Experiments:

I conducted experiments on the D184MB files.

1. Generating the indexes, adding files and generating the CSP database screenshot:

```
[!] Enter a password: password
[+] Keys generated.
[?] Is this the first time running the script? (y/n) y
[*] Enter folder name: D184MB
[*] Generating the indexes and adding files.
[*] Ellapsed time: 411.8613591194153 seconds
[+] Indexes outsourced to the TA.
[*] Generating CSP database.
[*] Ellapsed time: 76.37310004234314 seconds
[+] Data outsourced to the CSP.

[H] Enter s to search, d to delete or m to modify.
[SID]@shell:~$
```

Generating the indexes, adding files: 412 seconds = 6 Minutes and 51 Seconds
Generating the CSP database: 76 seconds = 1 Minute 16 Seconds

2. Search for word:

```
[H] Enter s to search, d to delete or m to modify.
[SID]@shell:~$ s
Enter a word to search: Palestine
[+] Word found in 153.txt. File downloaded and decrypted.
[+] Word found in 333.txt. File downloaded and decrypted.
[+] Word found in 392.txt. File downloaded and decrypted.
[+] Word found in 392.txt. File downloaded and decrypted.
[+] Word found in 14.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 44.txt. File downloaded and decrypted.
[+] Word found in 25.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 26.txt. File downloaded and decrypted.
[+] Word found in 122.txt. File downloaded and decrypted.
[+] Word found in 30.txt. File downloaded and decrypted.
[+] Word found in 110.txt. File downloaded and decrypted.
[+] Word found in 110.txt. File downloaded and decrypted.
[+] Word found in 258.txt. File downloaded and decrypted.
[+] Word found in 458.txt. File downloaded and decrypted.
[+] Word found in 130.txt. File downloaded and decrypted.
[+] Word found in 180.txt. File downloaded and decrypted.
[+] Word found in 48.txt. File downloaded and decrypted.
[+] Word found in 351.txt. File downloaded and decrypted.
[+] Word found in 204.txt. File downloaded and decrypted.
[+] Word found in 38.txt. File downloaded and decrypted.
[+] Word found in 368.txt. File downloaded and decrypted.
[+] Word found in 144.txt. File downloaded and decrypted.
[+] Word found in 10.txt. File downloaded and decrypted.
[+] Word found in 87.txt. File downloaded and decrypted.
[*] Ellapsed time: 8.386962413787842 seconds
[SID]@shell:~$
```

Search time for word "Palestine": 8 seconds

```
[SID]@shell:~$ s
Enter a word to search: whirlwinds
[+] Word found in 444.txt. File downloaded and decrypted.
[+] Word found in 392.txt. File downloaded and decrypted.
[+] Word found in 55.txt. File downloaded and decrypted.
[+] Word found in 26.txt. File downloaded and decrypted.
[+] Word found in 26.txt. File downloaded and decrypted.
[+] Word found in 19.txt. File downloaded and decrypted.
[+] Word found in 30.txt. File downloaded and decrypted.
[+] Word found in 409.txt. File downloaded and decrypted.
[+] Word found in 17.txt. File downloaded and decrypted.
[+] Word found in 17.txt. File downloaded and decrypted.
[+] Word found in 17.txt. File downloaded and decrypted.
[+] Word found in 164.txt. File downloaded and decrypted.
[+] Word found in 228.txt. File downloaded and decrypted.
[+] Word found in 22.txt. File downloaded and decrypted.
[+] Word found in 20.txt. File downloaded and decrypted.
[+] Word found in 10.txt. File downloaded and decrypted.
[*] Ellapsed time: 2.5951650142669678 seconds
```

Search time for word "Palestine": 2.5 seconds

```
[SID]@shell:~$ s
Enter a word to search: Conqueror
[+] Word found in 377.txt. File downloaded and decrypted.
[+] Word found in 206.txt. File downloaded and decrypted.
[+] Word found in 307.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 82.txt. File downloaded and decrypted.
[+] Word found in 174.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 11.txt. File downloaded and decrypted.
[+] Word found in 11.txt. File downloaded and decrypted.
[+] Word found in 26.txt. File downloaded and decrypted.
[+] Word found in 26.txt. File downloaded and decrypted.
[+] Word found in 26.txt. File downloaded and decrypted.
[+] Word found in 122.txt. File downloaded and decrypted.
[+] Word found in 110.txt. File downloaded and decrypted.
[+] Word found in 110.txt. File downloaded and decrypted.
[+] Word found in 110.txt. File downloaded and decrypted.
[+] Word found in 458.txt. File downloaded and decrypted.
[+] Word found in 476.txt. File downloaded and decrypted.
[+] Word found in 314.txt. File downloaded and decrypted.
[+] Word found in 408.txt. File downloaded and decrypted.
[+] Word found in 448.txt. File downloaded and decrypted.
[+] Word found in 157.txt. File downloaded and decrypted.
[+] Word found in 169.txt. File downloaded and decrypted.
[+] Word found in 378.txt. File downloaded and decrypted.
[*] Ellapsed time: 5.204015016555786 seconds
```

Search time for word "Conqueror": 5 seconds

The Search time is taken as the time it takes to generate the search token and the actual searching from the CSP database. For getting the average search time of a word I would probably need to search for every word in the words.db database. This would however take a lot of time probably and require more computational resources than my machine has. A CSP would have a large pool of resources and computational power as mentioned in the paper, however my code is designed to work on the same machine since I do not have another one.

