IR Assignment-1

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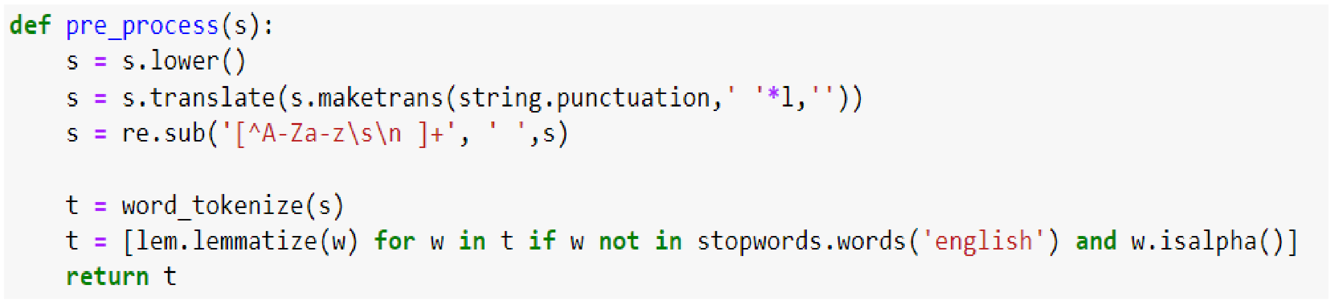
Q1)

- Firstly, import all the necessary libraries such as nltk, pandas, numpy, etc…
- Import tokenizer, stop words, stemmer and lemmatizer from the nltk library.

Pre-processing steps:

- Converted all the words to lowercase.
- Removed the punctuations and replaced it with space and also removed extra white spaces.
- Stop words are being removed.
- Word is tokenized with the help of tokenizer obtained from nltk library.
- Lemmatization is done with the help of lemmatizer obtained from the nltk library.
- Here we are mapping the document names with document numbers.

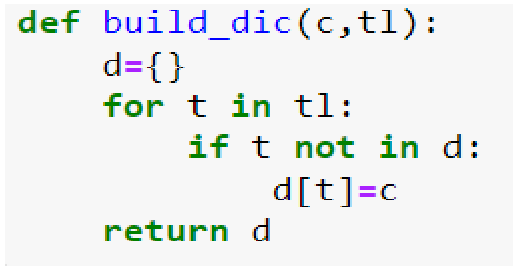


```python
def pre_process(s):
    s = s.lower()
    s = s.translate(s.maketrans(string.punctuation,' '*l,''))
    s = re.sub('[^A-Za-z\s\n ]+', ' ',s)

    t = word_tokenize(s)
    t = [lem.lemmatize(w) for w in t if w not in stopwords.words('english') and w.isalpha()]
    return t
```

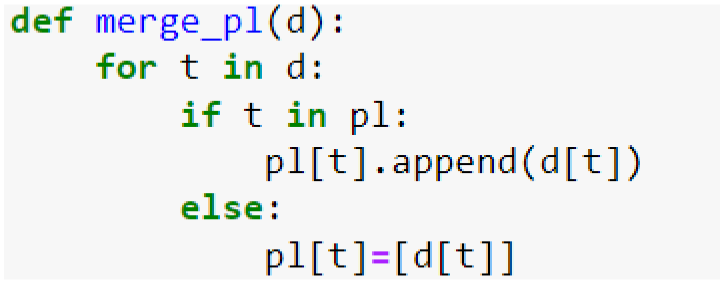
Building the Inverted index:

- First, we create a dictionary with words, we go through each word in the pre-processed words and if that word is not in the dictionary before, we add it to the dictionary.



```python
def build_dic(c,tl):
    d={}
    for t in tl:
        if t not in d:
            d[t]=c
    return d
```

➢ Then we get the posting list for each term in the dictionary by appending the document ids that the particular term is present in.

