagiarized.
Business Case	
Outline the business need for the project	In this modern area, plagiarism has become serious issue. Internet advent makes plagiarism easier. Many of the students and researchers use others works instead of utilizing their own abilities. So we have different strategies to prevent it, one of them is developing plagiarism checking tools. Also helpful for those who want to know or check that their work is not plagiarized.
End user of the product	<ul> <li>Students</li> <li>Researchers</li> <li>Teachers</li> <li>Almost all students took help from the goggle to understand the concept and to learn new things. Student can use it to check that their work is not plagiarized. Researchers during research read different articles and then write their own research about that topic so they can use it to check that their paper is not matching to any of the research paper available on the internet. Students copy each other work so teachers also use it to punish them.</li> </ul>
Motivation for Project	[This section to contain a clear statement of motivation which drives you to this project]
Description of the project objective(s)	> [Identify the key objectives of the project]
State the level of impact expected should the project proceed and implications of not proceeding	[State whether the implementation would have an impact at an operational level and/or strategic level and state the impact(s) in 2-3 lines]
Functional Requirements	<ul> <li>We provide two options to user</li> <li>check plagiarism between files</li> <li>check plagiarism between text enter by user</li> <li>Sign Up functionality but not mandatoryfor the user to sign up before using the application</li> <li>User can Login if he/she sign up once.</li> <li>User can Logout</li> </ul>

	<ul> <li>Application will show the number of matched word</li> <li>Application will show the matched text</li> <li>Application will show the percentage of similarity between text</li> </ul>
Benefits	
What benefits are expected/ anticipated?	<ul> <li>It gives the percentage of similler content</li> <li>Useful for writing new content within short time</li> <li>Improve our paraphrasing powers.</li> <li>It is also very useful for web writters</li> </ul>
Implementation Details	
Link to Github Repository	https://github.com/Ayesha-Azam/CS311S20PID22
Total Number of commits in repository before 5 <sup>th</sup> August 2020	26
Exact contribution of each member	2018-CS-124 (13 commits) 2018-CS-131 (13 commits)

# Commits in github repository by each member

Member Registration No.	<b>Total Commits</b>
2018-CS-124	13 commits
2018-CS-131	13 commits

# **Details of commits**

Sr. No.	Details of commit	Date	Member Reg No.
1	Added Sign Up, sign in and logout functionalities	2 days ago	2018-CS-131
2	Time complexity and analysis of algorithm	27 days ago	2018-CS-131
3	Made some changes in the UI	4 days ago	2018-CS-131
4	Pseudo Code	30 days ago	2018-CS-131
5	Plagiarism Checker Code File	25 days ago	2018-CS-131
6	Final Code For file handling	25 days ago	2018-CS-124
7	Rough working on pseudo code	28 days ago	2018-CS-124
8	Front End Design	18 days ago	2018-CS-131
9	Final Code File	22 days ago	2018-CS-131

Second page web de		11 days ago	2018-CS-124
11 Code implementation	on_3	22 days ago	2018-CS-124
12   Final		10 days ago	2018-CS-131
Commit			
(plagiarismChecking	gToolFinal.zip)	10.1	
Final commit		10 days ago	2018-CS-124
Have you used built in algorithms or you have implemented yourself?		ed version of LCS and for our own algorithm and in	
Formats of input	ways. One way is have provide two  Enter text  Upload fi User can select o new page having enter text and the By clicking on "Topen having two computer and up."	options to user by yourself les to check plagiarism ne of these two. "Enter to two columns for plagiaris n click "Check Plagiaris Jpload files to check plag browse file buttons. User load it for checking the pla	ext By yourself" opens a sm checking. User will m" button. iarism" a new page will will select files from its agiarism.
Validations	files or enter text one option at a ti our web app. It is	at one time. It is the valid	ations of sign up for using e wants to sign up.
Format of output	containing inform This opened page words or stateme	tick the "Check Plagiarism nation about the files or the e shows the percentage of nts and the length of the national coutput will be expected?	matched words, matched
Deployment	No. Have you deployedetails	ed your project in any for	mat? If yes, provide the
Details of algorithms			