3. Delete file:
```
Enter file to delete: 408.txt
[*] Ellapsed time: 8.329373598098755 seconds
[*] File 408.txt deleted.
[SID]@shell:~$
```
Delete time of File 408.txt (420 KiB): 8.3 seconds

```
[SID]@shell:~$ d
Enter file to delete: 30.txt
[*] Ellapsed time: 11.05744481086731 seconds
[*] File 30.txt deleted.
```
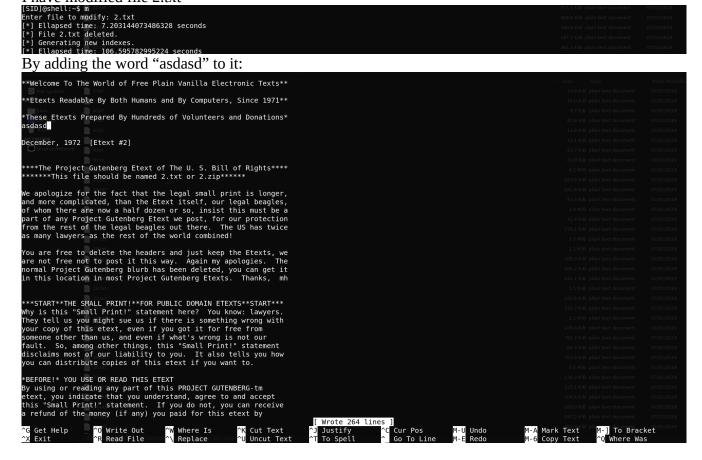Delete time of File 30.txt (5 MiB): 11 seconds

```
Enter file to delete: 25.txt
[*] Ellapsed time: 8.628788232803345 seconds
[*] File 25.txt deleted.
```
Delete time of File 25.txt (2.1 MiB): 8.6 seconds

For getting an average of the delete time I would need to delete all the files and map the delete time to the size of the file. I did not have time to do that as I was troubleshooting the code for days.

4. Modify File:
I have modified file 2.txt

```
[SID]@shell:~$ m
Enter file to modify: 2.txt
[*] Ellapsed time: 7.203144073486328 seconds
[*] File 2.txt deleted.
[*] Generating new indexes.
[*] Ellapsed time: 106.595782995224 seconds
```

By adding the word "asdasd" to it:

```
**Welcome To The World of Free Plain Vanilla Electronic Texts**

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*These Etexts Prepared By Hundreds of Volunteers and Donations*
asdasd

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```

And then searched for it:

```
[SID]@shell:~$ s
Enter a word to search: asdasd
[+] Word found in 2.txt. File downloaded and decrypted.
[*] Ellapsed time: 0.415926456451416 seconds
```

And it found the added word in 2.txt where I added it.

Bugs & other:
The program unfortunately has bugs that I did not manage to solve on time.
First, as seen from the Search for word section screenshots, the Search algorithm finds some words in the same file multiple times and then downloads and decrypts them multiple times. The issue is possibly related to how the data is added in the CSP database however after troubleshooting for days I still could not find the reason. This can also be the reason for another bug where it sometimes finds a word in a deleted file. For example:
I deleted files: 25.txt (contains the words: February, PROJECT) and 30.txt (contains the words: PROJECT, Exodus)
[SID]@shell:~$ d
Enter file to delete: 30.txt
[*] Ellapsed time: 11.05744481086731 seconds
[*] File 30.txt deleted.
[SID]@shell:~$ d
Enter file to delete: 25.txt
[*] Ellapsed time: 8.628788232803345 seconds
[*] File 25.txt deleted.

Then I searched for the words: February, PROJECT, Exodus:
[SID]@shell:~$ s
Enter a word to search: February
[+] Word found in 101.txt. File downloaded and decrypted.
[+] Word found in 101.txt. File downloaded and decrypted.
[+] Word found in 233.txt. File downloaded and decrypted.
[+] Word found in 233.txt. File downloaded and decrypted.
[+] Word found in 233.txt. File downloaded and decrypted.
[+] Word found in 153.txt. File downloaded and decrypted.
[+] Word found in 223.txt. File downloaded and decrypted.
[+] Word found in 244.txt. File downloaded and decrypted.
[*] Ellapsed time: 1.4182817935943604 seconds
As expected it did not find the word in 25.txt

[SID]@shell:~$ s
Enter a word to search: PROJECT
[+] Word found in 345.txt. File downloaded and decrypted.
[+] Word found in 101.txt. File downloaded and decrypted.
[+] Word found in 422.txt. File downloaded and decrypted.
[+] Word found in 255.txt. File downloaded and decrypted.
[+] Word found in 334.txt. File downloaded and decrypted.
[+] Word found in 233.txt. File downloaded and decrypted.
[+] Word found in 490.txt. File downloaded and decrypted.
[+] Word found in 73.txt. File downloaded and decrypted.
[*] Ellapsed time: 1.5648002624511719 seconds
Again, as expected it did not find the word in 25.txt nor in 30.txt

[SID]@shell:~$ s
Enter a word to search: Exodus
[+] Word found in 371.txt. File downloaded and decrypted.
[+] Word found in 417.txt. File downloaded and decrypted.
[+] Word found in 398.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
[+] Word found in 200.txt. File downloaded and decrypted.
cp: cannot stat 'CSP/30.txt_encrypted': No such file or directory
Traceback (most recent call last):
  File "SID.py", line 597, in <module>

  File "SID.py", line 562, in main
    t0 = time.time()
  File "SID.py", line 347, in SID_Search
    data = ''
FileNotFoundError: [Errno 2] No such file or directory: '30.txt_encrypted'
And now it found the word in 30.txt which it could not download so it gave an error

I do not know where the issue comes from, and I have been trying to fix these bugs for some time now. Moreover, as I tried to fix them up until the last day so I did not manage to do more experiments for the search and delete algorithms.