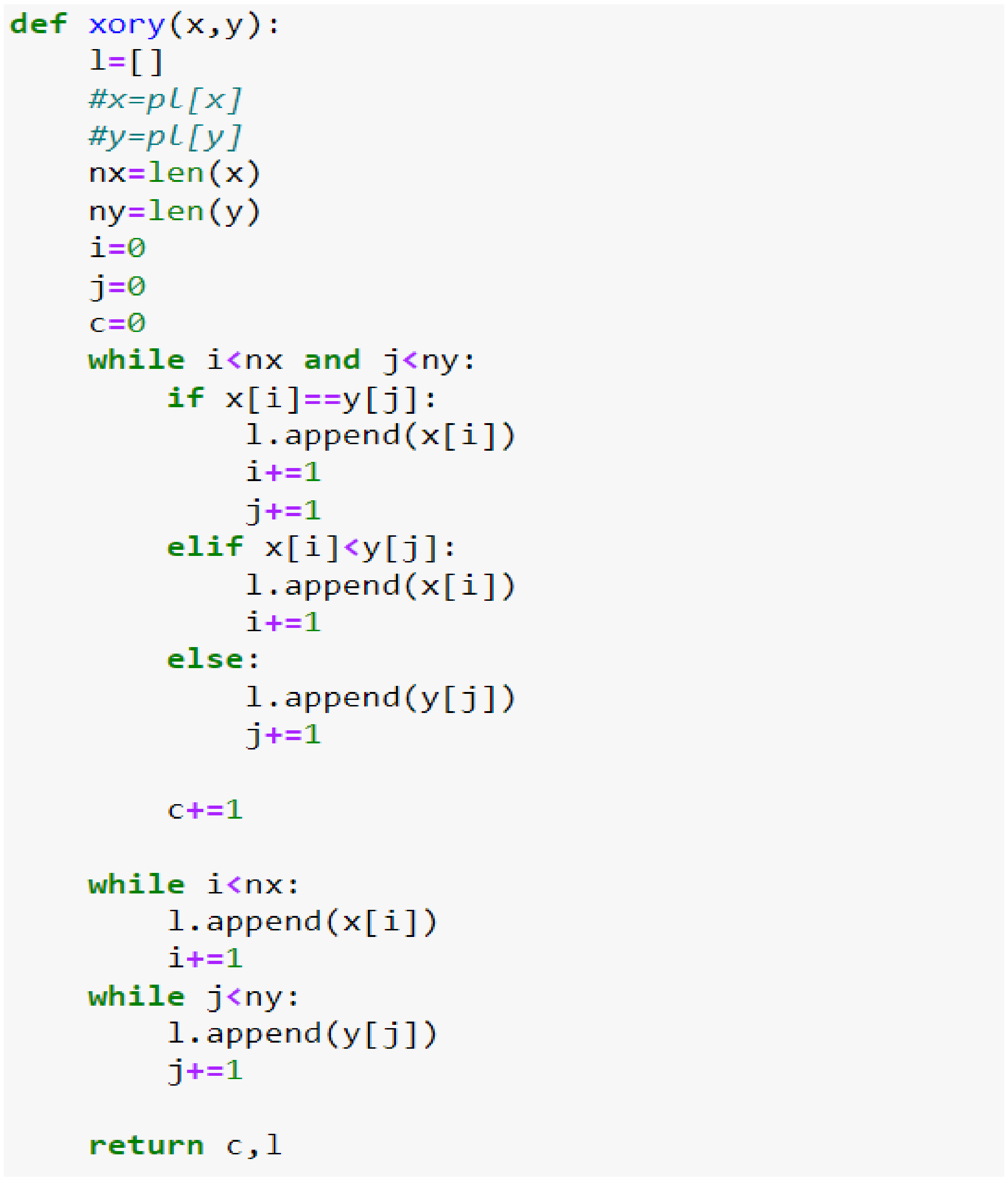


```python
def merge_pl(d):
    for t in d:
        if t in pl:
            pl[t].append(d[t])
        else:
            pl[t]=[d[t]]
```

