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In [1]:
```
# Importing libraries
import warnings
warnings.filterwarnings("ignore")
import pandas as pd
import numpy as np
import xml.etree.ElementTree as et
import os
import csv
from nltk.corpus import stopwords
from nltk.stem import SnowballStemmer, WordNetLemmatizer, PorterStemmer
from nltk.tokenize import word_tokenize
from datetime import datetime
```

In [2]:
```
# specifying the fields for csv file
fields = ['Id', 'Text', 'Topic', 'Title', 'Tags']
def parseXML(xmlfile, start_count):
    #create element tree object
    print("File", xmlfile)
    tree = et.parse(xmlfile)
    topic = xmlfile.split("/")[1].split("_")[0]
    # get root element
    root = tree.getroot()
    # create empty list for news items
    newsitems = []
    count = start_count
    # iterate news items
    for each_row in root.iter("row"):
        news = {}
        news["Id"] = count
        news["Text"] = each_row.attrib["Body"]
        news["Topic"] = topic
        try:
            news["Title"] = each_row.attrib["Title"]
        except:
            news["Title"] = None
        try:
            news["Tags"] = each_row.attrib["Tags"]
        except:
            news["Tags"] = None
        count=count+1
        newsitems.append(news)
    # return news items list
    print("len", len(newsitems))
    return newsitems
```

In [3]:
```
def savetoCSV(newsitems, filename):
    # writing to csv file
    with open(filename, 'x', encoding='utf-8') as csvfile:
        # creating a csv dict writer object
        writer = csv.DictWriter(csvfile, fieldnames = fields)
        # writing headers (field names)
        writer.writeheader()
        # writing data rows
        writer.writerows(newsitems)
```

In [5]:
```
# specifying the fields for csv file
fields = ['Id', 'Text', 'Topic', 'Title', 'Tags']
postfiles = os.listdir("allpostxml")
start_count = 0
for each_file in postfiles:
    print(each_file)
    # parse xml file
    newsitems = parseXML("allpostxml/"+each_file, start_count)
    csv_filename = each_file.split('.')[0] + ".csv"
    print("csv_filename", csv_filename)
    # store news items in a csv file
    savetoCSV(newsitems, "CSVFiles/" + csv_filename)
    start_count = len(newsitems) + start_count
```

```
ai_posts.xml
File allpostxml/ai_posts.xml
len 12546
csv_filename ai_posts.csv
ai_posts_meta.xml
File allpostxml/ai_posts_meta.xml
len 608
csv_filename ai_posts_meta.csv
cs_Posts.xml
File allpostxml/cs_Posts.xml
len 73252
csv_filename cs_Posts.csv
cs_Posts_meta.xml
File allpostxml/cs_Posts_meta.xml
len 1537
csv_filename cs_Posts_meta.csv
ds_Posts.xml
File allpostxml/ds_Posts.xml
len 43650
csv_filename ds_Posts.csv
ds_Posts_meta.xml
File allpostxml/ds_Posts_meta.xml
len 466
csv_filename ds_Posts_meta.csv
```

In [250]:
```
data = pd.read_csv('CSVFiles/ai_posts.csv')
data.head()
```

Out[250]:

	Id	Text	Topic	Title	Tags
0	0	<p>What does "backprop" mean? Is the "backprop...	ai	What is "backprop"?	<neural-networks><backpropagation><terminology...
1	1	<p>Does increasing the noise in data help to i...	ai	How does noise affect generalization?	<neural-networks><machine-learning><statistica...
2	2	<p>"Backprop" is the same as "backpropagation"...	ai	NaN	NaN
3	3	<p>When you're writing your algorithm, how do ...	ai	How to find the optimal number of neurons per ...	<deep-network><search><neurons>
4	4	<p>I have a LEGO Mindstorms EV3 and I'm wonder...	ai	How to program AI in Mindstorms	<python><mindstorms>

In [251]:
```
# Watching some samples of text
for i in range(5):
    print(data.iloc[i]['Text'])
```

```
<p>What does "backprop" mean? Is the "backprop" term basically the same as "bac
kpropagation" or does it have a different meaning?</p>

<p>Does increasing the noise in data help to improve the learning ability of a
network? Does it make any difference or does it depend on the problem being sol
ved? How is it affect the generalization process overall?</p>

<p>"Backprop" is the same as "backpropagation": it's just a shorter way to say
it. It is sometimes abbreviated as "BP".</p>

<p>When you're writing your algorithm, how do you know how many neurons you nee
d per single layer? Are there any methods for finding the optimal number of the
m, or is it a rule of thumb?</p>

<p>I have a LEGO Mindstorms EV3 and I'm wondering if there's any way I could st
art coding the bot in Python rather than the default drag-and-drop system. Is a
Mindstorm considered AI?</p>

<p>Is this possible?</p>

<hr>

<p>My goal is to write a basic walking program in Python. The bot is the EV3RST
ORM. I searched and found <a href="http://bitsandbricks.no/2014/01/19/getting-s
tarted-with-python-on-ev3/" rel="nofollow">this</a>, but don't understand it.
</p>
```

In [9]:
```
mdata = pd.read_csv('CSVFiles/ai_posts_meta.csv')
mdata.head()
```

Out[9]:

	Id	Text	Topic	Title	Tags
0	12546	<p>Besides being "one of the 7 meta questions ...	ai	How do we promote this site?	<discussion>
1	12547	<p>I've clicked on chat link, but the...	ai	Is there any chat room?	<support><chat>
2	12548	<p>I think this will be a crucial thing to fig...	ai	How broadly should we define "on topic"?	<discussion>
3	12549	<p>Are all questions asked on stats and data s...	ai	Are all questions asked on stats and data scie...	<discussion><scope>
4	12550	<p>I've seen several questions that use the <a...	ai	Why isn't the [artificial-intelligence] tag bl...	<bug><feature-request><tags>

In [10]:
```
for i in range(5):
    print(mdata.iloc[i]['Text'])
```

```
<p>Besides being "one of the 7 meta questions every site should ask", it's ju
st plain important. An "AI Stackexchange" site has been tried before, at leas
t once, and possibly a few times.   And in the past, it's been killed for lac
k of activity.  :-(</p>

<p>So... how so we promote this site well enough to attract a critical mass o
f participants? And how do we get people participating?  </p>

<p>I've clicked on <em>chat</em> link, but the list is empty. Also I've tried
to create one, but I couldn't, as it's saying:</p>

<blockquote>
  <p>This room might already exist.</p>
</blockquote>

<p>But it's not there yet.</p>

<p>I think this will be a crucial thing to figure out.  On the one hand, I th
ink it's important to be as inclusive as possible, and avoid being overly ped
antic and stay away from the extreme degree of elitism that infects many stac
kexchange sites.  BUT.. on the other hand, we want the site to be of interest
to everyone from hobbyists to serious academic researchers.   </p>

<p>The one thing I think we need to be leery of, is having the site become ov
erly oriented towards trans-humanism, Singularity, etc.  I think those things
are on-topic, but I suspect it would be easy to drift into a place where we'r
e more fringe-science / sci-fi than serious AI research.   Exactly how to str
ike that balance, I'm afraid I don't really know.  </p>

<p>Are all questions asked on stats and data science SE also on topic here? O
r is there some rule such as (on-topic in stats or data science SE implies of
f-topic here)?</p>

<p>Data science and the stats SE already have a huge overlap (>~80%), I am wo
rried to have a third SE that also significantly overlaps with them.</p>

<hr>

<p>As a side note, many other SE have an AI tags, e.g.:</p>

<ul>
<li><a href="https://philosophy.stackexchange.com/questions/tagged/artificial
-intelligence">https://philosophy.stackexchange.com/questions/tagged/artifici
al-intelligence</a></li>
<li><a href="https://worldbuilding.stackexchange.com/questions/tagged/artific
ial-intelligence">https://worldbuilding.stackexchange.com/questions/tagged/ar
tificial-intelligence</a> (for the most sci-fi questions)</li>
<li><a href="https://cstheory.stackexchange.com/questions/tagged/ai.artificia
l-intel">https://cstheory.stackexchange.com/questions/tagged/ai.artificial-in
tel</a></li>
<li><a href="https://cs.stackexchange.com/questions/tagged/artificial-intelli
gence">https://cs.stackexchange.com/questions/tagged/artificial-intelligence
</a></li>
```

```
<li><a href="https://cogsci.stackexchange.com/questions/tagged/artificial-int
elligence">https://cogsci.stackexchange.com/questions/tagged/artificial-intel
ligence</a></li>
<li><a href="https://hsm.stackexchange.com/questions/tagged/artificial-intell
igence">https://hsm.stackexchange.com/questions/tagged/artificial-intelligenc
e</a></li>
<li><a href="https://stackoverflow.com/questions/tagged/artificial-intelligen
ce">https://stackoverflow.com/questions/tagged/artificial-intelligence</a></l
i>
<li><a href="https://gamedev.stackexchange.com/questions/tagged/ai">https://g
amedev.stackexchange.com/questions/tagged/ai</a></li>
</ul>

<p>I've seen several questions that use the <a href="https://ai.stackexchang
e.com/questions/tagged/artificial-intelligence" class="post-tag" title="show
questions tagged &#39;artificial-intelligence&#39;" rel="tag">artificial-inte
lligence</a> tag, sometimes as the only tag on the question. That is not usef
ul for categorizing questions, so please don't add this to your question. </p
>

<p>For this reason, the site name is usually blacklisted as tag name. </p>

<ul>
<li>So the <a href="https://ai.stackexchange.com/questions/tagged/bug" class
="post-tag" title="show questions tagged &#39;bug&#39;" rel="tag">bug</a> is:
Why isn't <a href="https://ai.stackexchange.com/questions/tagged/artificial-i
ntelligence" class="post-tag" title="show questions tagged &#39;artificial-in
telligence&#39;" rel="tag">artificial-intelligence</a> blacklisted?</li>
<li>The <a href="https://ai.stackexchange.com/questions/tagged/feature-reques
t" class="post-tag" title="show questions tagged &#39;feature-request&#39;" r
el="tag">feature-request</a> is: Please blacklist <a href="https://ai.stackex
change.com/questions/tagged/artificial-intelligence" class="post-tag" title
="show questions tagged &#39;artificial-intelligence&#39;" rel="tag">artifici
al-intelligence</a>.</li>
</ul>
```

In [13]:
```
# Combine all the above dataframes
fields = ['Id', 'Text', 'Topic', 'Title', 'Tags']
all_dataframes = pd.DataFrame(columns=fields)
csvpostfiles = os.listdir("CSVFiles/")

for each_file in csvpostfiles:
    print("each file", each_file)
    df = pd.read_csv("CSVFiles/"+ each_file)
    print("shape", df.shape)
    all_dataframes = all_dataframes.append(df, ignore_index=True)
print("The shape of all dataframes combined is: ", all_dataframes.shape)
all_dataframes.head()
```

```
each file ai_posts.csv
shape (12546, 5)
each file ai_posts_meta.csv
shape (608, 5)
each file cs_Posts.csv
shape (73252, 5)
each file cs_Posts_meta.csv
shape (1537, 5)
each file ds_Posts.csv
shape (43650, 5)
each file ds_Posts_meta.csv
shape (466, 5)
The shape of all dataframes combined is:  (132059, 5)
```

Out[13]:

	Id	Text	Topic	Title	Tags
0	0	<p>What does "backprop" mean? Is the "backprop...	ai	What is "backprop"?	<neural-networks><backpropagation><terminology...
1	1	<p>Does increasing the noise in data help to i...	ai	How does noise affect generalization?	<neural-networks><machine-learning><statistica...
2	2	<p>"Backprop" is the same as "backpropagation"...	ai	NaN	NaN
3	3	<p>When you're writing your algorithm, how do ...	ai	How to find the optimal number of neurons per ...	<deep-network><search><neurons>
4	4	<p>I have a LEGO Mindstorms EV3 and I'm wonder...	ai	How to program AI in Mindstorms	<python><mindstorms>

In [14]:
```
# Number of Questions with diffrent Topics
all_dataframes['Topic'].value_counts()
```

Out[14]:
```
cs    74789
ds    44116
ai    13154
Name: Topic, dtype: int64
```

In [15]:
```
# Number of rows with Null values for diffrent coloumns
all_dataframes.isnull().sum()
```

Out[15]:
```
Id           0
Text       594
Topic        0
Title    72143
Tags     72143
dtype: int64
```

In [16]:
```
# Percentage of rows which contain null values for title or tags
(all_dataframes.isnull().sum()["Title"]/all_dataframes.shape[0])*100
```

Out[16]:
```
54.62937020574137
```

In [17]:
```
# Drop the title and tags coloum
all_dataframes_without_null = all_dataframes.dropna()
print(all_dataframes_without_null.shape)
all_dataframes_without_null.head()
```

```
(59916, 5)
```

Out[17]:

	Id	Text	Topic	Title	Tags
0	0	<p>What does "backprop" mean? Is the "backprop...	ai	What is "backprop"?	<neural-networks><backpropagation><terminology...
1	1	<p>Does increasing the noise in data help to i...	ai	How does noise affect generalization?	<neural-networks><machine-learning><statistica...
3	3	<p>When you're writing your algorithm, how do ...	ai	How to find the optimal number of neurons per ...	<deep-network><search><neurons>
4	4	<p>I have a LEGO Mindstorms EV3 and I'm wonder...	ai	How to program AI in Mindstorms	<python><mindstorms>
5	5	<p>Given the following definition of an intell...	ai	Are humans intelligent according to the defini...	<philosophy><definitions><intelligent-agent>

In [ ]:
```
# Save the above dataframe into the csv file
all_dataframes_without_null.to_csv('all_dataframe_without_preprocess_small.csv',
```

In [104]:
```
all_dataframe_without_preprocess_df_copy = pd.read_csv('all_dataframe_without_pr

# Remove the ID, Topic, and Tags since these are not important to search problem
all_dataframe_without_preprocess_df_copy.drop(['Id', 'Topic', 'Tags'], axis=1, i
all_dataframe_without_preprocess_df_copy.head()
```

Out[104]:

	Text	Title
0	<p>What does "backprop" mean? Is the "backprop...	What is "backprop"?
1	<p>Does increasing the noise in data help to i...	How does noise affect generalization?
2	<p>When you're writing your algorithm, how do ...	How to find the optimal number of neurons per ...
3	<p>I have a LEGO Mindstorms EV3 and I'm wonder...	How to program AI in Mindstorms
4	<p>Given the following definition of an intell...	Are humans intelligent according to the defini...

In [125]:
```
all_dataframe_without_preprocess_df_copy.shape
```

Out[125]:
```
(59916, 2)
```

Adding more StackOverflow data into the previous dataframe

In [126]:
```
more_stackoverflow_data = pd.read_csv('stackoverflow_data.csv')
print(more_stackoverflow_data.shape)
more_stackoverflow_data.head()
```

```
(826813, 2)
```

Out[126]:

	Title	Text
0	btnAdd click event opens two window after r...	<p>i m opening window(search.aspx)using below ...
1	java.lang.NoSuchMethodError: javax.servlet.S...	<p>i want to have a servlet to process inputs ...
2	"Specified initialization vector (IV) does no...	<p>I've had troubles using an CryptoStream for...
3	"subquery returns more than 1 row" error.	<p>I am new to web programming and I'm trying ...
4	'fi' or 'fl' result in big "S"-like symbol	<p>I use LyX with XeTeX, and the output font i...