We used two algorithms one is to store the matched words and second is to convert the input into a format in which want it to passes to a function. We write the LCS(longest common substring) using memorization.

```
// pseudo code (we write it ourselves)
// pseudo code for checking the plagiarism between entered text
   1. string1,string2
   2. str1[],str2[]
   3. s1.s2
   4. while(!(length of string1))
   5. s1=string1
   6. i=0:
   7. while(s1[i]!=".")
                  i. str1[i]=s1[i]
                  ii. i++
   8. while(!(length of string2))
                  i. s2=string2
                 ii. j=1
                 iii. while(s2[i]!=".")
                             str2[j]=s[j]
                            j++
                 iv. temp=0;
                  v. if((LongestCommonSubstring(str1,str2,lengthOfString1,
                     lengthOfString2)>temp)
                             temp=LongestCommonSubstring(str1,str2,lengthOfString1,
                             lengthOfString2)
```

9. // file2 whole text being comapre with file1 line by line and the line which has the longest common substring with file1 line of file2 it will be stored in resultArray[]

```
10. resultArray[]=str2;
11. // empty str1[] str2[]
12.
```

**Description:** it will take two strings from the user and check plagiarism between them. While. loop will iterates until the length of string1. While loop of line 7 takes one statement of string1(statement ends at '.'). while loop at line 8 also tale the one statement of string 2 and then memorized LCS call on it and store the length in temp. in net iteration of while loop of line 8 it will take line 2 of string 2 and compare it with line1 of string1 and if the number of matched words between these lines is greater than the previous value of temp then replace them and check until string 2 ended and store the longest matched string in the resultArray, and so on

// this is the pseudo code for plagiarism checking tool, it will take 2 files

```
// this is the pseudo code for plagiarism checking tool, it will take 2 files
   13. file1,file2
   14. str1[],str2[]
   15. s1,s2
   16. while(!(end of file1))
   17. file1<<s1
   18. i=0:
   19. while(s1[i]!=".")
                   i. file1<<str1[i];
                  ii. i++
   20. while(!(end of file2))
                   i. file2>>s2;
                  ii. i=1
                  iii. while(s2[j]!=".")
                              file2<<str2[i]
                              j++
                  iv. temp=0;
                  v. if((LongestCommonSubstring(str1,str2,lengthOfString1,
                      lengthOfString2)>temp)
                              temp=LongestCommonSubstring(str1,str2,lengthOfString1,
                              lengthOfString2)
   21. // file2 whole text being comapre with file1 line by line and the line which has the longest
       common substring with file1 line of file2 it will be stored in resultArray[]
    19.
                              resultArray[]=str2;
   20.
                        // empty str1[] str2[]
```

#### **Description:**

It will take two files as file1 and file2. While. loop will iterates until the end of file1. In line 4 we are reading the data from file and placing it in str1. In line 6 while loop terminates when it finds the .(end of statement). Line 7 while loop also doing the same, fetching one line and placing it in the str2. This way we get one statement of file1 and one statement of file2 we are then calling memorized LCS on these two statements and storing the length in temp. in next iteration it will read statement2 of file2 and call memorized LCS on it and if temp previous value is smaller than this time then store this value in the temp otherwise again takes next statement and start comparing it with the first statement of file1. We are trying to compare one line of file1 with whole file2 and the line whose matching length is highest we are considering it as plagiarized statement and storing it in the resultArray.

### // this is the pseudo code for plagiarism checking tool, it will take 2 or more than 2 files

- 1. str1[],str2[]
- 2. ArrayOfFile[] //it is dynamic array which contains the address of the files selected by user //e.g at 0 index file1 address is placed, at 1 file1 address lies and so on.
- 3. for t=0 to ArrayOfFile.length

```
4.
      while(!(end of ArrayOfFile[t]))
5.
               ArrayOfFile[t]<<s1
               i=0;
6.
7.
      while(s1[i]!=".")
8.
               ArrayOfFile[t]<<str1[i];
9.
               i++
10.
       while(!(end of ArrayOfFile[t]))
            ArrayOfFile[t+1]>>str2[0];
11.
12.
           i=1
13.
               while(s2[i]!=".")
14.
                    ArrayOfFile[t+1]<<str2[i]
15.
                     j++
16.
                temp=0;
               if((LongestCommonSubstring(str1,str2,lengthOfString1, lengthOfString2)>temp)
17.
18.
                    temp=LongestCommonSubstring(str1,str2,lengthOfString1, lengthOfString2)
19.
                // ArrayOfFile[t+1] whole text being comapre with ArrayOfFile[t] line by line and
   the line which has the longest common substring with ArrayOfFile[t] line of ArrayOfFile[t+1]
   it will be stored in resultArray[]
20.
               resultArray[]=str2;
                    // empty str1[] str2[]
21.
```