<u>Support for the following queries:</u>

<u>i)x OR y</u>

➢ Initially we pass posting lists as parameters to the function we defined.
➢ Then we have two pointers i for x and j for y and we check if document id at those indices are equal, if equal then increment both i and j.
➢ If document id at index i is less than j, then increment i else increment j.
➢ Since this or is like union, all the leftover document ids are added at the end of the resulting list.
➢ We keep track of the number of comparisons being made and increment the counter accordingly.



```python
def xory(x,y):
    l=[]
    #x=pl[x]
    #y=pl[y]
    nx=len(x)
    ny=len(y)
    i=0
    j=0
    c=0
    while i<nx and j<ny:
        if x[i]==y[j]:
            l.append(x[i])
            i+=1
            j+=1
        elif x[i]<y[j]:
            l.append(x[i])
            i+=1
        else:
            l.append(y[j])
            j+=1

        c+=1

    while i<nx:
        l.append(x[i])
        i+=1
    while j<ny:
        l.append(y[j])
        j+=1

    return c,l
```

<u>ii)x AND y</u>

- ➢ This is similar to that of x OR y, the difference being since AND is like intersection, we don't append the remaining document ids at the end.
- ➢ Here also we keep a counter to keep track of the number of comparisons that are being made.

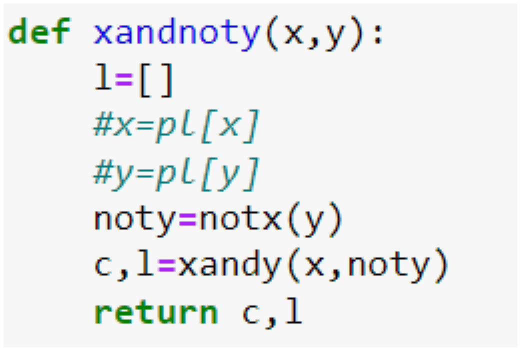
```python
def xandy(x,y):
    l=[]
    #x=pl[x]
    #y=pl[y]
    nx=len(x)
    ny=len(y)
    i=0
    j=0
    c=0
    while i<nx and j<ny:
        if x[i]==y[j]:
            l.append(x[i])
            i+=1
            j+=1
        elif x[i]<y[j]:
            i+=1
        else:
            j+=1
        c+=1
    return c,l
```

iii)<u>x AND NOT y</u>

- ➢ First, not operation is applied to y. We take every term that is not in y.

```python
def notx(x):
    l=[]
    for d in range(1,1134):
        if d not in x:
            l.append(d)
    return l
```

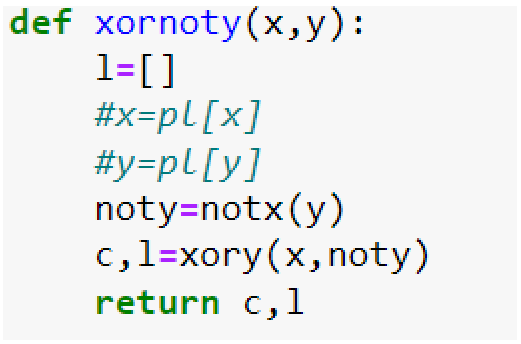
- ➢ Then we apply x AND y as usual once the above step is completed.
- ➢ We maintain a counter to keep track of number of comparisons made and then return that counter and resultant posting list.



```python
def xandnoty(x,y):
    l=[]
    #x=pl[x]
    #y=pl[y]
    noty=notx(y)
    c,l=xandy(x,noty)
    return c,l
```