Merging both dataframes

In [127]:
```
more_stackoverflow_data.shape, all_dataframe_without_preprocess_df_copy.shape
```

Out[127]:
```
((826813, 2), (59916, 2))
```

In [128]:
```
# Merge both above dataframes
combined_new_df = pd.concat([more_stackoverflow_data, all_dataframe_without_prepr
print(combined_new_df.shape)
combined_new_df.head()
```

```
(886729, 2)
```

Out[128]:

	Text	Title
0	<p>i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...
1	<p>i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...
2	<p>I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...
3	<p>I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.
4	<p>I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol

In [129]:
```
# Drop Duplicates
print(combined_new_df.duplicated().sum())
combined_new_df.drop_duplicates(inplace=True)
print(combined_new_df.duplicated().sum())
```

```
49
0
```

In [130]:
```
# Save above dataframe into csv file
combined_new_df.to_csv('all_dataframe_without_preprocess.csv', index=False)
```

Data preprocessing

Text

In [3]:
```
all_dataframes_without_null = pd.read_csv('all_dataframe_without_preprocess.csv'
all_dataframes_without_null.head()
```

Out[3]:

	Text	Title
0	<p>i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...
1	<p>i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...
2	<p>I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...
3	<p>I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.
4	<p>I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol

In [5]:
```
for i in range(10):
    try:
        print(all_dataframes_without_null['Text'][i])
    except:
        pass
```

```
<p>i m opening window(search.aspx)using below code.
 i hav add button in search.aspx
when i insert record from btnAdd click event then it opens another window.
after inserting record i have to close that window. How can i do that.</p>

<pre><code>       //calling Search.aspx on button click of abc.aspx
      if (window.showModalDialog) {
        window.showModalDialog("Search.aspx","name",
        "dialogWidth:255px;dialogHeight:250px");
        }
        //Search.aspx code behind
        protected void btnAdd_Click(object sender, EventArgs e)
        {

          //Insert query for adding record
        }

//Search.aspx code
$(document).ready(function ()
```

In [6]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text
stop_words = set(stopwords.words('english'))
#stemmer = SnowballStemmer('english')
stemmer = WordNetLemmatizer()
```

In [7]:
```
def preprocess_text(document_list):
    preprocessed_document_list = []
    for document in document_list:
        striped_html_text = strip_html(document)
        words = word_tokenize(str(striped_html_text.lower()))

        #Removing all single letter and and stopwords from question exceptt for 
        cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if 
        preprocessed_document_list.append(cleaned_document)
    return preprocessed_document_list
```

In [8]:
```
clean_list = preprocess_text(all_dataframes_without_null['Text'].values)
```

In [142]:
```
#import nltk
#nltk.download('punkt')
#nltk.download('wordnet')
```

```
[nltk_data] Downloading package wordnet to
[nltk_data]     C:\Users\ashish.shukla2\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
```

Out[142]:
```
True
```

In [10]:
```
for textone in range(10):
    print(textone, "*******", clean_list[textone])
    print("*"*30)
```

```
0 ******* opening window search aspx using code hav add button search aspx in
sert record btnadd click event open another window inserting record close win
dow calling search aspx button click abc aspx window showmodaldialog window s
howmodaldialog search aspx name dialogwidth px dialogheight px search aspx co
de behind protected void btnadd click object sender eventargs insert query ad
ding record search aspx code document ready function input id btnadd live cli
ck function csstablelisttdselected length alert select patient fixed appointm
ent return false else hidpid value table td csstablelisttdselected first text
lt asp button id btnadd width px cssclass cssbutton runat server text add onc
lick btnadd click gt
******************************
1 ******* want servlet process input standalone java program deploy servlet j
boss put servlet class file web inf class web xml gave servlet url mapping ja
va client program opened connected servlet using url object using localhost g
etting folowing error error org apache catalina connector coyoteadapter excep
tion error occurred container request processing java lang nosuchmethoderror
javax servlet servletcontext geteffectivesessiontrackingmodes ljava util set
org apache catalina connector coyoteadapter postparserequest coyoteadapter ja
va org apache catalina connector coyoteadapter service coyoteadapter java org
apache coyote http http processor process http processor java org apache coyo
te http http protocol http connectionhandler process http protocol java org a
pache tomcat util net jioendpoint worker run jioendpoint java web xml file co
ntent lt xml version encoding utf gt lt doctype web app public sun microsyste
ms inc dtd web application en java sun com ee dtds web app dtd gt lt web app
gt lt servlet gt lt servlet name gt reverseservlet lt servlet name gt lt serv
let class gt reverseservlet lt servlet class gt lt servlet gt lt servlet mapp
ing gt lt servlet name gt reverseservlet lt servlet name gt lt url pattern gt
lt url pattern gt lt servlet mapping gt lt web app gt
******************************
2 ******* trouble using cryptostream file encryption code public static void
encryptfile string inputfile string outputfile int num string puplr byte byte
new unicodeencoding getbytes string path outputfile filestream stream new fil
estream path filemode create rijndaelmanaged managed new rijndaelmanaged cryp
tostream crpytstream new cryptostream stream managed createencryptor byte byt
e cryptostreammode write filestream stream new filestream inputfile filemode
open num stream readbyte crpytstream writebyte byte num stream close crpytstr
eam close stream close trying managed blocksize seem work could fix error
******************************
3 ******* new web programming trying make twitter clone point table user id n
ame id auto generated id name user tweet id content user id id auto generated
id content text tweet user id id user made post follower id user id following
id id auto generated id user id user following following id user followed new
sql well trying build sql statement would return tweet currently logged user
everyone follows tried use statement work sometimes time get error say subque
ry return row statement select tweet user id select following id follower use
r id order date desc put example would id currently logged user luck statemen
t help would greatly appreciated thank
******************************
4 ******* use lyx xetex output font dejavu sans write input text fi fl output
text display strange big like symbol know help would appreciated
******************************
5 ******* code get authenticate user google displaying basic thing getting er
```

```
ror authenticate user google error invalid credential oauth google api throwi
ng apiserviceexception code lt php require google api php client src apiclien
t php require google api php client src contrib apiplusservice php require go
ogle api php client src contrib apioauth service php session start client new
apiclient client gt setapplicationname demo client gt setclientid asd egfdgtd
ewd client gt setclientsecret oorvhb nbdsfisfgf fsfsfj client gt setredirectu
ri http demo com client gt setdeveloperkey hgfhjvhjb rbbvjhdfjdsvkbdvdv clien
t gt setscopes array http www googleapis com auth plus http www googleapis co
m auth userinfo email plus new apiplusservice client oauth new apioauth servi
ce client isset request logout unset session access token isset get code clie
nt gt authenticate session access token client gt getaccesstoken header locat
ion http server http host server php self fixme exit missing isset session ac
cess token client gt setaccesstoken session access token client gt getaccesst
oken plus gt people gt get user oauth gt userinfo gt get email filter var use
r email filter sanitize email optparams array maxresults gt activity plus gt
activity gt listactivities public optparams session access token client gt ge
taccesstoken else authurl client gt createauthurl
******************************
6 ******* slim ghostwall implementing trivial allow disallow rule based port
protocol direction preferably gui open source supported abandoned year ago lo
ok like anyone
******************************
7 ******* looking deep explanation aidl android interface definition language
googled also got definition example like know detail help well others underst
and concept well link referred android developer website reilly official webs
ite famous marakana app solut version aidl
******************************
8 ******* recently built single page asp net mvc j jquery ui top view html ge
neral idea javascript work encountering issue gc properly freeing memory leav
ing large number element biggest form depending form loaded unloaded detached
dom viewable chrome developer tool heap profiler var mainapp function var meb
ase activeobject undefined somefunc function val val etc operation getview me
base activeobject null mebase bustactive else condition load static html via
get else switch activeobjectselector case casehere self activeobject new some
object self activeobject begininit break case bustactive function mebase acti
veobject destroy mebase activeobject null mebase getview var someobject funct
ion var mebase binding container somecontainer property unbind function somec
ontainer bound function click amp amp isfunction click unbind click blur amp
amp isfunction blur unbind blur change amp amp isfunction change unbind chang
e mouseenter amp amp isfunction mouseenter unbind mouseenter mouseleave amp a
mp isfunction mouseleave unbind mouseleave iterate mebase binding remove spec
ial binding live die mapevents function example somecontainer element click m
ebase someaction addclass bound create object removal function special bindin
g live die push mebase binding initui function setup tab datepickers etc dest
roy function mebase unbind remove object field method delete mebase someprop
mebase container empty delete mebase begininit delete mebase initui delete me
base mapevents delete mebase someaction delete mebase return true someaction
function something productive hopefully processview function data maincontain
er fadeout swing function empty append data loadview function ajax url somewh
ere something type get success mebase proccessview error someglobalobject log
ajaxerror begininit function load page via ajax mebase loadview mebase initui
mebase mapevents return true tried iteration javascript remove event element
destroy function substantially reduced number element left detached dom versu
s container empty container remove memory never properly collecting back cont
inually rise load unload drop random interval amount would expect normal many
element remain hung fundamental issue way code functioning thanks taking time
read first post please gentle
```

```
****************************
9 ******* got piece code frame myframe none index frame list insertstringitem
sys maxint test frame list setstringitem index test however execute nothing c
hange listctrl myframe even seems like creates hidden listctrl test leaf orig
inal unchanged
****************************
```

In [12]:
```
all_dataframes_without_null['preprocessed_text'] = clean_list
```

In [13]:
```
all_dataframes_without_null.head()
```

Out[13]:

	Text	Title	preprocessed_text
0	<p>i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...	opening window search aspx using code hav add ...
1	<p>i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...	want servlet process input standalone java pro...
2	<p>I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...	trouble using cryptostream file encryption cod...
3	<p>I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.	new web programming trying make twitter clone ...
4	<p>I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol	use lyx xetex output font dejavu sans write in...

Preprocessing of Title text

In [14]:
```
cleaned_titles = preprocess_text(all_dataframes_without_null['Title'].values)
all_dataframes_without_null['preprocessed_titles'] = cleaned_titles
```

In [15]:
```
# Drop the unprocessed data from this dataframe
all_dataframes_without_null.drop(['Text', 'Title'], axis=1, inplace=True)
all_dataframes_without_null.head()
```

Out[15]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [16]:
```
# Save preprocessed dataframe to a csv file
all_dataframes_without_null.to_csv('final_df.csv', index=False)
```

Preprocessing of Tags

In [57]:
```
# def clean_tags(tags_list):
#     processed_tags = []
#     for tags in tags_list:
#         tags = tags.replace("><", " ")
#         tags = tags.replace("<", "")
#         tags = tags.replace(">", "")
#         tags = tags.replace("-", "_")
#         processed_tags.append(tags)
#     return processed_tags
```

In [61]:
```
# cleaned_tags = clean_tags(all_dataframes_without_null['Tags'].values)
# all_dataframes_without_null['processed_tags'] =  cleaned_tags
```

In [65]:
```
# Drop already processed columns from the dataframe
# all_dataframes_without_null.drop(['Text', 'Title', 'Tags'], axis=1, inplace=Tru
```

In [68]:
```
# all_dataframes_without_null.head()
```

Out[68]:

	Id	Topic	preprocessed_text	preprocessed_titles	processed_tags
0	0	ai	backprop mean backprop term basically backprop...	backprop	neural_networks backpropagation terminology de...
1	1	ai	increasing noise data help improve learning ab...	noise affect generalization	neural_networks machine_learning statistical_a...
3	3	ai	writing algorithm know many neuron need per si...	find optimal number neuron per layer	deep_network search neurons
4	4	ai	lego mindstorms ev wondering way could start c...	program ai mindstorms	python mindstorms
5	5	ai	given following definition intelligent agent t...	human intelligent according definition intelli...	philosophy definitions intelligent_agent

In [70]:
```
#Save preprocessed dataframe to a csv file
# all_dataframes_without_null.to_csv('final_df.csv', index=False)
```

Featurization of text features

In [20]:
```
finaldf = pd.read_csv('final_df.csv')
finaldf.head()
```

Out[20]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [21]:
```
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_titles'] + " " + fin
finaldf.head()
```

Out[21]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	btnadd click event open two window record adde...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error	subquery return row error new web programming ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	fi fl result big like symbol use lyx xetex out...

In [22]:
```
# Prepare data for the traing of word2vec model
sentence_corpus = []
for sen in finaldf['preprocessed_titles_text'].values:
    sentence_corpus.append(str(sen).split())


# Train Word2Vec model for preprocessed_text and preprocessed_titles
from gensim.models import word2vec, KeyedVectors
from gensim.test.utils import get_tmpfile

# Initialize the model file
path = get_tmpfile("word2vec.model")

# Training the word2vec model
model = word2vec.Word2Vec(sentence_corpus, workers=8, size=400, min_count=5, win
model.save("word2vec.model")
```

In [23]:
```
# Convert preprocessed text and preprocessed titles into avgw2v and concatnate
# Average word2vec for the text

# Loading the already trained word2vec model
from gensim.models import word2vec, KeyedVectors
from gensim.test.utils import get_tmpfile
import pickle
model = word2vec.Word2Vec.load("word2vec.model")

def average_w2v(sentence):
    sentence = str(sentence)
    vector = np.zeros(300)
    number_of_words_in_sentence = 0
    for word in sentence.split():
        try:
            vector = vector + model[word]
        except:
            vector = vector + np.zeros(300)
        number_of_words_in_sentence += 1
    final_vector = vector/number_of_words_in_sentence
    return final_vector
```

In [24]:
```
# Convert all text into average word2vec
word2vec_text = []
for one_doc in finaldf['preprocessed_text'].values:
    word2vec_text.append(average_w2v(one_doc))

# Convert all text into average word2vec
word2vec_titles = []
for one_doc in finaldf['preprocessed_titles'].values:
    word2vec_titles.append(average_w2v(one_doc))

# Combine above both word2vec features
word2vec_title_text = []
for i in range(len(word2vec_text)):
    word2vec_title_text.append(np.concatenate([word2vec_text[i], word2vec_titles
```

In [26]:
```
word2vec_title_text[0].shape
```

Out[26]: (600,)

Analysis of tags

In [42]:
```
from sklearn.feature_extraction.text import CountVectorizer
vectorizer = CountVectorizer(tokenizer = lambda x: x.split(), binary='true')
multilabel_y = vectorizer.fit_transform(finaldf['processed_tags'].values)
```

In [74]:
```
all_tags_list = vectorizer.get_feature_names()
```

In [155]:
```
from sklearn.feature_extraction.text import CountVectorizer
vect = CountVectorizer(tokenizer = lambda x: x.split(), max_features=5000)
title_bow = vect.fit_transform(finaldf['preprocessed_titles'].values.astype("U")
```

In [136]:
```
# from sklearn.model_selection import train_test_split
# X_train, X_test, y_train, y_test = train_test_split(X, multilabel_y, test_size=
# X_train.shape, y_train.shape, X_test.shape, y_test.shape
```

Out[136]:
```
<59916x5000 sparse matrix of type '<class 'numpy.int64'>'
        with 2664432 stored elements in Compressed Sparse Row format>
```

In [171]:
```
# Train the svm model using above data of title, body as X and tags as y using o
from sklearn.multiclass import OneVsRestClassifier
from sklearn.linear_model import SGDClassifier
X = title_bow.copy()
multilabel_y = multilabel_y
tags_clf = OneVsRestClassifier(SGDClassifier(loss='hinge', n_jobs=-1, verbose=0)
tags_clf.fit(X, multilabel_y)
```

Out[171]:
```
OneVsRestClassifier(estimator=SGDClassifier(alpha=0.0001, average=False,
                                            class_weight=None,
                                            early_stopping=False, epsilon=0.1,
                                            eta0=0.0, fit_intercept=True,
                                            l1_ratio=0.15,
                                            learning_rate='optimal',
                                            loss='hinge', max_iter=1000,
                                            n_iter_no_change=5, n_jobs=-1,
                                            penalty='l2', power_t=0.5,
                                            random_state=None, shuffle=True,
                                            tol=0.001, validation_fraction=0.1,
                                            verbose=0, warm_start=False),
                    n_jobs=None)
```

In [172]:
```
from joblib import dump, load
dump(tags_clf, 'tags_clf_saved.joblib')
# tags_clf = load('tags_clf_saved.joblib')
```

Out[172]:
```
['tags_clf_saved.joblib']
```

In [173]:
```
tags_clf = load('tags_clf_saved.joblib')
```

In [175]:
```
test_point_index = 45
result = tags_clf.predict(title_bow[test_point_index].reshape(1, -1)).toarray()
i, = np.where(result[0] == 1) # Getting all the index for which our model pridic
all_tags_list_array = np.array(all_tags_list)
print("Predicted tags: ", all_tags_list_array[i])
print("Actual tags:", finaldf['processed_tags'].values[test_point_index])
```