## **Description:**

It will take two or more than two files. Array of file is the file containing the pointers. Each pointee pointing towards a file. For example, ArrayOfFile[0] holding the address of file1 and so on. For the first iteration it will take file1 and file2 and perform the following processing.

While. loop will iterates until the end of file1. In line 4 we are reading the data from file and placing it in str1. In line 6 while loop terminates when it finds the .(end of statement). Line 7 while loop also doing the same, fetching one line and placing it in the str2. This way we get one statement of file1 and one statement of file2 we are then calling memorized LCS on these two statements and storing the length in temp. in next iteration it will read statement2 of file2 and call memorized LCS on it and if temp previous value is smaller than this time then store this value in the temp otherwise again takes next statement and start comparing it with the first statement of file1. We are trying to compare one line of file1 with whole file2 and the line whose matching length is highest we are considering it as plagiarized statement and storing it in the resultArray. One file1 reaches to its end the most outer while loop terminates and then for loop increments and the same procedure continues again for the file2 and file3.

# **Complexity Analysis:**

```
ArrayOfFile[t]<<str1[i]; -----(n/li)
8.
                            -----(n/li)
9.
           i++
                            -----(n+1)
       while(!(end of file2))
10.
           ArrayOfFile[t+1]>>str2[0]; -----(n)
11.
                              -----(n)
12.
13.
           while(str2[j]!=0)
  (n/li+1)
14.
                ArrayOfFile[t+1]<<str2[i] -----(n/li)
15.
                j++
  (n/li)
16.
           temp=0;
           if((LongestCommonSubstring(str1,str2,lengthOfString1,
17.
  lengthOfString2)>temp)
18.
                temp=LongestCommonSubstring(str1,str2,lengthOfString1,
  lengthOfString2)
                      -----(n)
19.
                     resultArray[]=str2;
```

Here loop in the line 3 iterates equal to length of the number of files user enter. Like if user enter 3 it will executes 3 times. Loop in the lines number 4 iterates n+1 times.

li is equal to the number of lines or number of statements the file has.

Now,

Running time is =1+1+ 
$$(n+1) + n + n + (n+1)*n/li + n/li + n/li + (n+1)*(n+1) + n + (n+1)*n/li + n/li + n/$$

LCS is taking O(n) time proved later in this file.

Put it into the equation we are solving for finding the running time of algorithm.

$$\begin{aligned} \text{Running time is} &= 1 + 1 + (n + 1) + n + n + (n + 1)^*n/\text{li} + n/\text{li} + n/\text{li} + (n + 1)^*(n + 1) + n + (n + 1)^*n/\text{li} + n/\text{li} + n/\text{li} + n/\text{li} + n/\text{li} + (n + 1)^*(n + 1) + n + (n + 1)^*n/\text{li} + n/\text{li} + n/\text{li} + n/\text{li} + (n + 1)^*(n + 1) + n + (n + 1)^*n/\text{li} + n/\text{li} +$$