iv)x OR NOT y

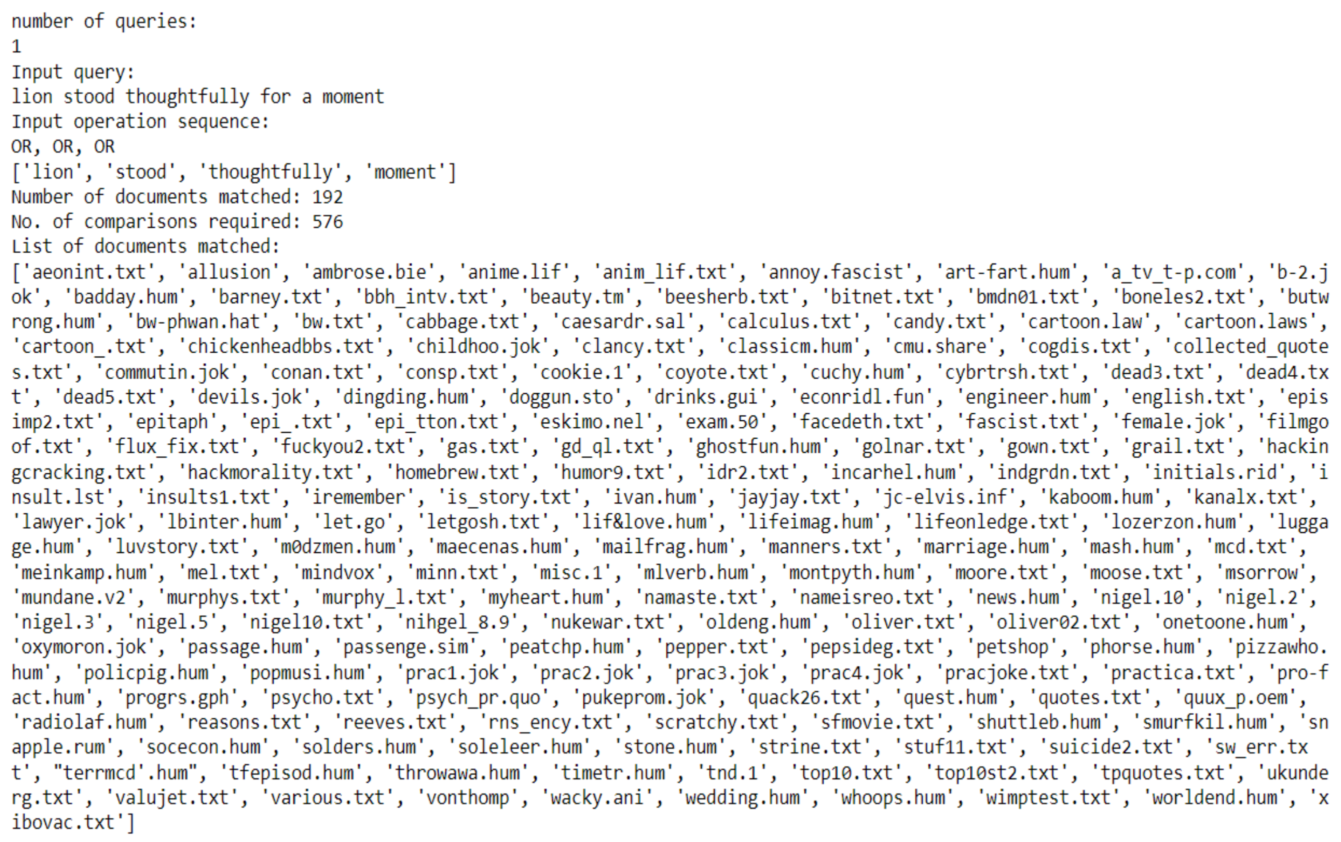
- ➢ Similar to x AND NOT y, we first get not of y and then call normally x or y.
- ➢ We return the number of comparisons made while merging along with the resultant posting list.



```python
def xornoty(x,y):
    l=[]
    #x=pl[x]
    #y=pl[y]
    noty=notx(y)
    c,l=xory(x,noty)
    return c,l
```

Sample Execution:

- ➢ We take the number of queries input from the user and then take the actual query one after another.
- ➢ After entering the query, we give the operation sequence separated by comma between each operation.
- ➢ We apply pre-processing to the inputted query, apply given sequence of operations, run the algorithm and finally print the number of documents matched, number of comparisons made and the list of the matched documents.