```
Predicted tags:  ['optimization']
Actual tags: optimization agi
```

In [177]:
```
for i in range(50, 100):
    test_point_index = i
    result = tags_clf.predict(title_bow[test_point_index].reshape(1, -1)).toarray
    i, = np.where(result[0] == 1) # Getting all the index for which our model pr
    all_tags_list_array = np.array(all_tags_list)
    print("Predicted tags: ", all_tags_list_array[i])
    print("Actual tags:", finaldf['processed_tags'].values[test_point_index])
```

```
Predicted tags:  []
Actual tags: neural_networks machine_learning deep_network comparison hidden_la
yers
Predicted tags:  ['fuzzy_logic']
Actual tags: fuzzy_logic
Predicted tags:  []
Actual tags: philosophy incompleteness_theorems
Predicted tags:  ['philosophy']
Actual tags: philosophy chinese_room_argument
Predicted tags:  ['deep_learning']
Actual tags: boltzmann_machine
Predicted tags:  ['cellular_automata']
Actual tags: evolutionary_algorithms topology efficiency
Predicted tags:  []
Actual tags: philosophy superintelligence
Predicted tags:  []
Actual tags: models agi aixi
Predicted tags:  []
Actual tags: neural_networks symbolic_ai symbolic_computing
Predicted tags:  ['hypercomputation']
Actual tags: neural_networks hypercomputation recurrent_neural_networks
Predicted tags:  ['halting_problem']
Actual tags: halting_problem
Predicted tags:  []
Actual tags: convolutional_neural_networks deepdream
Predicted tags:  ['deep_learning']
Actual tags: performance neural_doodle deepdreaming
Predicted tags:  ['autoencoder' 'machine_learning']
Actual tags: neural_networks
Predicted tags:  []
Actual tags: neural_networks math
Predicted tags:  []
Actual tags: neural_networks models
Predicted tags:  []
Actual tags: algorithm natural_language_processing pattern_recognition
Predicted tags:  ['deep_learning']
Actual tags: convolutional_neural_networks deepdreaming
Predicted tags:  []
Actual tags: convolutional_neural_networks deepdream computer_vision deepdreami
ng
Predicted tags:  []
Actual tags: quantum_computing handwritten_characters ocr
Predicted tags:  []
Actual tags: philosophy
Predicted tags:  []
Actual tags: emotional_intelligence new_ai
Predicted tags:  []
Actual tags: natural_language_processing algorithm word_embedding
```

```
Predicted tags:  []
Actual tags: neural_networks hidden_layers
Predicted tags:  []
Actual tags: knowledge_representation time embodied_cognition
Predicted tags:  ['halting_problem' 'quantum_computing']
Actual tags: quantum_computing halting_problem strong_ai
Predicted tags:  []
Actual tags: natural_language_processing chat_bots history turing_test
Predicted tags:  ['agi']
Actual tags: philosophy agi
Predicted tags:  []
Actual tags: natural_language_processing research semantics
Predicted tags:  []
Actual tags: emotional_intelligence chat_bots
Predicted tags:  []
Actual tags: algorithm deep_learning
Predicted tags:  []
Actual tags: neural_networks natural_language_processing text_summarization
Predicted tags:  []
Actual tags: storage
Predicted tags:  ['watson']
Actual tags: natural_language_processing watson
Predicted tags:  []
Actual tags: algorithm models research storage lexical_recognition
Predicted tags:  []
Actual tags: intelligence_testing
Predicted tags:  []
Actual tags: natural_language_processing lexical_recognition
Predicted tags:  ['unsupervised_learning']
Actual tags: machine_learning ai_basics models unsupervised_learning
Predicted tags:  []
Actual tags: research ai_community
Predicted tags:  []
Actual tags: cyborg intelligence_augmentation
Predicted tags:  []
Actual tags: training math recurrent_neural_networks
Predicted tags:  []
Actual tags: neural_networks
Predicted tags:  []
Actual tags: image_recognition hardware
Predicted tags:  ['genetic_algorithms']
Actual tags: genetic_algorithms
Predicted tags:  []
Actual tags: natural_language_processing problem_solving world_knowledge
Predicted tags:  ['backpropagation' 'machine_learning']
Actual tags: neural_networks machine_learning backpropagation learning_theory
Predicted tags:  ['deep_learning']
Actual tags: deep_learning
Predicted tags:  ['unsupervised_learning']
Actual tags: image_recognition unsupervised_learning
Predicted tags:  []
Actual tags: artificial_neuron
Predicted tags:  []
Actual tags: research signal_processing
```

We tried the approach of first detecting the tags in query question and

then calculating the cosine distance to only all those stored questions which also have these tags. Since most of the time model does not predict the correct tags or if the wrong tag is predicted by the model then our further recommended results get affected. So we tried the keyword-based method which is also used by google search .

Case 1 : Average Word2Vec, Cosine Similarity, Keywords

Keywords models for reducing time to search

https://www.google.com/search/howsearchworks/ (https://www.google.com/search/howsearchworks/

In [3]:
```
finaldf = pd.read_csv('final_df.csv')
finaldf.head()
```

Out[3]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [4]:
```
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_titles'] + " " + fina
finaldf.head()
```

Out[4]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	btnadd click event open two window record adde...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error	subquery return row error new web programming ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	fi fl result big like symbol use lyx xetex out...

In [5]:
```
# Getting all the keywords
titles_text_array = finaldf['preprocessed_titles_text'].values
keyword_index_dict = dict()
index = 0
for title_text in titles_text_array:
    titles_text_word_list = str(title_text).split()
    for keyword in titles_text_word_list:
        try:
            keyword_index_dict[keyword].append(index)
        except:
            keyword_index_dict[keyword] = []
            keyword_index_dict[keyword].append(index)
    index += 1
```

In [105]:
```
print("Total Number of keywords stored in the dictionary is: ",len(keyword_index_
```

```
Total Number of keywords stored in the dictionary is:  1664772
```

In [7]:
```
count = 0
for val in keyword_index_dict.keys():
    print(val)
    count = count + 1
    if count == 50:
        break
    else:
        pass
```

```
btnadd
click
event
open
two
window
record
added
opening
search
aspx
using
code
hav
add
button
insert
another
inserting
close
calling
abc
showmodaldialog
name
dialogwidth
px
dialogheight
behind
protected
void
object
sender
eventargs
query
adding
document
ready
function
input
id
live
csstablelisttdselected
length
alert
select
patient
fixed
```

```
appointment
return
false
```

In [95]:
```
# Let test some data points using cosine similarity Id =14, index=8
# https://stackoverflow.com/questions/37454785/how-to-handle-negative-values-of-c
# https://stackoverflow.com/questions/34226400/find-the-index-of-the-k-smallest-v

from sklearn.metrics.pairwise import cosine_similarity

def index_top_k_similar(all_arrays, test_arrays, k):
    """
    Here all arrays shape should be (n, d) and
    test array shape should be (1, d)
    """
    # all_cosine_similarity = cosine_similarity(all_arrays, test_array.reshape(1,
    all_cosine_similarity = cosine_similarity(all_arrays, test_arrays)
    all_cosine_distances = (1 - all_cosine_similarity).reshape(1, -1)[0]

    # Since we have to select only k minimum distances so there is no need to sho
    index_of_least_distances = np.argpartition(all_cosine_distances, k)[:k]
    selected_k_cosine_distances =  all_cosine_distances[index_of_least_distances

    index_of_least_distances_sorted = np.argsort(selected_k_cosine_distances) # (
    final_index_of_least_distances_sorted = index_of_least_distances[index_of_lea

    least_cosine_distances = all_cosine_distances[final_index_of_least_distances_
    return final_index_of_least_distances_sorted, least_cosine_distances
```

In [88]:
```
# Convert preprocessed text and preprocessed titles into avgw2v and concatnate
# Average word2vec for the text

# Loading the already trained word2vec model
from gensim.models import word2vec, KeyedVectors
from gensim.test.utils import get_tmpfile
import pickle
model = word2vec.Word2Vec.load("word2vec.model")

def average_w2v(sentence):
    sentence = str(sentence)
    vector = np.zeros(400)
    number_of_words_in_sentence = 0
    for word in sentence.split():
        try:
            vector = vector + model[word]
        except:
            vector = vector + np.zeros(400)
        number_of_words_in_sentence += 1
    final_vector = vector/number_of_words_in_sentence
    return final_vector
```

In [80]:
```
# Convert all text into average word2vec
word2vec_titles = []
for one_doc in finaldf['preprocessed_titles'].values:
    word2vec_titles.append(average_w2v(one_doc))
print(len(word2vec_titles))
```

```
886680
```

In [81]:
```
def get_indexes(keywords_in_question, all_data_index_dictionary):
    all_indexes = []
    for keyword in keywords_in_question:
        try:
            all_indexes.extend(all_data_index_dictionary[keyword])
        except:
            pass
    return np.array(list(set(all_indexes)))
```

In [82]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text
stop_words = set(stopwords.words('english'))
#stemmer = SnowballStemmer('english')
stemmer = WordNetLemmatizer()
```

In [83]:
```
def preprocess_title(document):
    striped_html_text = strip_html(document)
    words = word_tokenize(str(striped_html_text.lower()))
    #Removing all single letter and and stopwords from question exceptt for the
    cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if j no
    return cleaned_document
```

In [89]:
```
# Algorithm for detecting text
def suggest_questions_for_question_title(question_title, k):
    # Load already trained model for the detecting tags in a question which is tr
    # question_title is the title of the single question

    # Preprocess and vectorize the given question
    question_title_preprocessed = preprocess_title(question_title)
    print("Preprocessed question title is: ", question_title_preprocessed)

    question_title_vectorized = average_w2v(question_title_preprocessed).reshape
    print("question_title_vectorized shape is: ", question_title_vectorized.shap

    keywords_in_question = question_title_preprocessed.split()
    print("Keywords in the question is: ", keywords_in_question)

    # keyword_index_dict contain keywords as keys and list of index of documents
    index_questions_keyword = get_indexes(keywords_in_question, keyword_index_di

    # Convert all title word2vec into numpy array
    word2vec_titles_array = np.array(word2vec_titles)
    print("word2vec_titles_array shape is: ", word2vec_titles_array.shape)

    # Select only those questions which contain keyword
    word2vec_titles_array_selected = word2vec_titles_array[index_questions_keywo

    a, b = index_top_k_similar(word2vec_titles_array_selected, question_title_ve

    # a is the numpy array contain k indexes
    index_questions_keyword_similar = index_questions_keyword[a]

    recommendations = all_dataframe_without_preprocess_df.loc[index_questions_ke

    return recommendations
```

In [85]:
```
all_dataframe_without_preprocess_df = pd.read_csv('all_dataframe_without_preproc
all_dataframe_without_preprocess_df.head(10)
```

Out[85]:

	Text	Title
0	i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...
1	i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...
2	I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...
3	I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.
4	I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol
5	This is how I code to get authenticate user...	401 invalid credentials with oauth 2.0 google...
6	I.e.: \n\n<ul>\n<li>as slim as GhostWal...	A small open-source firewall for Windows XP?
7	Looking for deep explanation about AIDL (an...	AIDL (Android Interface Definition Language)
8	I have recently built an single-page ASP.NE...	ASP.NET MVC 3 Single-Page Application using J...
9	So I got this piece of code: \n\n<pre><c...	Accessing ListCtrl from a different class?

In [99]:
```
# Test 1
from datetime import datetime

question = "How to create a linked list in python?"
print("The asked question is: ", question)

start_time = datetime.now()
recommendations = suggest_questions_for_question_title(question, 10)
print("Time required to run the cell is:", datetime.now()-start_time)

print("Suggested questions are: ")
for rec in recommendations:
    print(rec)
```

```
The asked question is:  How to create a linked list in python?
Preprocessed question title is:  create linked list python
question_title_vectorized shape is:  (1, 400)
Keywords in the question is:  ['create', 'linked', 'list', 'python']
word2vec_titles_array shape is:  (886680, 400)
Time required to run the cell is: 0:00:02.995003
Suggested questions are:
How can I create a list in Python?
How do I create a list of timedeltas in python?
linked list in python
Linked Lists Python 2.7
circularly linked list in python
How to create a list of lists in Python
Python - manipulating lists to create another list
Create a list of defaultdict in python
Python; Linked list and traversing!
Python - Create a specific list
```

In [100]:
```
# Test 2
from datetime import datetime

question = "How to reverse a linked list in C?"
print("The asked question is: ", question)

start_time = datetime.now()
recommendations = suggest_questions_for_question_title(question, 15)
print("Time required to run the cell is:", datetime.now()-start_time)
print("Suggested questions are: ")

for rec in recommendations:
    print(rec)
```

```
The asked question is:  How to reverse a linked list in C?
Preprocessed question title is:  reverse linked list c
question_title_vectorized shape is:  (1, 400)
Keywords in the question is:  ['reverse', 'linked', 'list', 'c']
word2vec_titles_array shape is:  (886680, 400)
Time required to run the cell is: 0:00:02.994993
Suggested questions are:
How to reverse linked list C++
reverse printing of linked list in c
How to reverse a linked list?
reverse a linked list?
Reversing a singly linked list in C
Reverse doubly-link list in C++
C++ Linked list
linked list in C++
C 2D linked list
More linked lists in C
Linked List in C
C Progamming: Linked Lists
Why is this C linked list corrupting?
Singly Linked List - C
Doubly linked list in C
```

Approach 2 for sentence similarity

TF-IDF Word2vec with Cosine similarity and *keyword based* search method

In [3]:
```
# Reading Unprocessed data from the file
all_dataframe_without_preprocess_df = pd.read_csv('all_dataframe_without_preproc
print(all_dataframe_without_preprocess_df.shape)
all_dataframe_without_preprocess_df.head(5)
```

```
(886680, 1)
```

Out[3]:

	Title
0	btnAdd click event opens two window after r...
1	java.lang.NoSuchMethodError: javax.servlet.S...
2	"Specified initialization vector (IV) does no...
3	"subquery returns more than 1 row" error.
4	'fi' or 'fl' result in big "S"-like symbol

In [4]:
```
# Reading preprocessed data from the saved file
finaldf = pd.read_csv('final_df.csv')
print("The shape of the final dataframe is: ", finaldf.shape)
finaldf.head()
```

```
The shape of the final dataframe is:  (886680, 2)
```

Out[4]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [5]:
```
# Adding one more coloumn into the data table by combining text and titles
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_text'] + " " + final
finaldf.head()
```

Out[5]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	opening window search aspx using code hav add ...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	want servlet process input standalone java pro...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	trouble using cryptostream file encryption cod...
3	new web programming trying make twitter clone ...	subquery return row error	new web programming trying make twitter clone ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	use lyx xetex output font dejavu sans write in...