# //pseudo code for memorized LCS

1. constant MAX\_SIZE=10000

2. resultArray[MAX\_SIZE] //make it dynamic in our code 3. memoizedArray[MAX SIZE][MAX SIZE] 4. //Longest Common Substrings 5. **function** LongestCommonSubString(string string1[],string string2[], lengthOfString1, lengthOfString2) if(lengthOfString1==0 OR lengthOfString2==0) 6. 7. return 0 8. //if the data is already in the table then return it instead of recomputing it if(memoizedArray[m-1][n-1]!=-1) 9. //for this place -1 in the whole 2d array 10. return memoizedArray[m-1][n-1] 11. //case 1: if matches 12. if(string1[m-1]==string2[n-1])13. return 1+LongestCommonSubstring(string1, string2, lengthOfString1-1, lengthOfString2-1) 14. //if do not match 15. else return max(LongestCommonSubstring(string1,string2, lengthOfString1-1, 16. lengthOfString2),LongestCommonSubsequence(string1, string2, lengthOfString1, lengthOfString2-1)) **Description:** This algorithm takes two strings and their length. It has 3 cases. If string1's or string2's length is equal to zero then there is no need to check for plagiarism simply return 0. We filles the memoized Array with -1 and if the memorized Array at that particular index !=-1 then it will definately has some value and it will simply return it.

Otherwise case2 comes in which start matching from the end if last character matches than again call the same function for second last charcter +1. We are adding because last character matches. And if none of above conditions are true the else case will run which will call itself for length(str1-1) and then with length(str2-1). And return the max of these 2 return values. This is recursive function with memorization. Following is the complexity analysis of this algorithm.

## **Complexity Analysis:**

constant MAX_SIZE=10000	(1)
resultArray[MAX_SIZE]	(1)
memoizedArray[MAX_SIZE][MAX_SIZE]	(1)
function LongestCommonSubString(string string1	[],string string2[], lengthOfString1, lengthOfString2)

```
if(lengthOfString1==0 OR lengthOfString2==0)
             return 0
      //if the data is already in the table then return it instead of recomputing it
      if(memoizedArray[m-1][n-1]!=-1)
                                                         -----(1)
             return memoizedArray[m-1][n-1]
      //case 1: if matches
      if(string1[m-1]==string2[n-1])
                      return 1+LongestCommonSubstring(string1, string2, lengthOfString1-1,
   lengthOfString2-1)
                                                 (i)
      //if do not match
      else
                           return max(LongestCommonSubstring(string1,string2, lengthOfString1-1,
   lengthOfString2),
                                              (ii)
   LongestCommonSubsequence(string1, string2, lengthOfString1, lengthOfString2-1))
Recurrence equation for equation (i) is:
 T(n) = \langle T(n1-1, n2-1) + 1 \rangle
        1,n2-2) + 1 when matches ......max(T(n1-1,n2),T(n1,n2-1)+1 when do not matches.
T(n1-1,n2-1)+1
T(n1-2,n2-2)+2
T(n1-3,n2-3)+3
T(n1-k,n2-k)+k
Assume, n_1-k=0 => n_1=k \text{ similarly, } n_2-k=0 => n_2=k
As k=n1 as well as k=n2 so let k=n
```

So,  $T(n1-n1,n2-n2)+n \rightarrow T(0)+n \rightarrow$  we know T(0)=0 which is base case so is it n. Do same for other recursive equation.

T(n1-1,n2)+1	T(n1,n2-1)+1	
$\downarrow\downarrow$	$\downarrow$	
T(n1-2,n2)+2	T(n1,n2-2)+2	
$\downarrow\downarrow$	$\downarrow$	
T(n1-3,n2)+3	T(n1,n2-3)+3	
↓	$\downarrow$	
<b>:</b>	:	
<b>:</b>	:	
<b>:</b>	:	
↓	$\downarrow$	
T(n1-k,n2)+k	T(n1,n2-k)+k	
Assume, $n1-k=0 \Rightarrow n1=k$	Assume, $n2-k=0 =>$	n2=k
As k=n1 as well as k=n2 so let k=n	As k=n1 as well as	k=n2 so
So, $T(n1-n1,n2)+n \rightarrow T(0,n2) + n \rightarrow we$	So, $T(n1,n2-n2)+n$	<b>→</b> T(0
know $T(0) = 0$ which is base case so is it n.	know $T(0) = 0$ which	h is base

So 
$$1+1+1+1+1+n+n \rightarrow 5+2n \rightarrow O(n)$$

# **Correctness of algorithm:**

Correctness of algorithm can be shown suing contradiction and inductive hypothesis. But we will show that our algorithm is correct using loop invariant. For this we will claim that before and after each iteration of loop it(result array) has the longest common matched substring.