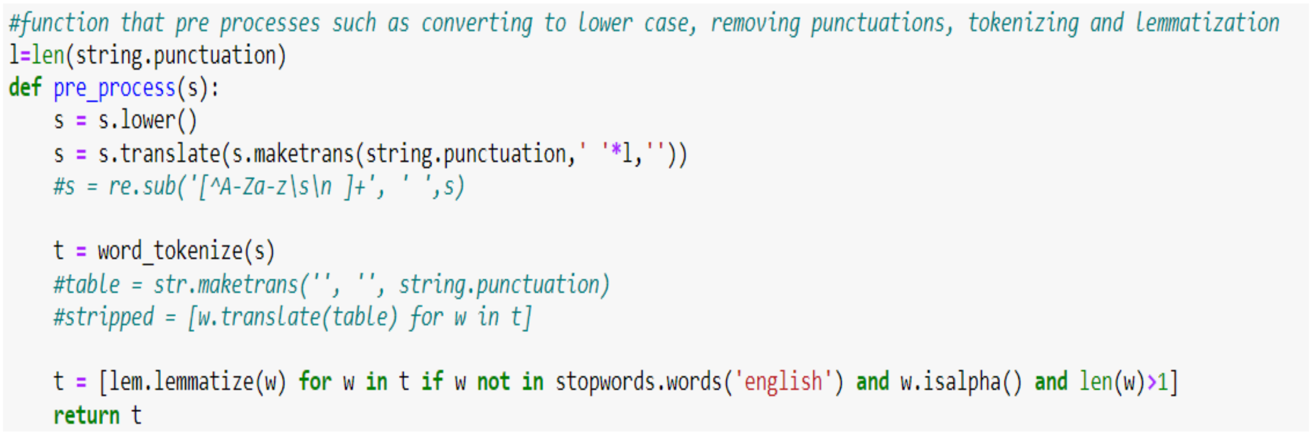
```
number of queries:
1
Input query:
lion stood thoughtfully for a moment
Input operation sequence:
OR, OR, OR
['lion', 'stood', 'thoughtfully', 'moment']
Number of documents matched: 192
No. of comparisons required: 576
List of documents matched:
['aeonint.txt', 'allusion', 'ambrose.bie', 'anime.lif', 'anim_lif.txt', 'annoy.fascist', 'art-fart.hum', 'a_tv_t-p.com', 'b-2.j
ok', 'badday.hum', 'barney.txt', 'bbh_intv.txt', 'beauty.tm', 'beesherb.txt', 'bitnet.txt', 'bmdn01.txt', 'boneles2.txt', 'butw
rong.hum', 'bw-phwan.hat', 'bw.txt', 'cabbage.txt', 'caesardr.sal', 'calculus.txt', 'candy.txt', 'cartoon.law', 'cartoon.laws',
'cartoon_.txt', 'chickenheadbbs.txt', 'childhoo.jok', 'clancy.txt', 'classicm.hum', 'cmu.share', 'cogdis.txt', 'collected_quote
s.txt', 'commutin.jok', 'conan.txt', 'consp.txt', 'cookie.1', 'coyote.txt', 'cuchy.hum', 'cybrtrsh.txt', 'dead3.txt', 'dead4.tx
t', 'dead5.txt', 'devils.jok', 'dingding.hum', 'doggun.sto', 'drinks.gui', 'econridl.fun', 'engineer.hum', 'english.txt', 'epis
imp2.txt', 'epitaph', 'epi_.txt', 'epi_tton.txt', 'eskimo.nel', 'exam.50', 'facedeth.txt', 'fascist.txt', 'female.jok', 'filmgo
of.txt', 'flux_fix.txt', 'fuckyou2.txt', 'gas.txt', 'gd_ql.txt', 'ghostfun.hum', 'golnar.txt', 'gown.txt', 'grail.txt', 'hackin
gcracking.txt', 'hackmorality.txt', 'homebrew.txt', 'humor9.txt', 'idr2.txt', 'incarhel.hum', 'indgrdn.txt', 'initials.rid', 'i
nsult.lst', 'insults1.txt', 'iremember', 'is_story.txt', 'ivan.hum', 'jayjay.txt', 'jc-elvis.inf', 'kaboom.hum', 'kanalx.txt',