In [6]:
```
# Getting all the keywords
titles_text_array = finaldf['preprocessed_titles_text'].values
keyword_index_dict = dict()
index = 0
for title_text in titles_text_array:
    titles_text_word_list = str(title_text).split()
    for keyword in titles_text_word_list:
        try:
            keyword_index_dict[keyword].append(index)
        except:
            keyword_index_dict[keyword] = []
            keyword_index_dict[keyword].append(index)
    index += 1
print("Total Number of unique keywords stored in the dictionary is: ", len(keywo
```

```
Total Number of unique keywords stored in the dictionary is:  1206787
```

In [7]:
```
# Let test some data points using cosine similarity Id =14, index=8
# https://stackoverflow.com/questions/37454785/how-to-handle-negative-values-of-
# https://stackoverflow.com/questions/34226400/find-the-index-of-the-k-smallest-

from sklearn.metrics.pairwise import cosine_similarity

def index_top_k_similar(all_arrays, test_arrays, k):
    """
    Here all arrays shape should be (n, d) and
    test array shape should be (1, d)
    """
    # all_cosine_similarity = cosine_similarity(all_arrays, test_array.reshape(1,
    all_cosine_similarity = cosine_similarity(all_arrays, test_arrays)
    all_cosine_distances = (1 - all_cosine_similarity).reshape(1, -1)[0]

    # Since we have to select only k minimum distances so there is no need to sho
    index_of_least_distances = np.argpartition(all_cosine_distances, k)[:k]
    selected_k_cosine_distances =  all_cosine_distances[index_of_least_distances

    index_of_least_distances_sorted = np.argsort(selected_k_cosine_distances) # 
    final_index_of_least_distances_sorted = index_of_least_distances[index_of_le

    least_cosine_distances = all_cosine_distances[final_index_of_least_distances_
    return final_index_of_least_distances_sorted, least_cosine_distances
```

In [8]:
```
# Train the TF-IDF vectorizer on the question title data
from sklearn.feature_extraction.text import TfidfVectorizer
corpus = finaldf['preprocessed_titles'].values.astype('U')
vectorizer = TfidfVectorizer()
vectorizer.fit(corpus)
dictionary_idf = dict(zip(vectorizer.get_feature_names(), vectorizer.idf_))
```

In [9]:
```
# Convert preprocessed text and preprocessed titles into avgw2v and concatnate
# Average word2vec for the text

# Loading the already trained word2vec model
from gensim.models import word2vec, KeyedVectors
from gensim.test.utils import get_tmpfile
import pickle
model = word2vec.Word2Vec.load("word2vec.model")

def tf_idf_w2v(sentence):
    sentence = str(sentence)
    vector = np.zeros(400)
    sum_of_tfidf = 0
    for word in sentence.split():
        try:
            tfidf_word = dictionary_idf[word] * (sentence.count(word)/len(senten
            vector = vector + ((model[word]) * tfidf_word)
            sum_of_tfidf += tfidf_word
        except:
            vector = vector + np.zeros(400)
    if(sum_of_tfidf == 0):
        return vector
    else:
        return vector/sum_of_tfidf
```

In [10]:
```
# Find tfidf word2vec for all the titles
word2vec_titles = [tf_idf_w2v(doc) for doc in finaldf['preprocessed_titles'].valu
```

In [11]:
```
print("Total number tf-idf word2vec title vectors is: ", len(word2vec_titles))
print("Length of each tf-idf word2vec title vector is: ", len(word2vec_titles[0]
```

```
Total number tf-idf word2vec title vectors is:  886680
Length of each tf-idf word2vec title vector is:  400
```

In [12]:
```
def get_indexes(keywords_in_question, all_data_index_dictionary):
    all_indexes = []
    for keyword in keywords_in_question:
        try:
            all_indexes.extend(all_data_index_dictionary[keyword])
        except:
            pass
    return np.array(list(set(all_indexes)))
```

In [13]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text


def preprocess_title(document):
    stop_words = set(stopwords.words('english'))
    #stemmer = SnowballStemmer('english')
    stemmer = WordNetLemmatizer()
    striped_html_text = strip_html(document)
    words = word_tokenize(str(striped_html_text.lower()))
    #Removing all single letter and and stopwords from question exceptt for the 
    cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if j no
    return cleaned_document
```

In [14]:
```
# Algorithm for detecting text
def suggest_questions_for_question_title(question_title, k):

    # question_title is the title of the single question

    # Preprocess and vectorize the given question
    question_title_preprocessed = preprocess_title(question_title)
    print("Preprocessed question titles is: ", question_title_preprocessed)

    question_title_vectorized = tf_idf_w2v(question_title_preprocessed).reshape(
    print("question_title_vectorized shape is: ", question_title_vectorized.shap

    keywords_in_question = question_title_preprocessed.split()
    print("Keywords of question title is: ", keywords_in_question)

    # keyword_index_dict contain keywords as keys and list of index of documents
    index_questions_keyword = get_indexes(keywords_in_question, keyword_index_di

    # Convert all title word2vec into numpy array
    word2vec_titles_array = np.array(word2vec_titles)

    # Select only those questions which contain keyword of query question
    word2vec_titles_array_selected = word2vec_titles_array[index_questions_keywo

    a, b = index_top_k_similar(word2vec_titles_array_selected, question_title_ve

    # a is the numpy array contain k indexes
    index_questions_keyword_similar = index_questions_keyword[a]
    recommendations = all_dataframe_without_preprocess_df.loc[index_questions_ke
    return recommendations
```

In [17]:
```
# Test 1
query_question = "How to create a linked list in python?"
print("The query question is:  ", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:   How to create a linked list in python?
Preprocessed question titles is:  create linked list python
question_title_vectorized shape is:  (1, 400)
Keywords of question title is:  ['create', 'linked', 'list', 'python']
Time taken is:  0:00:03.164538
Suggestions are:
Linked Lists Python 2.7
linked list in python
circularly linked list in python
how to create a linked list inside a linked list in c
Python; Linked list and traversing!
Creating a circually linked list in C#?
creating a linked list in c++?
Add a linked list to another linked list in java
How do I add a linked list or convert it to a linked list using a stack functio
n
How to create my own single linked list
How can I create a list in Python?
Linked List of Linked Lists in Java
C Progamming: Linked Lists
Linked list of Linked List of Integers, Java.
How do I create a list of timedeltas in python?
```

In [18]:
```
# Test 2
query_question = "How to reverse a linked list in C?"
print("The query question is:\n", query_question)
start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)
print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to reverse a linked list in C?
Preprocessed question titles is:  reverse linked list c
question_title_vectorized shape is:  (1, 400)
Keywords of question title is:  ['reverse', 'linked', 'list', 'c']
Time taken is:  0:00:02.954126
Suggestions are:
How to reverse linked list C++
reverse a linked list?
How to reverse a linked list?
reverse the order of the linked list
reverse linked list problem
how to reverse a single linked list
linked list reverse is not working ....?
reverse part of a doubly linked list
How to reverse singly linked list - Java
Reverse Linked List Recursively
Linked list recursive reverse
Reverse and merge a linked list
single linked list reverse in python
reversing linked list
Reversing a linked list
```

Approach 3, Using language models, DistilBERT

Here We use language model Pretrained DistilBERT to convert Documents directly into vectors

In [1]:
```
import tensorflow as tf
tf.__version__
```

Out[1]:
```
'2.1.0'
```

In [2]:
```
# Download  and Testing the Pretrained DistilBert Model
from transformers import DistilBertTokenizer, TFDistilBertModel

tokenizer = DistilBertTokenizer.from_pretrained('distilbert-base-cased')
model = TFDistilBertModel.from_pretrained('distilbert-base-cased')
input_ids = tf.constant(tokenizer.encode("Hello, my dog is cute"))[None, :]  # B
outputs = model(input_ids)
last_hidden_states = outputs[0]  # The last hidden-state is the first element of
print(last_hidden_states.shape)
```

```
(1, 8, 768)
```

In [18]:
```
# Reading preprocessed data from the saved file
finaldf = pd.read_csv('final_df.csv')
print("The shape of the final dataframe is: ", finaldf.shape)
finaldf.head()
```

```
The shape of the final dataframe is:  (886680, 2)
```

Out[18]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [ ]:
```
# To reduce the memory used keep only preprocessed title part
final_df_temp = finaldf['preprocessed_titles']
print(final_df_temp.shape)
final_df_temp.to_csv('final_df_temp.csv', index=False)
```

In [ ]:
```
# Load the preprocessed title part
final_df_temp = pd.read_csv('final_df_temp.csv', names=['preprocessed_titles'])
print(final_df_temp.shape)
final_df_temp.head()
```

In [20]:
```
from tqdm import tqdm
distill_bert_ids = []
for doc in tqdm(final_df_temp['preprocessed_titles'].values, position=0, leave=T
    input_ids = tokenizer.encode(str(doc), pad_to_max_length=True, max_length=16
    distill_bert_ids.append(input_ids)

print(len(distill_bert_ids))
```

```
100%|[redacted]|
886680/886680 [02:33<00:00, 5762.52it/s]

886680
```

In [19]:
```
distill_bert_ids_tensor = tf.constant(distill_bert_ids)
distill_bert_ids_tensor.shape
```

Out[19]:
```
TensorShape([886680, 16])
```

In [ ]:
```
# Getting the vectors from the trained model
final_numpy_vectors = []
batch_size = 256
nop = distill_bert_ids_tensor.shape[0]
nob = nop//batch_size
for batch_number in tqdm(range(nob), position=0, leave=True):
    distill_bert_ids_tensor_batch = distill_bert_ids_tensor[batch_number*batch_s
    output_tensor = model(distill_bert_ids_tensor_batch)[0]
    for point_number in range(batch_size):
        one_point = output_tensor[point_number]
        numpy_output =sum(one_point).numpy()
        final_numpy_vectors.append(numpy_output)
print(len(final_numpy_vectors))
print(final_numpy_vectors[0].shape)
```

In [ ]:
```
final_numpy_vectors_vectors_more = []
distill_bert_ids_tensor_batch = distill_bert_ids_tensor[(nob*batch_size):]
print(distill_bert_ids_tensor_batch.shape)
output_tensor = model(distill_bert_ids_tensor_batch)[0]
for point_number in range(distill_bert_ids_tensor_batch.shape[0]):
    one_point = output_tensor[point_number]
    numpy_output = sum(one_point).numpy()
    final_numpy_vectors_vectors_more.append(numpy_output)
print(len(final_numpy_vectors_vectors_more))
print(final_numpy_vectors_vectors_more[0].shape)
```

In [ ]:
```
final_numpy_vectors.extend(final_numpy_vectors_vectors_more)
final_numpy_vectors_array = np.array(final_numpy_vectors)
np.save("final_numpy_vectors_array_all.npy", final_numpy_vectors_array)
```

In [4]:
```
# Load above file final_numpy_vectors_array_all.npy
word2vec_titles_array = np.load('final_numpy_vectors_array_all.npy')
word2vec_titles_array.shape
```

Out[4]:
```
(886680, 768)
```

In [36]:
```
all_dataframe_without_preprocess_df = pd.read_csv('all_dataframe_without_preproc
print(all_dataframe_without_preprocess_df.shape)
all_dataframe_without_preprocess_df.head(5)
```

```
(886680, 2)
```

Out[36]:

	Text	Title
0	<p>i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...
1	<p>i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...
2	<p>I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...
3	<p>I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.
4	<p>I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol

In [6]:
```
finaldf.head()
```

Out[6]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [7]:
```
# Adding one more coloumn into the data table by combining text and titles
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_text'] + " " + final
finaldf.head()
```

Out[7]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	opening window search aspx using code hav add ...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	want servlet process input standalone java pro...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	trouble using cryptostream file encryption cod...
3	new web programming trying make twitter clone ...	subquery return row error	new web programming trying make twitter clone ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	use lyx xetex output font dejavu sans write in...

In [8]:
```
# Getting all the keywords
titles_text_array = finaldf['preprocessed_titles_text'].values
keyword_index_dict = dict()
index = 0
for title_text in titles_text_array:
    titles_text_word_list = str(title_text).split()
    for keyword in titles_text_word_list:
        try:
            keyword_index_dict[keyword].append(index)
        except:
            keyword_index_dict[keyword] = []
            keyword_index_dict[keyword].append(index)
    index += 1
print("Total Number of unique keywords stored in the dictionary is: ", len(keywo
```

```
Total Number of unique keywords stored in the dictionary is:  1206787
```

In [10]:
```
# Let test some data points using cosine similarity Id =14, index=8
# https://stackoverflow.com/questions/37454785/how-to-handle-negative-values-of-
# https://stackoverflow.com/questions/34226400/find-the-index-of-the-k-smallest-

from sklearn.metrics.pairwise import cosine_similarity

def index_top_k_similar(all_arrays, test_arrays, k):
    """
    Here all_arrays shape should be (n, d) and
    test array shape should be (1, d)
    """
    # all_cosine_similarity = cosine_similarity(all_arrays, test_array.reshape(1,
    all_cosine_similarity = cosine_similarity(all_arrays, test_arrays)
    all_cosine_distances = (1 - all_cosine_similarity).reshape(1, -1)[0]

    # Since we have to select only k minimum distances so there is no need to sh
    index_of_least_distances = np.argpartition(all_cosine_distances, k)[:k]
    selected_k_cosine_distances =  all_cosine_distances[index_of_least_distances

    index_of_least_distances_sorted = np.argsort(selected_k_cosine_distances) # 
    final_index_of_least_distances_sorted = index_of_least_distances[index_of_le

    least_cosine_distances = all_cosine_distances[final_index_of_least_distances_
    return final_index_of_least_distances_sorted, least_cosine_distances
```

In [11]:
```
def get_indexes(keywords_in_question, all_data_index_dictionary):
    all_indexes = []
    for keyword in keywords_in_question:
        try:
            all_indexes.extend(all_data_index_dictionary[keyword])
        except:
            pass
    return np.array(list(set(all_indexes)))
```

In [12]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text


def preprocess_title(document):
    stop_words = set(stopwords.words('english'))
    #stemmer = SnowballStemmer('english')
    stemmer = WordNetLemmatizer()
    striped_html_text = strip_html(document)
    words = word_tokenize(str(striped_html_text.lower()))
    #Removing all single letter and and stopwords from question exceptt for the
    cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if j no
    return cleaned_document
```

In [ ]:
```
tokenizer = DistilBertTokenizer.from_pretrained('distilbert-base-cased')
model = TFDistilBertModel.from_pretrained('distilbert-base-cased')
input_ids = tf.constant(tokenizer.encode("Hello, my dog is cute"))[None, :]  # B
outputs = model(input_ids)
last_hidden_states = outputs[0]  # The last hidden-state is the first element of
print(last_hidden_states.shape)
```

In [42]:
```
def func_question_title_vectorized(question_title_preprocessed):
    """
    question_title_preprocessed Should be a single string which have preprocesse
    """
    input_ids = tf.constant(tokenizer.encode(question_title_preprocessed, pad_to
    outputs = model(input_ids)
    last_hidden_states = outputs[0]  # The last hidden-state is the first elemen
    final_vectorized_array = sum(last_hidden_states[0]).numpy().reshape(1, -1)
    return final_vectorized_array
```

In [43]:
```
func_question_title_vectorized("what is the use of loc and iloc in python?").sha
```

Out[43]:
```
(1, 768)
```

In [44]:
```
# Algorithm for detecting text
def suggest_questions_for_question_title(question_title, k):
    # Load already trained model for the detecting tags in a question which is tr
    # question_title is the title of the single question

    # Preprocess and vectorize the given question
    question_title_preprocessed = preprocess_title(question_title)
    print("Preprocessed question title is: ", question_title_preprocessed)

    question_title_vectorized = func_question_title_vectorized(question_title_pre
    print("Shape of question_title_vectorized is: ", question_title_vectorized.sh

    keywords_in_question = question_title_preprocessed.split()
    print("Keywords are: ", keywords_in_question)


    # keyword_index_dict contain keywords as keys and list of index of documents
    index_questions_keyword = get_indexes(keywords_in_question, keyword_index_di
    print("Number of data points used for search : ", len(index_questions_keywor

    # word2vec_titles_array is the pre loaded array of all vectors

    # Select only those questions which contain keyword of query question
    word2vec_titles_array_selected = word2vec_titles_array[index_questions_keywo

    a, b = index_top_k_similar(question_title_vectorized, word2vec_titles_array_s

    # a is the numpy array contain k indexes
    index_questions_keyword_similar = index_questions_keyword[a]
    recommendations = all_dataframe_without_preprocess_df.loc[index_questions_key
    return recommendations
```

In [47]:
```
# Test 1
query_question = "How to create a linked list in python?"
print("The query question is:\n", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to create a linked list in python?
Preprocessed question title is:  create linked list python
Shape of question_title_vectorized is:  (1, 768)
Keywords are:  ['create', 'linked', 'list', 'python']
Number of data points used for search :  258801
Time taken is:  0:00:01.338418
Suggestions are:
Circular Linked list in python
Creating "Typed" Lists in Python 2.5
How to create a list of lists in Python
remove list from list in python
Creating and editing lists in python
How to keep a list static in Python?
Replace element with a list in python
Compare List Similarity Python
Creating Lists in Python
create a list of integers from a to b in python
Can I create a "view" on a Python list?
Convert python list to string
Convert string to list in python
Removing items from a list in python
How can I create a list in Python?
```

In [48]:
```
# Test 2
query_question = "How to reverse a linked list in C?"
print("The query question is:\n", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to reverse a linked list in C?
Preprocessed question title is:  reverse linked list c
Shape of question_title_vectorized is:  (1, 768)
Keywords are:  ['reverse', 'linked', 'list', 'c']
Number of data points used for search :  238314
Time taken is:  0:00:01.256638
Suggestions are:
How to reverse linked list C++
Displaying a Linked List C++
Sorting a linked list in C
Linked List crashing, c
creating a linked list in c++?
Double Linked List in C
Error with Linked Lists in C++
Linked list sorting in C
Linked List in C
More linked lists in C
linked list in C++
Linked List C Error
Linked List Stack in C
Issue with Linked Lists - C++
Issue with linked list in c
```

In [ ]:

Approach 4, Topic modeling With Jenson shannon distance

In [14]:
```
# https://www.analyticsvidhya.com/blog/2016/08/beginners-guide-to-topic-modeling
# Importing the non preprocessed text and title dataframe
all_dataframe_without_preprocess_df = pd.read_csv('all_dataframe_without_preproc
print(all_dataframe_without_preprocess_df.shape)
all_dataframe_without_preprocess_df.head(5)
```

```
(886680, 2)
```

Out[14]:

	Text	Title
0	<p>i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...
1	<p>i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...
2	<p>I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...
3	<p>I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.
4	<p>I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol

In [15]:
```
# Reading preprocessed data from the saved file
finaldf = pd.read_csv('final_df.csv')
print("The shape of the final dataframe is: ", finaldf.shape)
finaldf.head()
```

```
The shape of the final dataframe is:  (886680, 2)
```

Out[15]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [16]:
```
# Adding one more coloumn into the data table by combining text and titles
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_text'] + finaldf['pr
finaldf.head()
```

Out[16]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	opening window search aspx using code hav add ...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	want servlet process input standalone java pro...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	trouble using cryptostream file encryption cod...
3	new web programming trying make twitter clone ...	subquery return row error	new web programming trying make twitter clone ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	use lyx xetex output font dejavu sans write in...