# **Initialization:**

Before the first iteration, lcs was not called and temp =0 which means number of matched words is 0. Which is the correct answer.

## **Maintenance:**

Line one of file1 will be selected and lcs was called on line 1 of file1 with each line of file 2 one by one. Simply, line1 of file matches with line1 of file 2 then matched words length stored in temp. again line 1 of file 1 matches with line 2 of file2 and match words length store in temp if it is greater than previous value of temp. this procedure continuouse until the file2 ends. Hence the line of file2 which matches with greatest matched words with line 1 of file1 then stored in resultArray. Here loop invariant maintains because after the forst iteration result array has the longest common words from both files.

# **Termination:**

As we explained in maintenance how our algo works for one line of file 1. It will do the same for each and every line of file1. In the end result array wil have all the longest common substrings or words.

Lets suppose two files.

File1:	File2:
Lorem ipsum is simply dummy text. There a	are Lorem ipsum is not simply random text. Here
many variations of passages available.	are some variations of pages available.

In the beginning temp=0 because no files text gets compare with other. And this is correct result. Then our algorithm will take line of file which is "lorem ipsum is simply dummy text" and take line no 1 of file 2 which is "lorem ipsum is not simply random text" and then apply lcs on both of these. It returns 5 as 5 strings are common and store this value in temp. in the next iteration it took second line of file2 which is 'here are some variations of pages available" and apply lcn on them. It returns 0 as no string is common. And this inner loop terminates and result array has "lorem ipsum is simply text". After first iteration outer loop takes line 2 of file and coampre it with whole file2 and store 5 in temp and finally the outer loop also terminates as file2 ended.

In the result array has "lorem ipsum is simply text are variations of passages available". And length =10.

So our algorithm is correct.

#### //Bonus Task Cpp Plagiarism Checking (python code)

```
function CPPdataReadingAndLCS(file1, file2)
  global resultArray
  global f1, f2
  global res
  char arr1 []
  char_arr2 []
  string1 []
  string2 []
  f1 = file1.read()
  f2 = file2.read()
  11 = length(f1)
  12 = length(f2)
  for i in range(0, 11):
     temp=0
     if f1[i] != ';':
       char_arr1.append(f1[i])
     else:
       string1 = ''''
```

```
for x in char_arr1:
          string1 += x
       for f in range(0, len(char_arr1)):
         if (char_arr1[f] == ' '):
           char_arr1[f] = '\0'
       for j in range(0, 12):
          if f2[j] != ';':
            char_arr2.append(f2[j])
          else:
            string2 = ''''
            for y in char_arr2:
               string2 += y
            #temp = 0
            #for f in range(0, len(char_arr1)):
             # if (char_arr1[f] == ' '):
                  char\_arr1[f] = ' \setminus 0'
            for f in range(0, len(char_arr2)):
               if (char_arr2[f] == ' '):
                 char_arr2[f] = '\0'
            s=LongestommonSubstring(char_arr1,char_arr2,len(char_arr1),len(char_arr2))
            if(s>temp):
               temp = s
               char_arr2 = []
               char_arr1 = []
       resultArray = string2
       #print(string2, end=" ")
       res += temp
main Function:
memoizedArray = [[-1 for i in range(MAX_SIZE)]
   for i in range(length(file1))]
CPPdataReadingAndLCS(file1, file2)
print("matched words are: ")
print(resultArray)
numerator=0
if(p1<p2):
  numerator=p2
elif(p1==p2):
  numerator=p1
else:
  numerator=p1
print(res)
percent=(res/numerator)*100
if(percent>30):
  print("these are plagiarised files")
```