'lawyer.jok', 'lbinter.hum', 'let.go', 'letgosh.txt', 'lif&love.hum', 'lifeimag.hum', 'lifeonledge.txt', 'lozerzon.hum', 'lugga
ge.hum', 'luvstory.txt', 'm0dzmen.hum', 'maecenas.hum', 'mailfrag.hum', 'manners.txt', 'marriage.hum', 'mash.hum', 'mcd.txt',
'meinkamp.hum', 'mel.txt', 'mindvox', 'minn.txt', 'misc.1', 'mlverb.hum', 'montpyth.hum', 'moore.txt', 'moose.txt', 'msorrow',
'mundane.v2', 'murphys.txt', 'murphy_l.txt', 'myheart.hum', 'namaste.txt', 'nameisreo.txt', 'news.hum', 'nigel.10', 'nigel.2',
'nigel.3', 'nigel.5', 'nigel10.txt', 'nihgel_8.9', 'nukewar.txt', 'oldeng.hum', 'oliver.txt', 'oliver02.txt', 'onetoone.hum',
'oxymoron.jok', 'passage.hum', 'passenge.sim', 'peatchp.hum', 'pepper.txt', 'pepsideg.txt', 'petshop', 'phorse.hum', 'pizzawho.
hum', 'policpig.hum', 'popmusi.hum', 'prac1.jok', 'prac2.jok', 'prac3.jok', 'prac4.jok', 'pracjoke.txt', 'practica.txt', 'pro-f
act.hum', 'progrs.gph', 'psycho.txt', 'psych_pr.quo', 'pukeprom.jok', 'quack26.txt', 'quest.hum', 'quotes.txt', 'quux_p.oem',
'radiolaf.hum', 'reasons.txt', 'reeves.txt', 'rns_ency.txt', 'scratchy.txt', 'sfmovie.txt', 'shuttleb.hum', 'smurfkil.hum', 'sn
apple.rum', 'socecon.hum', 'solders.hum', 'soleleer.hum', 'stone.hum', 'strine.txt', 'stuf11.txt', 'suicide2.txt', 'sw_err.tx
t', "terrmcd'.hum", 'tfepisod.hum', 'throwawa.hum', 'timetr.hum', 'tnd.1', 'top10.txt', 'top10st2.txt', 'tpquotes.txt', 'ukunde
rg.txt', 'valujet.txt', 'various.txt', 'vonthomp', 'wacky.ani', 'wedding.hum', 'whoops.hum', 'wimptest.txt', 'worldend.hum', 'x
ibovac.txt']
```