In [ ]:

In [3]:
```
final_df_titles = pd.read_csv('final_df_temp.csv', names=['preprocessed_titles']
final_df_titles.head()
```

Out[3]:

	preprocessed_titles
0	btnadd click event open two window record added
1	java lang nosuchmethoderror javax servlet serv...
2	specified initialization vector iv match block...
3	subquery return row error
4	fi fl result big like symbol

In [4]:
```
# Preparting the cleaned and splitted text for topic moddling
doc_clean = [str(doc).split() for doc in final_df_titles['preprocessed_titles'].
```

In [5]:
```
# Counting all words present and unique words present
all_title_text_words = []
for i in doc_clean:
    for j in i:
        all_title_text_words.append(j)

all_title_text_words_set_len = len(list(set(all_title_text_words)))
print(all_title_text_words_set_len)

all_title_text_words_len = len(all_title_text_words)
print(all_title_text_words_len)
```

```
93198
4992036
```

In [6]:
```
# importing gensim for LDA and converting text to Bag of words text
import gensim
from gensim import corpora

# Creating the dictionary of words
dictionary = corpora.Dictionary(doc_clean)
# Filer words from the dictionary
dictionary.filter_extremes(no_below=10, no_above=0.99)

doc_term_matrix = [dictionary.doc2bow(doc) for doc in doc_clean]
```

In [7]:
```
print("Total number of key value pair stored in dictionary are: ", len(dictionar
```

```
Total number of key value pair stored in dictionary are:  14492
```

In [8]:
```
# printing some words from the dictionary
for key in range(10):
    print(dictionary[key])
```

```
added
click
event
open
record
two
window
java
javax
lang
```

In [9]:
```
print("length of Doc term matrix is: ", len(doc_term_matrix))
for matrix in doc_term_matrix[:10]:
    print(matrix)
```

```
length of Doc term matrix is:  886680
[(0, 1), (1, 1), (2, 1), (3, 1), (4, 1), (5, 1), (6, 1)]
[(7, 1), (8, 1), (9, 1), (10, 1), (11, 1), (12, 1), (13, 1), (14, 1), (15, 1)]
[(16, 1), (17, 1), (18, 1), (19, 1), (20, 1), (21, 1), (22, 1), (23, 1), (24,
1)]
[(25, 1), (26, 1), (27, 1), (28, 1)]
[(29, 1), (30, 1), (31, 1), (32, 1), (33, 1), (34, 1)]
[(35, 1), (36, 1), (37, 1), (38, 1), (39, 1), (40, 1)]
[(3, 1), (6, 1), (41, 1), (42, 1), (43, 1), (44, 1)]
[(45, 1), (46, 1), (47, 1), (48, 1), (49, 1)]
[(23, 1), (50, 1), (51, 1), (52, 1), (53, 1), (54, 1), (55, 1), (56, 1), (57,
1), (58, 1), (59, 1), (60, 1), (61, 1), (62, 1)]
[(63, 1), (64, 1), (65, 1), (66, 1)]
```

In [10]:
```
# Creating the object for LDA model using gensim library
Lda = gensim.models.LdaMulticore

# Running and Trainign LDA model on the document term matrix.
# Choosing number of topics as 100
ldamodel = Lda(doc_term_matrix, num_topics=150, id2word = dictionary, passes=20)
```

In [11]:
```
# Calculating the topics probability distribution for all documents in the corpus
all_docs_prob_distribution = []
for doc_term_bow in doc_term_matrix:
    one_doc_prob_distribution = np.array([tup[1] for tup in ldamodel.get_documen
    all_docs_prob_distribution.append(one_doc_prob_distribution)
all_docs_prob_distribution = np.array(all_docs_prob_distribution)
print(all_docs_prob_distribution.shape)
```

```
(886680, 150)
```

In [ ]:

inspection of some topics

In [12]:
```
ldamodel.show_topics()
```

Out[12]:
```
[(123,
  '0.597*"app" + 0.228*"j" + 0.055*"compiler" + 0.048*"node" + 0.046*"express"
+ 0.020*"beta" + 0.003*"obsolete" + 0.000*"conditionals" + 0.000*"dart" + 0.000
*"cyclical"'),
 (8,
  '0.673*"value" + 0.184*"like" + 0.075*"current" + 0.050*"making" + 0.009*"pos
tback" + 0.006*"act" + 0.000*"datepickers" + 0.000*"conditionals" + 0.000*"reop
en" + 0.000*"fn"'),
 (98,
  '0.483*"application" + 0.190*"cs" + 0.061*"detect" + 0.056*"full" + 0.040*"ne
eded" + 0.031*"gwt" + 0.029*"filtering" + 0.017*"margin" + 0.016*"ok" + 0.016
*"white"'),
 (94,
  '0.241*"loop" + 0.227*"size" + 0.090*"last" + 0.088*"always" + 0.078*"develop
ment" + 0.056*"bad" + 0.056*"decision" + 0.050*"jsp" + 0.048*"jsf" + 0.021*"l
i"'),
 (21,
  '0.241*"activity" + 0.183*"symfony" + 0.147*"main" + 0.127*"alternative" + 0.
069*"clear" + 0.065*"fragment" + 0.059*"intent" + 0.045*"flag" + 0.019*"using"
+ 0.019*"initialized"'),
 (75,
  '0.324*"read" + 0.281*"message" + 0.227*"state" + 0.040*"keeping" + 0.038*"go
ing" + 0.027*"press" + 0.020*"ctrl" + 0.012*"alt" + 0.012*"hp" + 0.006*"nc"'),
 (9,
  '0.289*"path" + 0.213*"used" + 0.192*"dynamically" + 0.103*"virtual" + 0.055
*"live" + 0.039*"provider" + 0.023*"asynchronous" + 0.021*"physical" + 0.021*"c
ompiled" + 0.015*"hyper"'),
 (126,
  '0.179*"context" + 0.171*"domain" + 0.131*"stored" + 0.114*"mode" + 0.111*"pr
ocedure" + 0.073*"boost" + 0.067*"apply" + 0.051*"transaction" + 0.026*"sometim
es" + 0.022*"may"'),
 (27,
  '0.515*"image" + 0.125*"remove" + 0.083*"device" + 0.072*"computer" + 0.070
*"remote" + 0.047*"using" + 0.045*"entry" + 0.028*"medium" + 0.007*"administrat
or" + 0.004*"wmi"'),
 (50,
  '0.288*"content" + 0.189*"difference" + 0.145*"nested" + 0.101*"empty" + 0.09
0*"silverlight" + 0.073*"width" + 0.032*"divs" + 0.025*"using" + 0.023*"busines
s" + 0.014*"creates"')]
```

In [17]:
```
# Getting all the keywords
titles_text_array = finaldf['preprocessed_titles_text'].values
keyword_index_dict = dict()
index = 0
for title_text in titles_text_array:
    titles_text_word_list = str(title_text).split()
    for keyword in titles_text_word_list:
        try:
            keyword_index_dict[keyword].append(index)
        except:
            keyword_index_dict[keyword] = []
            keyword_index_dict[keyword].append(index)
    index += 1
print("Total Number of unique keywords stored in the dictionary is: ", len(keywo
```

```
Total Number of unique keywords stored in the dictionary is:  1664772
```

In [101]:
```
for key in keyword_index_dict.keys():
    keyword_index_dict[key] = list(set(keyword_index_dict[key]))
print("Total Number of unique keywords stored in the dictionary is: ", len(keywo
```

```
Total Number of unique keywords stored in the dictionary is:  1664772
```

In [84]:
```
from scipy.spatial.distance import jensenshannon
def calc_jensenshannon_dist(p, q):
    return jensenshannon(p, q)
```

In [90]:
```
# https://scipy.github.io/devdocs/generated/scipy.spatial.distance.jensenshannon
# https://stackoverflow.com/questions/34226400/find-the-index-of-the-k-smallest-

from sklearn.metrics import pairwise_distances

def index_top_k_similar(test_array, all_arrays, k):

    # Convert list of distances into numpy array
    all_js_distances_array = pairwise_distances(all_arrays, test_array, metric=c

    # Since we have to select only k minimum distances so there is no need to sh
    index_of_least_distances = np.argpartition(all_js_distances_array, k)[:k]

    least_distances = all_js_distances_array[index_of_least_distances]
    return index_of_least_distances, least_distances
```

In [117]:
```
def get_indexes(keywords_in_question, all_data_index_dictionary):
    all_indexes = []
    all_keywords = [keywords_in_question[i]+keywords_in_question[i+1] for i in r
    all_keywords.extend(keywords_in_question)

    for keyword in all_keywords:
        try:
            all_indexes.extend(all_data_index_dictionary[keyword])
        except:
            pass
    return np.array(list(set(all_indexes)))
```

In [92]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text


def preprocess_title(document):
    stop_words = set(stopwords.words('english'))
    #stemmer = SnowballStemmer('english')
    stemmer = WordNetLemmatizer()
    striped_html_text = strip_html(document)
    words = word_tokenize(str(striped_html_text.lower()))
    #Removing all single letter and and stopwords from question exceptt for the 
    cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if j no
    return cleaned_document
```

In [118]:
```
# Algorithm for detecting text
def suggest_questions_for_question_title(question_title, k):
    # Load already trained model for the detecting tags in a question which is tr
    # question_title is the title of the single question

    # Preprocess and vectorize the given question
    question_title_preprocessed_words = str(preprocess_title(question_title)).spl

    # Convert preprocessed title into bag of words using the dictionary
    question_title_preprocessed_bow = dictionary.doc2bow(question_title_preproces

    query_doc_prob_distribution = np.array([tup[1] for tup in ldamodel.get_docum

    print("query_doc_prob_distribution shape is: ",query_doc_prob_distribution.sl

    keywords_in_question = question_title_preprocessed_words

    # keyword_index_dict contain keywords as keys and list of index of documents
    index_questions_keyword = get_indexes(keywords_in_question, keyword_index_di


    # Select only those questions which contain keyword of query question
    word2vec_titles_array_selected = all_docs_prob_distribution[index_questions_k

    a, b = index_top_k_similar(query_doc_prob_distribution, word2vec_titles_array

    # a is the numpy array contain k indexes
    index_questions_keyword_similar = index_questions_keyword[a]
    recommendations = all_dataframe_without_preprocess_df.loc[index_questions_key
    return recommendations
```

In [121]:
```
# Test 1
query_question = "How to create a linked list in python?"
print("The query question is:\n", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to create a linked list in python?
query_doc_prob_distribution shape is:  (1, 150)
Time taken is:  0:00:10.530826
Suggestions are:
How do I create a list of timedeltas in python?
How do I create lists in Python while using object oriented programming?
Python - manipulating lists to create another list
Create a list of tuples from list in python
how to create a list of identical tuples in python
python: create list of tuples from lists
Using python to create an average out of a list of times
How can I create a list in Python?
How do you include newlines in a python list unpack?
Python create custom NaN
How to create a list of lists in Python
Create a list of defaultdict in python
Does Python use linked lists for lists? Why is inserting slow?
create and initialize python list
How do you create an indexable empty list in python?
```

In [123]:
```
# Test 2
query_question = "How to reverse a linked list in C?"
print("The query question is:\n", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to reverse a linked list in C?
query_doc_prob_distribution shape is:  (1, 150)
Time taken is:  0:00:10.649547
Suggestions are:
Lists - C (Homework)
List Output in C#
Iterator over a list of pairs in C++?
Iterating over list of structs
lists in structs in F#?
Convert list to double[][] in C#3.0
List comparison in C#
C# generic list is not being garbage collected
Implementing Skip List in C++
F# discriminated union picking 0 or 1 from a list
Convert List of KeyValuePair into IDictionary "C#"
ANTLR C grammar, optional init_declarator_list?
c# List<Class> Additions
Linked List substring in c
C++ iterator of list
```

In [ ]:

Approach 5, Doc2Vec and Clusturing

In [22]:
```
all_dataframe_without_preprocess_df = pd.read_csv('all_dataframe_without_preproc
print(all_dataframe_without_preprocess_df.shape)
all_dataframe_without_preprocess_df.head(5)
```

```
(886680, 2)
```

Out[22]:

	Text	Title
0	<p>i m opening window(search.aspx)using below ...	btnAdd click event opens two window after r...
1	<p>i want to have a servlet to process inputs ...	java.lang.NoSuchMethodError: javax.servlet.S...
2	<p>I've had troubles using an CryptoStream for...	"Specified initialization vector (IV) does no...
3	<p>I am new to web programming and I'm trying ...	"subquery returns more than 1 row" error.
4	<p>I use LyX with XeTeX, and the output font i...	'fi' or 'fl' result in big "S"-like symbol

In [23]:
```
# Reading preprocessed data from the saved file
finaldf = pd.read_csv('final_df.csv')
print("The shape of the final dataframe is: ", finaldf.shape)
finaldf.head()
```

```
The shape of the final dataframe is:  (886680, 2)
```

Out[23]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [24]:
```
# Adding one more coloumn into the data table by combining text and titles
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_text'] + finaldf['pr
finaldf.head()
```

Out[24]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	opening window search aspx using code hav add ...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	want servlet process input standalone java pro...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	trouble using cryptostream file encryption cod...
3	new web programming trying make twitter clone ...	subquery return row error	new web programming trying make twitter clone ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	use lyx xetex output font dejavu sans write in...

In [2]:
```
final_df_small = pd.read_csv('final_df_temp.csv', names=['preprocessed_titles'])
print(final_df_small.shape)
final_df_small.head()
```

```
(886680, 1)
```

Out[2]:

	preprocessed_titles
0	btnadd click event open two window record added
1	java lang nosuchmethoderror javax servlet serv...
2	specified initialization vector iv match block...
3	subquery return row error
4	fi fl result big like symbol

In [3]:
```
# Preparing the text for the doc2vec training
title_text_splitted = [str(doc).split() for doc in final_df_small['preprocessed_
from gensim.models.doc2vec import Doc2Vec, TaggedDocument