#### else:

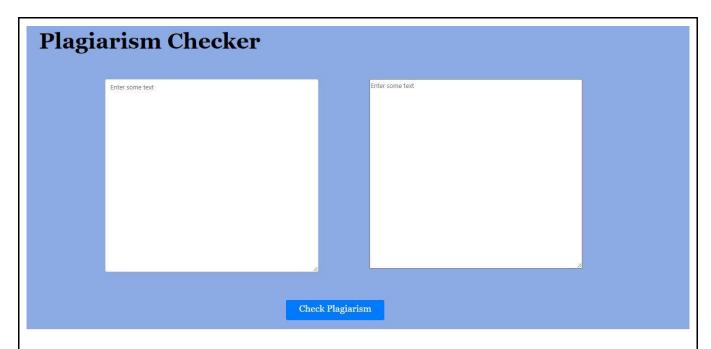
print("this is not plagiarised text")
print(percent)

## **Description:**

This is the code for plagiarism checking between cpp files. It will take two cpp files. We are using ";" as end of one statement. It takes one statement of file1 and one statement of file2 and apply memorized LCS on them. Then it will take second statement of file2 and apply memorized LCS on it. Basically it comparing one statement of file1 and with whole file2 and storing the line which has maximum matched words. Then in main file we are setting numerator equals to the length of file having maximum length and diving the match words length by numerator and multiplying the result with 100 for calculating the percentage. As keywords of the language are same in all files and mostly programmers use I,j,k,x,yz as loop variables so we are setting a margin of 30% to 20% as not plagiarized text.

# Interfaces for your project

# Plagiarism Checker Between text stored in Files Between text enter by user in text area This is the front page of our web application user have two options. User will select one of them. Id user selects "Between text enter by user in text area" the following Page will opens:



Here user will enter its text and click the check plagiarism button which will open the following page showing the information including matched words, length of matched words and percentage of plagiarized text.

Result page

But if user select the option of "between text stored in files". The following page will open.



User will upload files and click on the "check plagiarism button". When click on the button a new page will open showing the information including matched words, length of matched words and percentage

of plagiarized text.

We also integrate our website with database for login and sign up functions. But it is not mandatory for the user to sign up before using the website.

Following is the interface of sign up page which is connect to a database.

Plagiarism Che	cker
First Name:	Sign Up Form
First Name	
Last Name:	
LastName	
Username:	
username	
Email address	
Enter email	
We'll never share y  Password	our email with anyone else.
Password	
Confirm Passw	ord
Confirm Pass	word
	Submit

We are using postgresql and pgAdmin for using the GUI database interface. We migrate the data to a database that we get from this page. User data is store in the database by the next time he/she will only use login button and login into the application. We set some validations like no two user can have the same username, no two user can have the same email. For login user will click on the login button shown in the first page of website.

We added one more functionality. If the username that is user trying to enter during sign up process is already present in the database then it will generate an error message "user name already present." in the red color. Similarly for email it will show tha error message "email already exists" if entered eail present in the database.

Plagiarism	Checker
	Login
	Username:
	username
	Password
	Password
	Submit

User will enter the username and password when click on the submit button this information is compare with the stored data in database if it matches user can successfully login. We also added the logout functionality in the application but due to an error logout page is not opening so we do not add it in our report.

