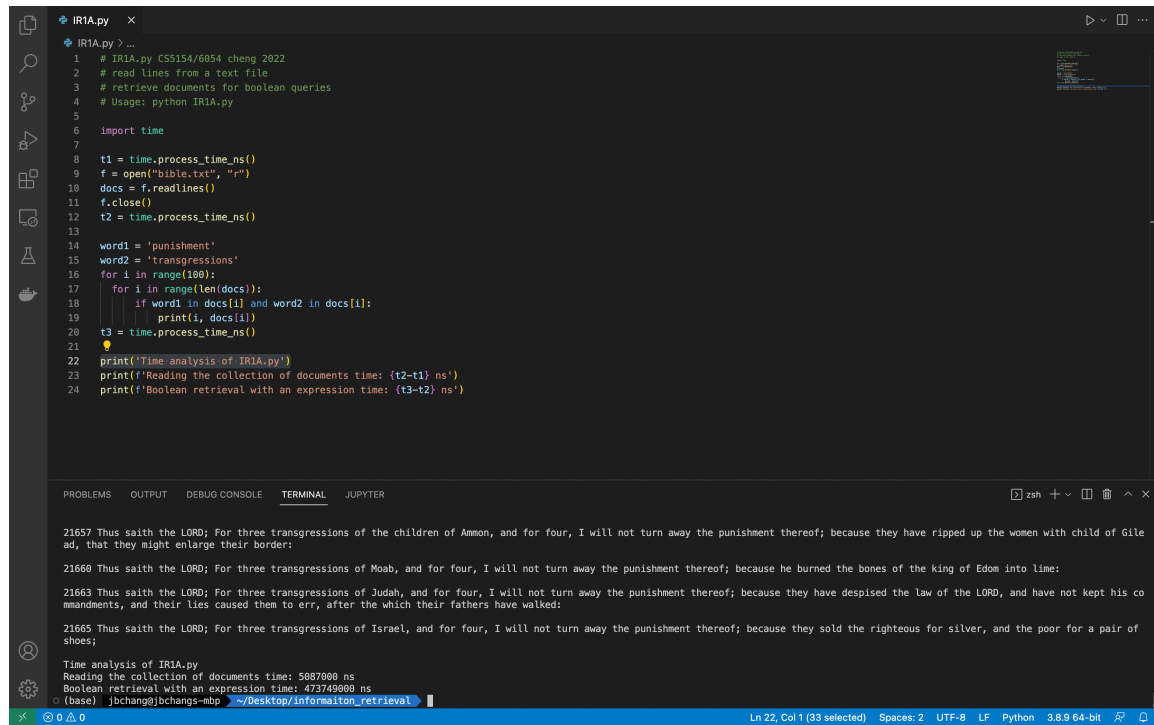


The Following image is the screenshot of the IR1A.py and the result.



```
1 # IR1A.py CS5154/6854 cheng 2022
2 # read lines from a text file
3 # retrieve documents for boolean queries
4 # Usage: python IR1A.py
5
6 import time
7
8 t1 = time.process_time_ns()
9 f = open("bible.txt", "r")
10 docs = f.readlines()
11 f.close()
12 t2 = time.process_time_ns()
13
14 word1 = 'punishment'
15 word2 = 'transgressions'
16 for i in range(100):
17     for j in range(len(docs)):
18         if word1 in docs[j] and word2 in docs[j]:
19             print(i, docs[j])
20 t3 = time.process_time_ns()
21
22 print('Time analysis of IR1A.py')
23 print('Reading the collection of documents time: {t2-t1} ns')
24 print('Boolean retrieval with an expression time: {t3-t2} ns')
```

21657 Thus saith the LORD; For three transgressions of the children of Ammon, and for four, I will not turn away the punishment thereof; because they have ripped up the women with child of Gilead, that they might enlarge their border:

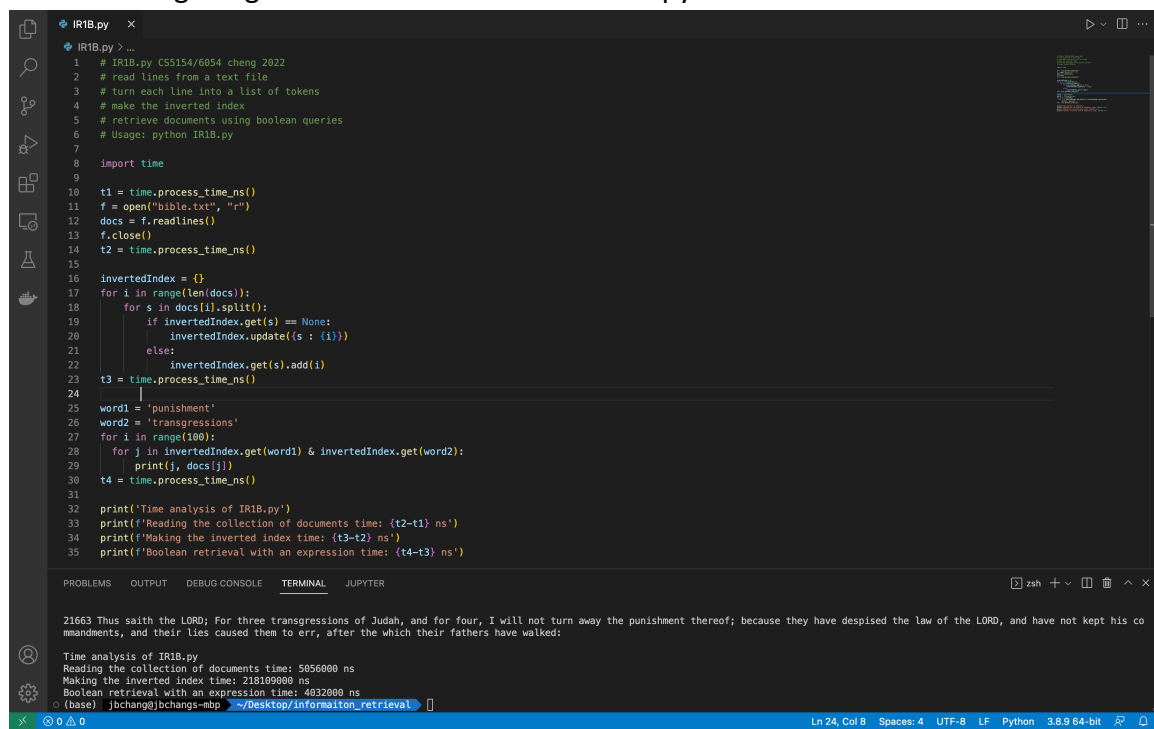
21660 Thus saith the LORD; For three transgressions of Moab, and for four, I will not turn away the punishment thereof; because he burned the bones of the king of Edom into lime:

21663 Thus saith the LORD; For three transgressions of Judah, and for four, I will not turn away the punishment thereof; because they have despised the law of the LORD, and have not kept his commandments, and their lies caused them to err, after the which their fathers have walked:

21665 Thus saith the LORD; For three transgressions of Israel, and for four, I will not turn away the punishment thereof; because they sold the righteous for silver, and the poor for a pair of shoes;

Time analysis of IR1A.py
Reading the collection of documents time: 5087000 ns
Boolean retrieval with an expression time: 473749000 ns
(base) jchang@jchang-mbp ~/Desktop/informaiton_retrieval

The Following image is the screenshot of the IR1B.py and the result.



```
1 # IR1B.py CS5154/6854 cheng 2022
2 # read lines from a text file
3 # turn each line into a list of tokens
4 # make the inverted index
5 # retrieve documents using boolean queries
6 # Usage: python IR1B.py
7
8 import time
9
10 t1 = time.process_time_ns()
11 f = open("bible.txt", "r")
12 docs = f.readlines()
13 f.close()
14 t2 = time.process_time_ns()
15
16 invertedIndex = {}
17 for i in range(len(docs)):
18     for s in docs[i].split():
19         if invertedIndex.get(s) == None:
20             invertedIndex.update({s: {i}})
21         else:
22             invertedIndex.get(s).add(i)
23 t3 = time.process_time_ns()
24
25 word1 = 'punishment'
26 word2 = 'transgressions'
27 for i in range(100):
28     for j in invertedIndex.get(word1) & invertedIndex.get(word2):
29         print(j, docs[j])
30 t4 = time.process_time_ns()
31
32 print('Time analysis of IR1B.py')
33 print('Reading the collection of documents time: {t2-t1} ns')
34 print('Making the inverted index time: {t3-t2} ns')
35 print('Boolean retrieval with an expression time: {t4-t3} ns')
```

21663 Thus saith the LORD; For three transgressions of Judah, and for four, I will not turn away the punishment thereof; because they have despised the law of the LORD, and have not kept his commandments, and their lies caused them to err, after the which their fathers have walked:

Time analysis of IR1B.py
Reading the collection of documents time: 5056000 ns
Making the inverted index time: 218109000 ns
Boolean retrieval with an expression time: 4032000 ns
(base) jchang@jchang-mbp ~/Desktop/informaiton_retrieval