Q2)

- ➢ Firstly, all the necessary libraries such as nltk, pandas, numpy, etc…are imported.
- ➢ Import tokenizer, stop words, stemmer and lemmatizer from the nltk library.

<u>Pre-processing steps:</u>

- ➢ Initially, all the words are converted to lowercase.
- ➢ Word_tokenize imported from nltk is used to perform tokenization on the given dataset.
- ➢ Next, the stop words present are removed from the dataset
- ➢ Removed the punctuations present and they are replaced with space and also extra white spaces are removed.
- ➢ Blank space tokens are being removed by checking if length greater than one or not.
- ➢ Here we are mapping the document names with document numbers.



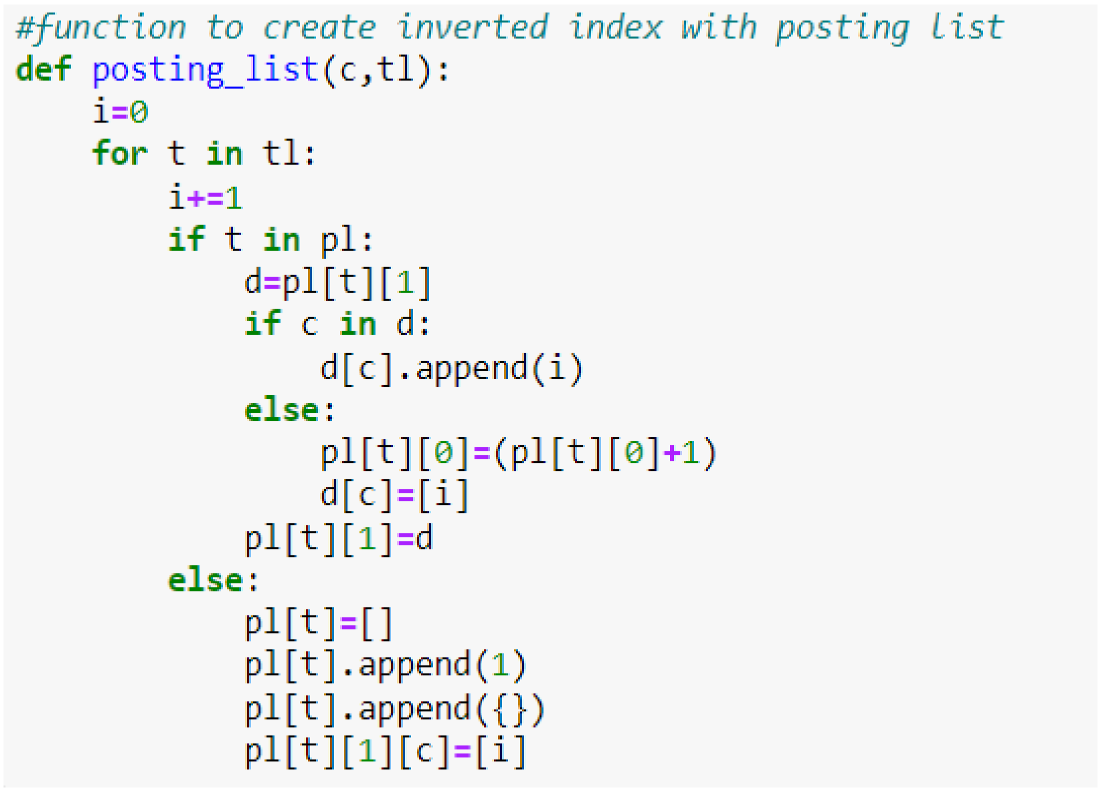
```
#function that pre processes such as converting to lower case, removing punctuations, tokenizing and lemmatization
l=len(string.punctuation)
def pre_process(s):
    s = s.lower()
    s = s.translate(s.maketrans(string.punctuation,' '*l,''))
    #s = re.sub('[^A-Za-z\s\n ]+', ' ',s)

    t = word_tokenize(s)
    #table = str.maketrans('', '', string.punctuation)
    #stripped = [w.translate(table) for w in t]

    t = [lem.lemmatize(w) for w in t if w not in stopwords.words('english') and w.isalpha() and len(w)>1]
    return t
```

Building the Positional index:

- ➢ Collected all the pre-processed tokens from each document.
- ➢ For each token, it is stored in the dictionary.
- ➢ It further contains a dictionary of documents in which the token is present and it's position in the document.



```
#function to create inverted index with posting list
def posting_list(c,tl):
    i=0
    for t in tl:
        i+=1
        if t in pl:
            d=pl[t][1]
            if c in d:
                d[c].append(i)
            else:
                pl[t][0]=(pl[t][0]+1)
                d[c]=[i]
            pl[t][1]=d
        else:
            pl[t]=[]
            pl[t].append(1)
            pl[t].append({})
            pl[t][1][c]=[i]
```

Processing the query:

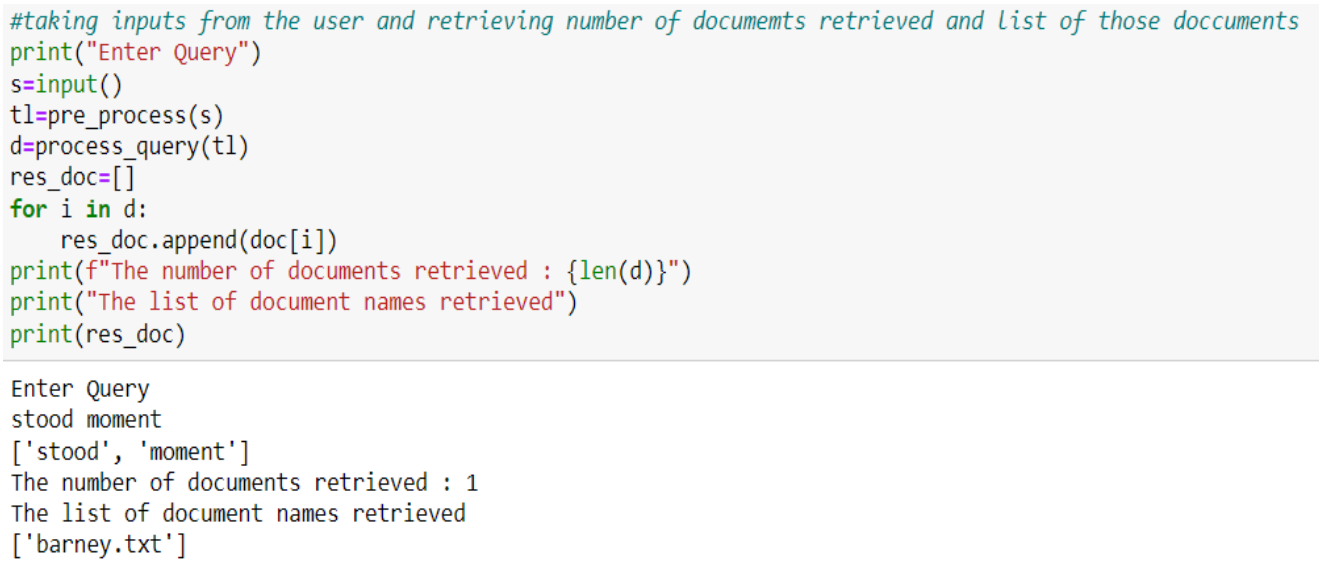
- First we collected all the common documents in which all the given tokens are present.
- We assume that user gives proper queries with valid operations only.
- Then, we took the positional indexes token wise in a list for each document.
- Finally, we checked for the consecutive positions and stored the corresponding document in the result, If all the tokens are present consecutively.

```
#function to process the query given by the user
def process_query(tl):
    print(tl)
    ans=[]
    cd=com_doc(tl)
    pl1=list_pos(tl,cd)
    for d in cd:
        f=False
        tp=pl1[d]
        tp1=tp[0]
        for i in range(len(tp1)):
            f1=True
            c=tp1[i]
            for j in range(1,len(tp)):
                c+=1
                if c not in tp[j]:
                    f1=False
                    break
            if(f1):
                f=True
        if(f):
            ans.append(d)
        ans=list(set(ans))

    return ans
```

Sample Execution:

➢ First, we take the query from the user, then process the query and finally return the number of documents retrieved and list of documents that are retrieved as the result.



```python
#taking inputs from the user and retrieving number of documemts retrieved and list of those doccuments
print("Enter Query")
s=input()
tl=pre_process(s)
d=process_query(tl)
res_doc=[]
for i in d:
    res_doc.append(doc[i])
print(f"The number of documents retrieved : {len(d)}")
print("The list of document names retrieved")
print(res_doc)
```

```
Enter Query
stood moment
['stood', 'moment']
The number of documents retrieved : 1
The list of document names retrieved
['barney.txt']
```