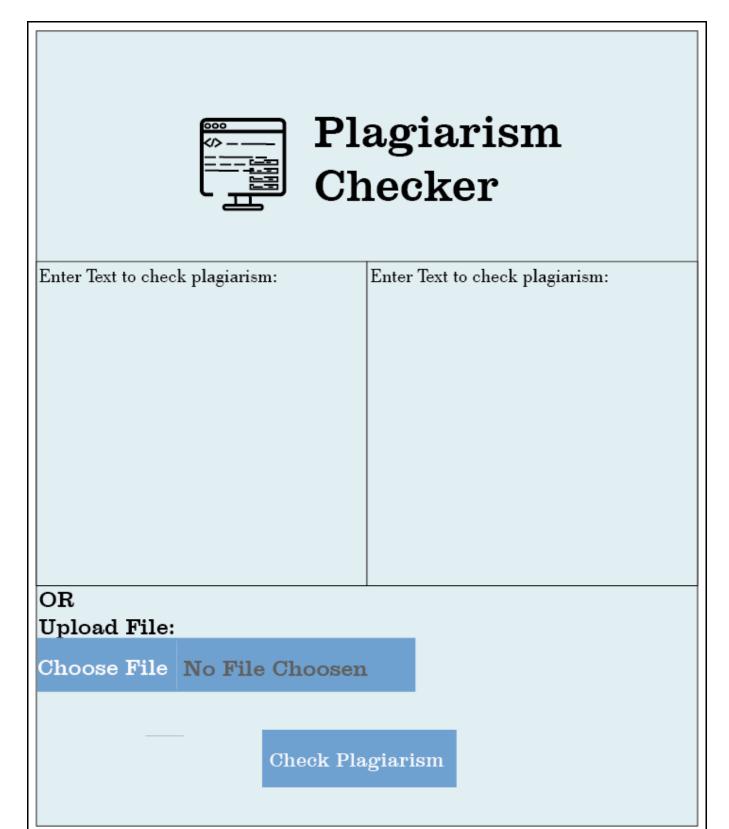
#### Integration

We faced too many problems when we are integrating our implemented python code with our UI. Since we are using django for this purpose. We have not used it or learned it before. We took some help from the google and watch many tutorials first and then start integrating it. Creating UI is not a headache we designed our pages in a very short time but integration part took a lot of time. We faced many errors and all of them are new to us but we try our best to solve them, but still we have an error of "MultiValueDictKeyError". We try to resolve it but unfortunately we are not succeeded. Due to this single error we are not able to check the proper functionality of our sign up and sign in pages as well as for sign out, but we are hoping that it works well when this error resolve.

During the implementation of algorithm as we write it ourselves we also face some logical errors and we resolved many of them. Due to the some other workloads and working from home in this pandemic it is also difficult for us to share our ideas clearly. But we put our best in this project.

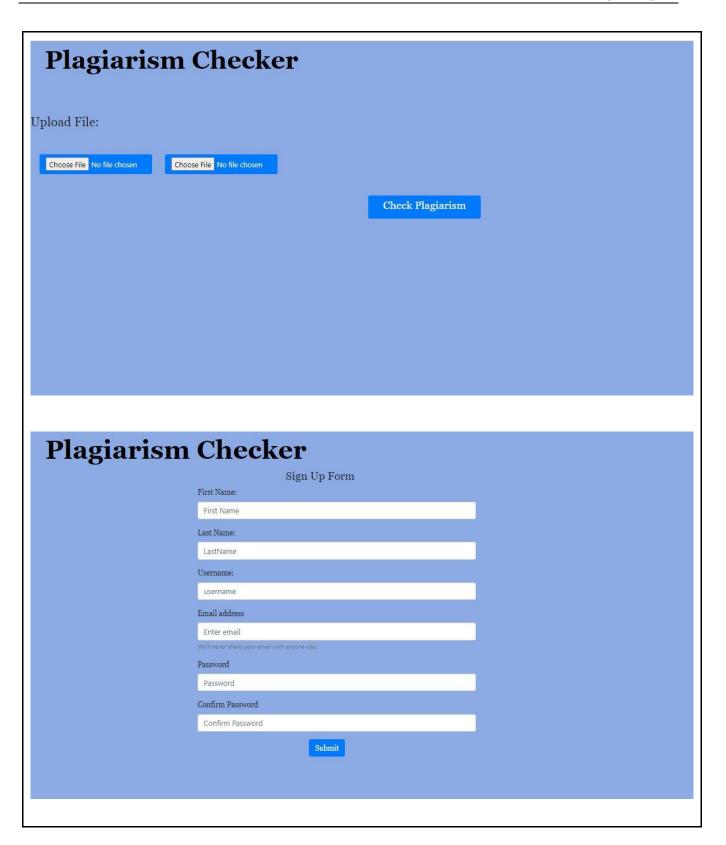
## Change Requests

Yes, we made some changes in the UI. We proposed the following interface in the deadlines.



In this UI design we were decided to add both options in a single page and we did not decided to add login, sign up and logout functionality but later due to the date extension of submitting the project we

decided to add it. Above UI is our proposed UI and we submitted it in the deadlines but now we changed it and make separate pages for both option(file upload, enter text). We change it and convert it into the following designs. **Plagiarism Checker** Sign Up Login Between text stored in Files Between text enter by user in text area **Plagiarism Checker** Enter some text Check Plagiarism



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