# Preparing the tagged document
documents = [TaggedDocument(doc, [i]) for i, doc in enumerate(title_text_splitte

# Trainig doc2vec model
model = Doc2Vec(documents, vector_size=400, window=10, min_count=1, workers=8)
```

In [4]:
```
all_titles_doc2vec = []
for title_splitted in title_text_splitted:
    all_titles_doc2vec.append(model.infer_vector(title_splitted))
all_titles_doc2vec_array = np.array(all_titles_doc2vec)
all_titles_doc2vec_array.shape
```

Out[4]:
```
(886680, 400)
```

In [5]:
```
# Apply K means++ clustering on the all_titles_doc2vec_array
from sklearn.cluster import KMeans
number_of_clusters = 31
kmeans = KMeans(n_clusters=number_of_clusters, random_state=42, n_jobs=-1)
kmeans.fit(all_titles_doc2vec_array)
```

Out[5]:
```
KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
       n_clusters=31, n_init=10, n_jobs=-1, precompute_distances='auto',
       random_state=42, tol=0.0001, verbose=0)
```

In [6]:
```
# Find cluster predictions for the allthe points
predictions = kmeans.predict(all_titles_doc2vec_array)
predictions
```

Out[6]:
```
array([25,  5, 24, ...,  6, 23, 30])
```

In [7]:
```
# Build a dictionary which contain key as cluster number and value as a list
# list contain index of all the points which belongs to that clusters number
cluster_point_dict = dict()
for cluster_number in range(number_of_clusters):
    cluster_point_dict[cluster_number] = list(np.where(predictions == cluster_nu
```

In [8]:
```
# Calculate length of various clusters
print("Cluster Number      |     Number of Points")
for i in range(number_of_clusters):
    print(i,"               |              ", len(cluster_point_dict[i]))
    print("*"*50)
```

```
Cluster Number      |     Number of Points
0                |               7593
**************************************************
1                |               10492
**************************************************
2                |               5511
**************************************************
3                |               6918
**************************************************
4                |               5949
**************************************************
5                |               45119
**************************************************
6                |               130076
**************************************************
7                |               9507
**************************************************
8                |               10345
**************************************************
9                |               4790
**************************************************
10                |               10066
**************************************************
11                |               5127
**************************************************
12                |               21379
**************************************************
13                |               82127
**************************************************
14                |               53777
**************************************************
15                |               40923
**************************************************
16                |               13188
**************************************************
17                |               19886
**************************************************
18                |               10075
**************************************************
19                |               4505
**************************************************
20                |               5102
**************************************************
21                |               9596
**************************************************
22                |               5990
**************************************************
23                |               19857
**************************************************
24                |               31998
```

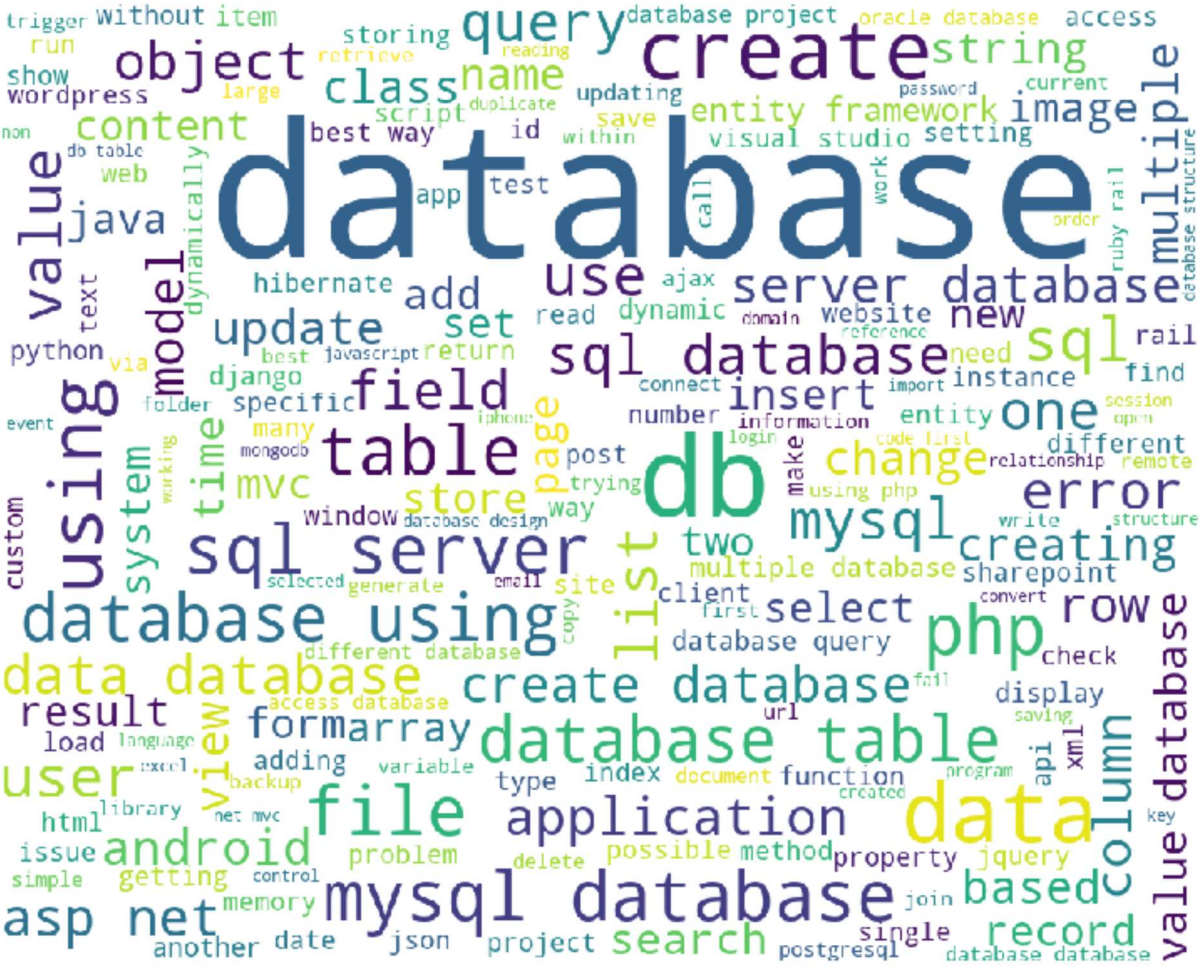
```
**************************************************
25                |               40173
**************************************************
26                |               7478
**************************************************
27                |               6947
**************************************************
28                |               37665
**************************************************
29                |               122883
**************************************************
30                |               101638
**************************************************
```

In [9]:
```
%matplotlib inline
```

In [12]:
```
def draw_wordcloud(clusterNumber):
    # Show Wordnet for some clusters

    # importing all necessery modules
    from wordcloud import WordCloud, STOPWORDS
    import matplotlib.pyplot as plt

    # Preparing data
    all_words = ""
    for ind in cluster_point_dict[clusterNumber]:
        all_words = all_words + " " + str(final_df_small['preprocessed_titles'].
    print(len(all_words))

    stopwords = set(STOPWORDS)

    wordcloud = WordCloud(width = 1000, height = 800,
                          background_color ='white', stopwords = stopwords, min_

    # plot the WordCloud image
    plt.figure(figsize = (10, 8), facecolor = None)
    plt.imshow(wordcloud)
    plt.axis("off")
    plt.tight_layout(pad = 0)
    plt.show()
```

In [13]:
```
draw_wordcloud(3)
```

311463



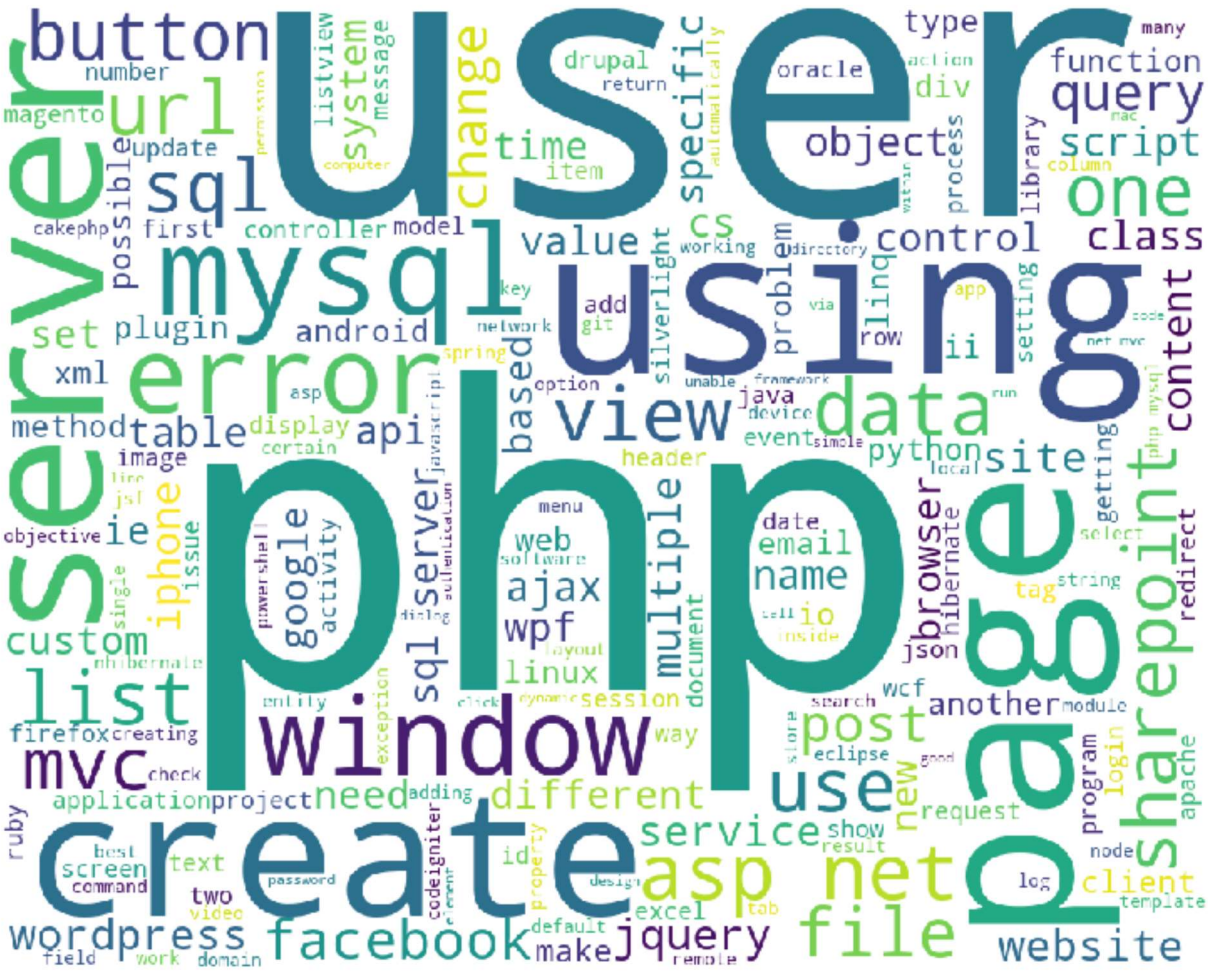
In [14]:
```
draw_wordcloud(5)
```

1816373

create
using
use
problem
error
data
window
set
function
android
work
asp
net
python
java
one
code
object
multiple
algorithm
issue
based
class
method
without
value
model
list
file
image
make
possible
page
time
different
difference
number
change
php
user
system
getting
server
add
jquery
linux
mvc
application
working
display
call
text
best way
update
content
database
convert
custom
element
creating
inside
build
show
find
need
program
javascript
iphone
used
type
name
string
visual studio
access
input
array
output
form
load
fail
remove
simple
running
property
settings
link
api
specific
library
framework
entity
machine learning
neural network
ruby rail
exception
package
request
solution
interface
filter
format
log
message
project
html
good
div
generate
cs
mode
line
instead
size
view
support
field
process
client
another
found
first
check
question
graph
variable
attribute
return
run
via
start
given
word
non
query
option
button
group
need help
local
feature
state
date
character
stop
test
mac
node
domain
tag
open
google map
many many
adding
looking
point
parameter
browser
read
save
tool
showing
io
space
version
plugin
web application
ubuntu
control
command
implement
network
etc
rail
path
order
install
missing
folder
cause
app
web service
single
performance
sql server
within
objective
bit
state
output
feature
form
load
date
test
fail
remove
build
entity
framework
library
specific
script
looking
point
save
tool
showing
io
creating
read
space
version
plugin
web application
ubuntu
control
call
working
element
custom
convert
database
content
update
difference
number
best way
parameter
different
text
implement
command
function
set
window
simple
time
page
data
add
server
getting
model
system
jquery
without
linux
value
change
net
mvc
user
php
asp
net
list
make
possible
file
image
work
android
function
set
text
different
best way
update
difference
number

In [17]:
```
draw_wordcloud(15)
```

1735196


user
using
php
page
server
create
window
mysql
error
button
sql
list
mvc
wordpress
facebook
asp
net
file
website
jquery
sharepoint
browser
data
view
table
api
google
iphone
ajax
wpf
linux
post
use
different
service
need
project
application
firefox
custom
ie
objective
xml
set
plugin
android
method
image
display
header
python
site
email
name
date
web
multiple
server
sql
session
another
wcf
search
eclipse
new
request
show
result
client
log
node
template
login
program
apache
module
redirect
getting
select
tag
string
hibernate
io
inside
ruby
screen
text
command
two
video
best
field
work
domain
make
excel
tab
default
password
code
run
net mvc
framework
device
event
simple
local
unable
option
asp
javascript
spring
network
git
key
app
via
working
directory
problem
linq
row
silverlight
add
setting
ii
control
value
cs
class
one
script
function
query
type
many
oracle
drupal
return
div
objects
process
library
column
mac
specific
automatically
change
time
item
system
listview
message
magento
update
number
cakephp
first
controller
model
possible
content
code
run
mysql
php
page
sharepoint
redirect
apache
login
program
client
template
node
log
show
result
request
new
wcf
another
post
use
different
need
project
application
firefox
custom
ie
objective
xml
set
plugin
android
method
image
display
header
python
site
email
name
date
web
multiple
server
sql
session
linux
wpf
ajax
google
iphone
list
mvc
wordpress
facebook
asp
net
file
website
jquery

In [18]:
```
draw_wordcloud(20)
```

228503

In [19]:
```
# Let test some data points using cosine similarity Id =14, index=8
# https://stackoverflow.com/questions/37454785/how-to-handle-negative-values-of-c
# https://stackoverflow.com/questions/34226400/find-the-index-of-the-k-smallest-v

from sklearn.metrics.pairwise import cosine_similarity

def index_top_k_similar(test_array, all_arrays, k):
    # all_cosine_similarity = cosine_similarity(all_arrays, test_array.reshape(1,
    all_cosine_similarity = cosine_similarity(all_arrays, test_array.reshape(1, 
    all_cosine_distances = (1 - all_cosine_similarity).reshape(1, -1)[0]

    # Since we have to select only k minimum distances so there is no need to sho
    index_of_least_distances = np.argpartition(all_cosine_distances, k)[:k]
    # index_of_least_distances = np.argsort(all_cosine_distances)[:k]
    least_cosine_distances = all_cosine_distances[index_of_least_distances]
    return index_of_least_distances, least_cosine_distances
```

In [20]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text


def preprocess_title(document):
    stop_words = set(stopwords.words('english'))
    #stemmer = SnowballStemmer('english')
    stemmer = WordNetLemmatizer()
    striped_html_text = strip_html(document)
    words = word_tokenize(str(striped_html_text.lower()))
    #Removing all single letter and and stopwords from question exceptt for the 
    cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if j not
    return cleaned_document
```

In [25]:
```
# Algorithm for detecting text
def suggest_questions_for_question_title(question_title, k):

    # Preprocess and vectorize the given question
    question_title_preprocessed = str(preprocess_title(question_title)).split()

    question_title_vectorized = model.infer_vector(question_title_preprocessed)

    predicted_cluster = kmeans.predict(question_title_vectorized.reshape(1, -1))

    # Get all the other points indexes which belongs to predicted clsuter
    index_questions_keyword = cluster_point_dict[predicted_cluster]

    # Select only those questions which contain keyword of query question
    doc2vec_titles_array_selected = all_titles_doc2vec_array[index_questions_keyw

    a, b = index_top_k_similar(question_title_vectorized, doc2vec_titles_array_s

    # a is the numpy array contain k indexes
    index_questions_keyword_array = np.array(index_questions_keyword)
    index_questions_keyword_similar = index_questions_keyword_array[a]
    recommendations = all_dataframe_without_preprocess_df.loc[index_questions_key
    return recommendations
```

In [28]:
```
# Test 1
query_question = "How to create a linked list in python?"
print("The query question is:\n", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)
print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to create a linked list in python?
Time taken is:  0:00:00.129627
Suggestions are:
Python non-ascii characters
How can I create a regular expression in Python?
How to create a programming language in Python
Python, rrdtool create - time stamp, timezone
python create celery task job
How to create <!DOCTYPE> with Python's cElementTree
Python: My server mail is sent to spam
python and static methods
How can I subtract a day from a python date?
python functional testing
Creating Bar Charts in Python
Python in Vim buffer?
python compare two dates
Using Python to match an exact word
Python Peewee resets primary key
```

In [27]:
```
# Test 2
query_question = "How to reverse a linked list in C?"
print("The query question is:\n", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)
print("Time taken is: ", datetime.now()-start)
print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:
 How to reverse a linked list in C?
Time taken is:  0:00:01.214815
Suggestions are:
C++ linking to libraries with makefile (newbe)
How to pass a pointer to a member function to a C function?
Aes encryption in c++
C - Convert GIF to JPG
Unresolved external symbol vftable c++
Setting environment variable in C
Traversing Z3_ast tree in C/C++
C random number generator
Deserialize JSON string to c# object
convert from char to hex in C++
C++ references Vs C# references
c function pointers
Crop image in c#
Strange C syntax
A dynamic 2 dimensional array in C++?
```

Universal sentence encoder method with cosine similarity

In [2]:
```
# importing tensorflow hub
import tensorflow_hub as hub
print(hub.__version__)
```

```
0.8.0
```

In [3]:
```
embed = hub.load("https://tfhub.dev/google/universal-sentence-encoder/4")
embeddings = embed([
    "The quick brown fox jumps over the lazy dog.",
    "I am a sentence for which I would like to get its embedding"])

print(embeddings)
print(embeddings[1].numpy().shape)
```

```
tf.Tensor(
[[-0.03133018 -0.06338634 -0.01607502 ... -0.03242778 -0.04575741
   0.05370456]
 [ 0.0508086  -0.01652428  0.01573781 ...  0.00976659  0.03170123
   0.01788119]], shape=(2, 512), dtype=float32)
(512,)
```

In [4]:
```
# Load the preprocesed data
import pandas as pd
final_df_titles = pd.read_csv('final_df_temp.csv', names=['preprocessed_titles']
final_df_titles.fillna("0", inplace=True)
print(final_df_titles.shape)
final_df_titles.head()
```

```
(886680, 1)
```

Out[4]:

	preprocessed_titles
0	btnadd click event open two window record added
1	java lang nosuchmethoderror javax servlet serv...
2	specified initialization vector iv match block...
3	subquery return row error
4	fi fl result big like symbol

In [5]:
```
# all_titles_embeddings = embed(list(final_df_titles['preprocessed_titles'].valu
# all_titles_embeddings = all_titles_embeddings.numpy()
# print(all_titles_embeddings.shape)
# np.save('all_titles_embeddings.npy', all_titles_embeddings)
```

Out[5]:
```
(886680, 512)
```

In [5]:
```
# If you don't have the 'all_titles_embeddings.npy' file which is numpy vectors
# using universal sentence encoder, then uncomment the above cell and run it. It
word2vec_titles_array = np.load('all_titles_embeddings.npy')
word2vec_titles_array.shape
```

Out[5]:
```
(886680, 512)
```

In [6]:
```
all_dataframe_without_preprocess_df = pd.read_csv('all_dataframe_without_preproc
print(all_dataframe_without_preprocess_df.shape)
all_dataframe_without_preprocess_df.head(5)
```

```
(886680, 1)
```

Out[6]:

	Title
0	btnAdd click event opens two window after r...
1	java.lang.NoSuchMethodError: javax.servlet.S...
2	"Specified initialization vector (IV) does no...
3	"subquery returns more than 1 row" error.
4	'fi' or 'fl' result in big "S"-like symbol

In [7]:
```
# Reading preprocessed data from the saved file
finaldf = pd.read_csv('final_df.csv')
print("The shape of the final dataframe is: ", finaldf.shape)
finaldf.head()
```

```
The shape of the final dataframe is:  (886680, 2)
```

Out[7]:

	preprocessed_text	preprocessed_titles
0	opening window search aspx using code hav add ...	btnadd click event open two window record added
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...
3	new web programming trying make twitter clone ...	subquery return row error
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol

In [8]:
```
# Adding one more coloumn into the data table by combining text and titles
finaldf['preprocessed_titles_text'] = finaldf['preprocessed_text'] + " " + final
finaldf.head()
```

Out[8]:

	preprocessed_text	preprocessed_titles	preprocessed_titles_text
0	opening window search aspx using code hav add ...	btnadd click event open two window record added	opening window search aspx using code hav add ...
1	want servlet process input standalone java pro...	java lang nosuchmethoderror javax servlet serv...	want servlet process input standalone java pro...
2	trouble using cryptostream file encryption cod...	specified initialization vector iv match block...	trouble using cryptostream file encryption cod...
3	new web programming trying make twitter clone ...	subquery return row error	new web programming trying make twitter clone ...
4	use lyx xetex output font dejavu sans write in...	fi fl result big like symbol	use lyx xetex output font dejavu sans write in...

In [9]:
```
# Getting all the keywords
titles_text_array = finaldf['preprocessed_titles_text'].values
keyword_index_dict = dict()
index = 0
for title_text in titles_text_array:
    titles_text_word_list = str(title_text).split()
    for keyword in titles_text_word_list:
        try:
            keyword_index_dict[keyword].append(index)
        except:
            keyword_index_dict[keyword] = []
            keyword_index_dict[keyword].append(index)
    index += 1
print("Total Number of unique keywords stored in the dictionary is: ", len(keywo
```

```
Total Number of unique keywords stored in the dictionary is:  1206787
```

In [10]:
```
for key in keyword_index_dict.keys():
    keyword_index_dict[key] = list(set(keyword_index_dict[key]))
print("Total Number of unique keywords stored in the dictionary is: ", len(keywo
```

```
Total Number of unique keywords stored in the dictionary is:  1206787
```

In [11]:
```
# Let test some data points using cosine similarity Id =14, index=8
# https://stackoverflow.com/questions/37454785/how-to-handle-negative-values-of-
# https://stackoverflow.com/questions/34226400/find-the-index-of-the-k-smallest-

from sklearn.metrics.pairwise import cosine_similarity

def index_top_k_similar(all_arrays, test_arrays, k):
    """
    Here all_arrays shape should be (n, d) and
    test array shape should be (1, d)
    """
    # all_cosine_similarity = cosine_similarity(all_arrays, test_array.reshape(1,
    all_cosine_similarity = cosine_similarity(all_arrays, test_arrays)
    all_cosine_distances = (1 - all_cosine_similarity).reshape(1, -1)[0]

    # Since we have to select only k minimum distances so there is no need to sho
    index_of_least_distances = np.argpartition(all_cosine_distances, k)[:k]
    selected_k_cosine_distances =  all_cosine_distances[index_of_least_distances

    index_of_least_distances_sorted = np.argsort(selected_k_cosine_distances) # 
    final_index_of_least_distances_sorted = index_of_least_distances[index_of_le

    least_cosine_distances = all_cosine_distances[final_index_of_least_distances_
    return final_index_of_least_distances_sorted, least_cosine_distances
```

In [12]:
```
def get_indexes(keywords_in_question, all_data_index_dictionary):
    all_indexes = []
    for keyword in keywords_in_question:
        try:
            all_indexes.extend(all_data_index_dictionary[keyword])
        except:
            pass
    return np.array(list(set(all_indexes)))
```

In [13]:
```
import re  # For using regular expression
def strip_html(data):
    cleanr = re.compile('<.*?>')
    cleancode = re.compile('<code>.*?</code>')

    clean_text = re.sub(cleanr, ' ', data)
    clean_text = re.sub(cleancode, ' ', clean_text)
    clean_text = re.sub(r'[^A-Za-z]+',' ',clean_text)
    clean_text = clean_text.lower()
    return clean_text


def preprocess_title(document):
    stop_words = set(stopwords.words('english'))
    #stemmer = SnowballStemmer('english')
    stemmer = WordNetLemmatizer()
    striped_html_text = strip_html(document)
    words = word_tokenize(str(striped_html_text.lower()))
    #Removing all single letter and and stopwords from question exceptt for the 
    cleaned_document = ' '.join(str(stemmer.lemmatize(j)) for j in words if j no
    return cleaned_document
```

In [14]:
```
question_title_preprocessed = "what is the use of loc and iloc in python?"
embed([question_title_preprocessed]).numpy().shape
```

Out[14]:
```
(1, 512)
```

In [15]:
```
# Algorithm for detecting text
def suggest_questions_for_question_title(question_title, k):
    # Load already trained model for the detecting tags in a question which is tr
    # question_title is the title of the single question

    # Preprocess and vectorize the given question
    question_title_preprocessed = preprocess_title(question_title)
    print("Preprocessed question title is: ", question_title_preprocessed)

    question_title_vectorized = embed([question_title_preprocessed]).numpy()
    print("Shape of question_title_vectorized is: ", question_title_vectorized.sl

    keywords_in_question = question_title_preprocessed.split()
    print("Keywords are: ", keywords_in_question)


    # keyword_index_dict contain keywords as keys and list of index of documents
    index_questions_keyword = get_indexes(keywords_in_question, keyword_index_di
    print("Number of data points used for search : ", len(index_questions_keywor

    # word2vec_titles_array is the pre loaded array of all vectors

    # Select only those questions which contain keyword of query question
    word2vec_titles_array_selected = word2vec_titles_array[index_questions_keywo

    a, b = index_top_k_similar(question_title_vectorized, word2vec_titles_array_

    # a is the numpy array contain k indexes
    index_questions_keyword_similar = index_questions_keyword[a]
    recommendations = all_dataframe_without_preprocess_df.loc[index_questions_ke
    return recommendations
```

In [20]:
```
# Test 1
query_question = "How to create a linked list in python?"
print("The query question is: ", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)

print("Time taken is: \n", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:  How to create a linked list in python?
Preprocessed question title is:  create linked list python
Shape of question_title_vectorized is:  (1, 512)
Keywords are:  ['create', 'linked', 'list', 'python']
Number of data points used for search :  258801
Time taken is:
 0:00:00.870647
Suggestions are:
linked list in python
Linked Lists Python 2.7
circularly linked list in python
Python; Linked list and traversing!
Concatenate Python Linked List
Circular Linked list in python
Why Python doesn't have a native Linked List implementation?
Python linked list O(1) insert/remove
doubly Linked list iterator python
single linked list reverse in python
Singly Linked List with special methods in python, stuck
Does Python use linked lists for lists? Why is inserting slow?
Faster way to create a linked list of n-length in Python
python linked list evaluation on the node of self
How to create a linked list with a given size(java)?
```

In [22]:
```
# Test 2
query_question = "How to reverse a linked list in C?"
print("The query question is: ", query_question)

start = datetime.now()
recommendations = suggest_questions_for_question_title(query_question, 15)

print("Time taken is:\n ", datetime.now()-start)

print("Suggestions are: ")
for recom in recommendations:
    print(recom)
```

```
The query question is:  How to reverse a linked list in C?
Preprocessed question title is:  reverse linked list c
Shape of question_title_vectorized is:  (1, 512)
Keywords are:  ['reverse', 'linked', 'list', 'c']
Number of data points used for search :  238314
Time taken is:
  0:00:00.794873
Suggestions are:
How to reverse linked list C++
Reversing a singly linked list in C
How to reverse a linked list?
reverse a linked list?
reverse printing of linked list in c
Modifying Linked Lists in C++
Singly Linked List - C
Sort a linked list in C++
Reversing a linked list
reversing linked list
Linked List in C
More linked lists in C
linked list in C++
reverse linked list problem
Doubly linked list in C
```

In [ ]:

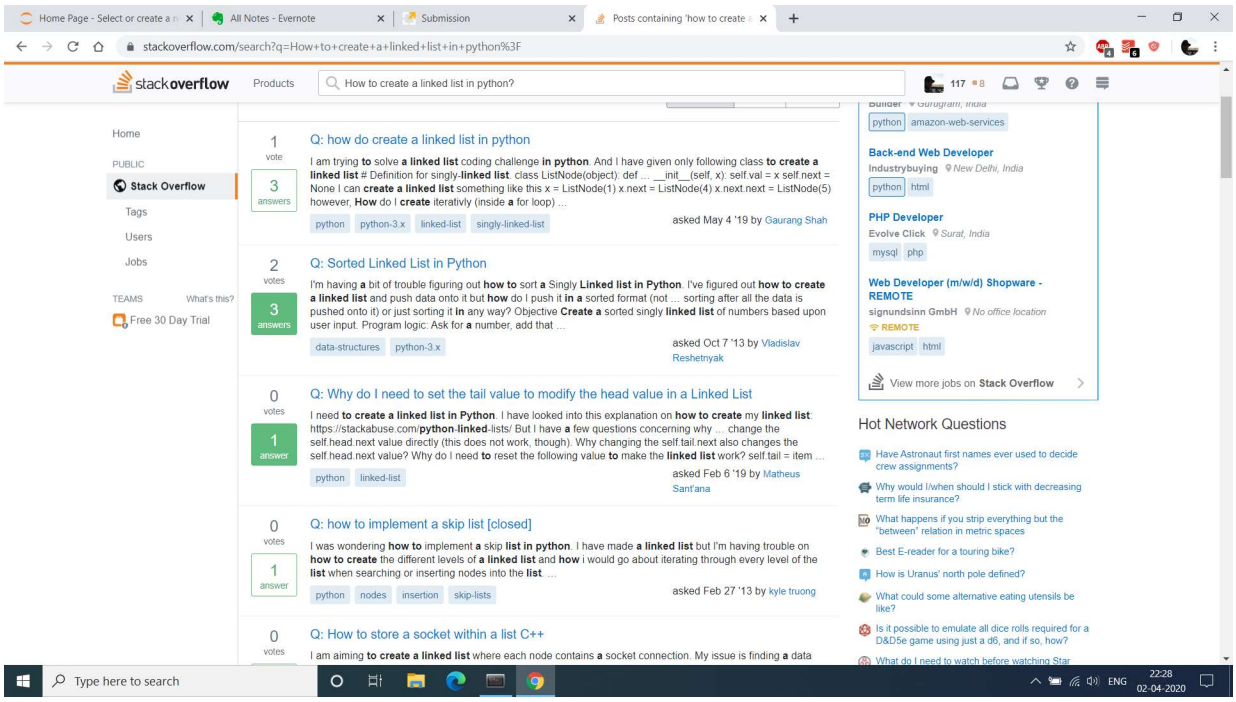
Stackoverflow Results

Question 1, How to create a linked list in Python

In [4]:
```
from IPython.display import Image
```

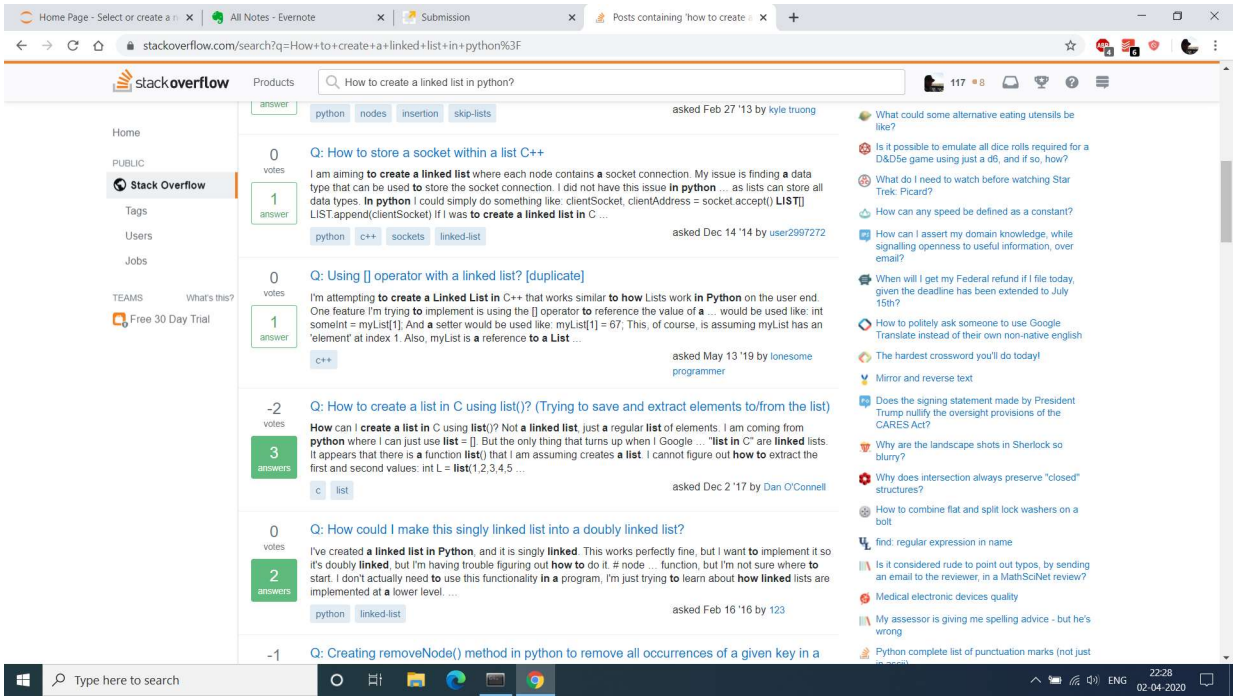
In [5]:
```
Image('q1 (1).png')
```

Out[5]:



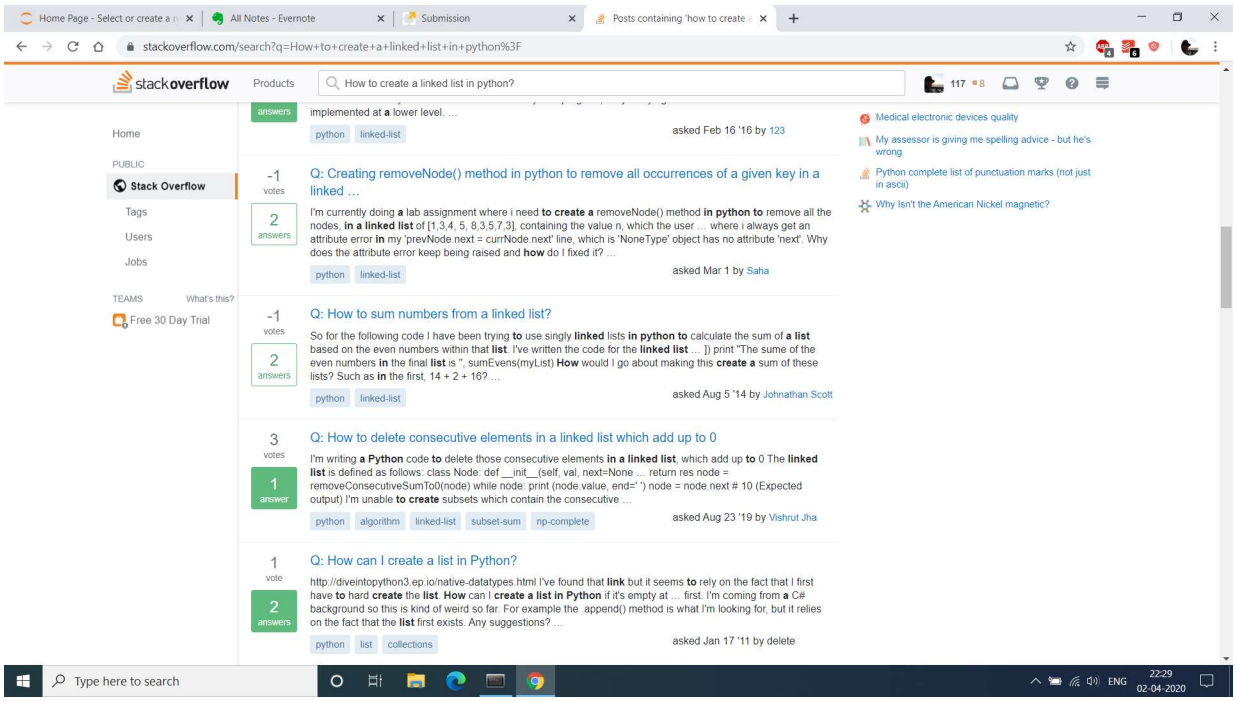
In [6]:
```
Image('q1 (2).png')
```

Out[6]:



In [7]:
```
Image('q1 (3).png')
```

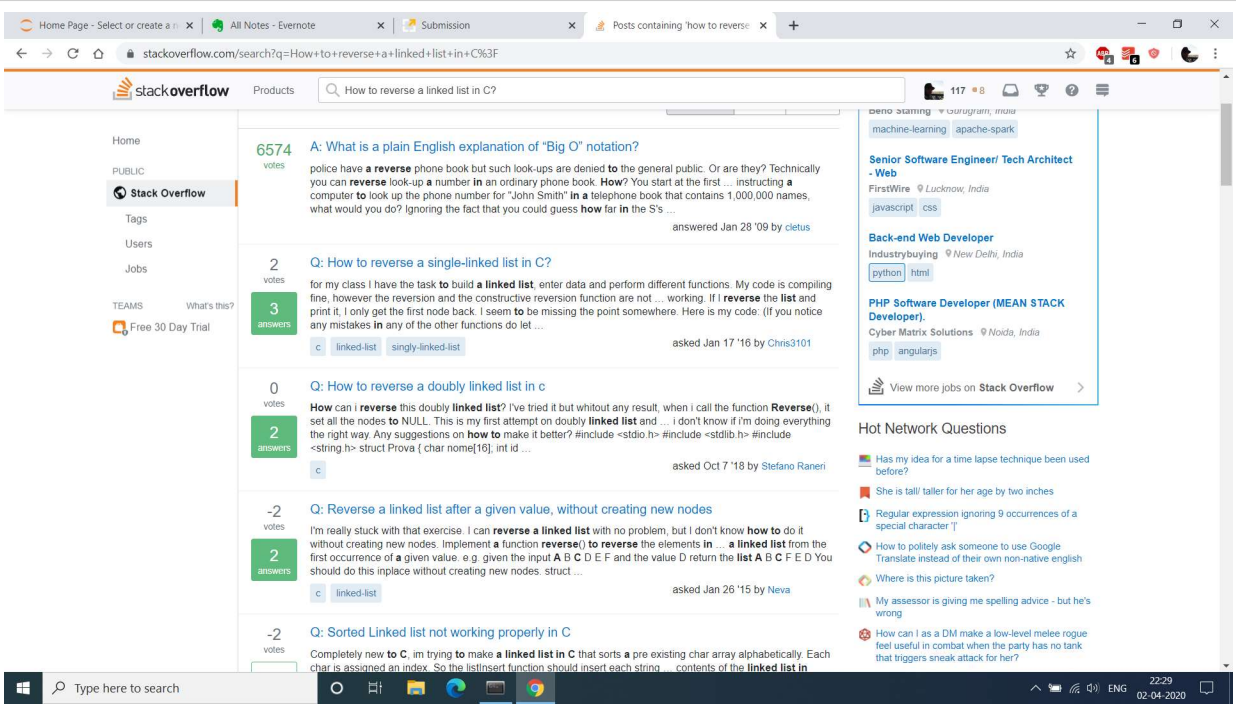
Out[7]:



Question 2, How to reverse a linked list in C?

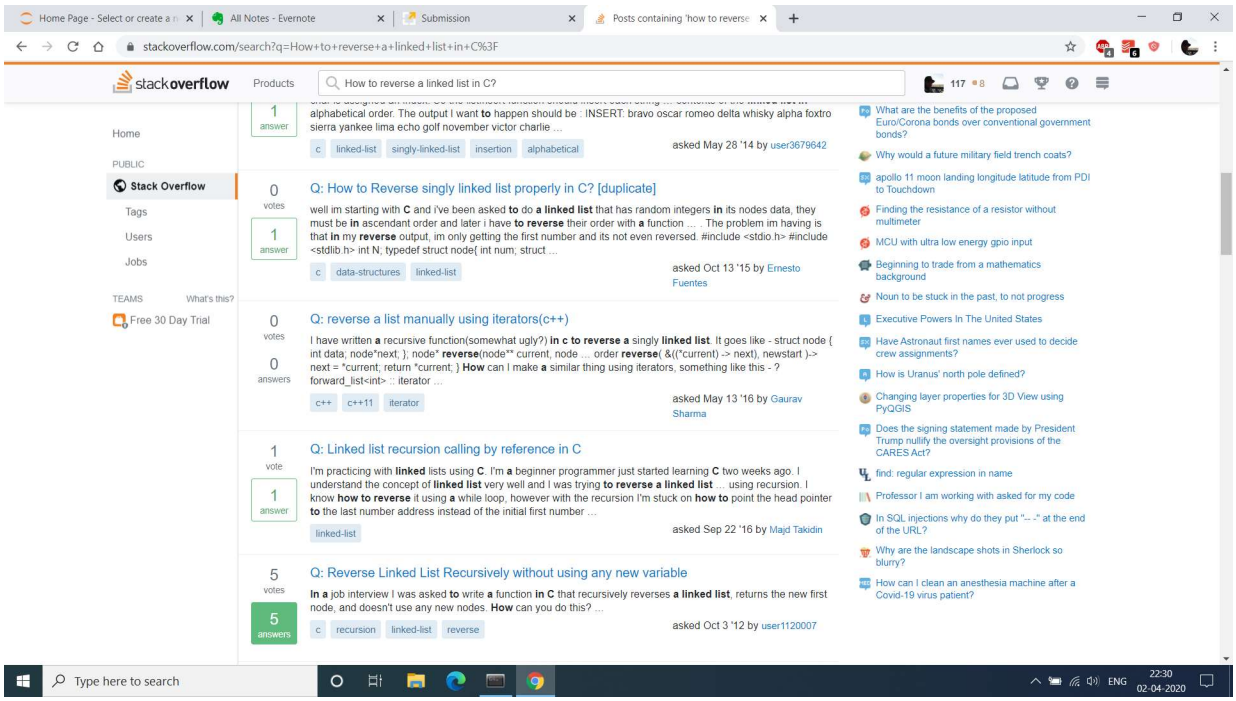
In [17]:
```
Image('q2 (1).png')
```

Out[17]:



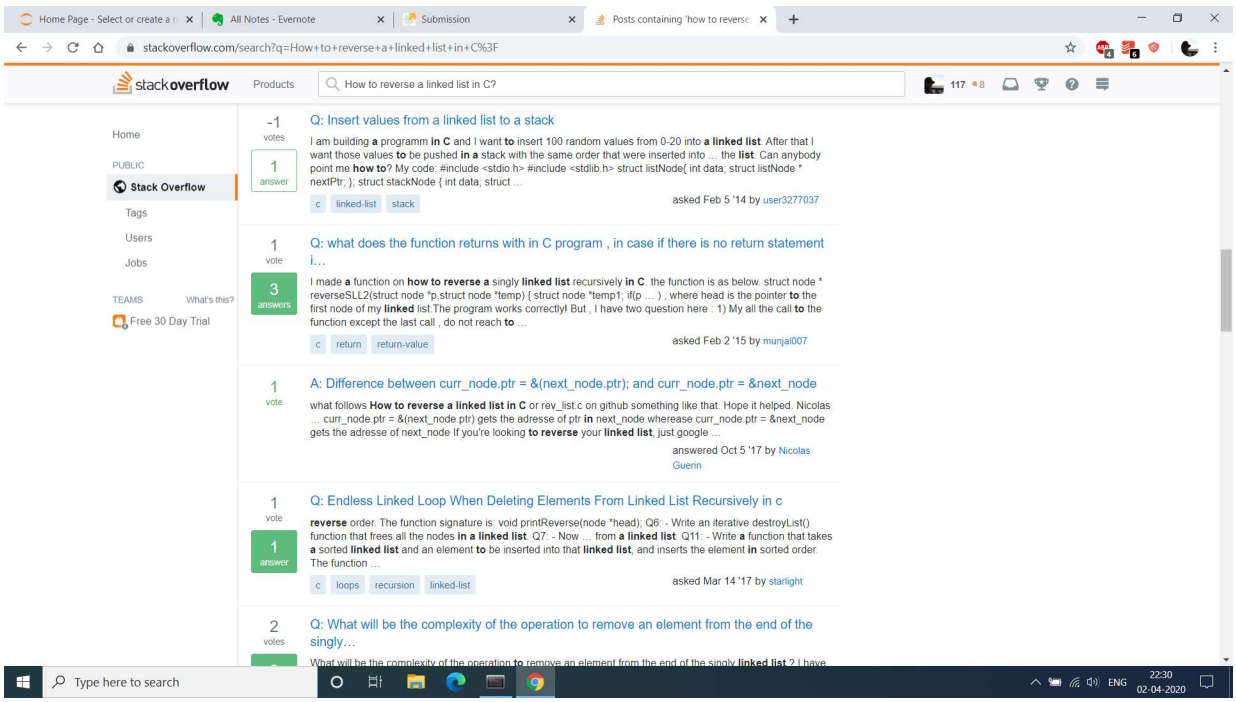
In [18]:
```
Image('q2 (2).png')
```

Out[18]:



In [19]:
```
Image('q2 (3).png')
```

Out[19]:



Comparision of time of fetching the results

Below given Results are "relative" . We can further decrease the timings by using faster and larger Ram(So that models don't use secondary storage as a virtual memory) and faster CPUs. In case of

DistillBert and Universal Sentence Encoder We can use GPUs to run the model in Production to further decrease the result fetch time

Our Configurations are :
16 GB DDR4 2400 MHz RAM
Intel Quad Core i5 8th gen 1.60 GHz CPU
256 GB SSD

In [24]:
```
from prettytable import PrettyTable
x = PrettyTable(["Vectorization method", "Similarity method",  "Time Taken(Secon
x.add_row(["Avg Word2vec", "Cosine_Similarity" , (2.99+2.99)/2])
x.add_row(["TF-IDF Word2vec", "Cosine_Similarity" , (3.07+2.95)/2])
x.add_row(["DistillBert", "Cosine_Similarity" , (1.33+1.25)/2])
x.add_row(["Topic_modeling(LDA)", "JensenShannon Distance" , (10.53+10.64)/2])
x.add_row(["Doc2vec, Clustering(K-Means++)", "Cosine_Similarity" , (0.12+1.21)/2
x.add_row(["Universal Sentence Encoder", "Cosine_Similarity" , (0.87+0.80)/2])
print(x)
```

```
+--------------------------------+-----------------------+--------------------
-+
|      Vectorization method      |   Similarity method   | Time Taken(Seconds)
|
+--------------------------------+-----------------------+--------------------
-+
|          Avg Word2vec          |   Cosine_Similarity   |         2.99
|
|        TF-IDF Word2vec         |   Cosine_Similarity   |         3.01
|
|          DistillBert           |   Cosine_Similarity   |         1.29
|
|      Topic_modeling(LDA)       | JensenShannon Distance |        10.585
|
| Doc2vec, Clustering(K-Means++) |   Cosine_Similarity   |        0.665
|
|   Universal Sentence Encoder   |   Cosine_Similarity   |        0.835
|
+--------------------------------+-----------------------+--------------------
-+
```

Analysis of Results Genrated by models

Question 1 = "How to create a linked list in Python?"
Question 2 = "How to reverse a linked list in C?"

1 - Results for Question 2 in case of TF-IDF W2V and AVG-W2V are almost same and they are very close to what is asked for. But In Case of Question 1, AVG-W2V Model is confused between the "list of lists" and "Linked List" terms but it gives best similar results in the top 10 results. Timing of fetching the results in both the cases are almost the same.
2 - Our Distillbert Model gives good similar results in case of Question 2 but In case of Question 1 it gives most results related to list and circular linked list not linked list. It fetches results in less time compared to AVG-W2V and TF-IDF W2V

3 - For Question 1 our Topic_modeling(LDA) + JensenShannon Distance model gives results related to lists and Python not linked lists. Similarly For Question 2 It gives results related to lists, C++ and C#. This gives no results not even related to linked list and C. This method also takes most time to genrate resuls which is more than 10 seconds.
4 - We get worst results in case of Doc2vec, Clustering(K-Means++) Which is not anywhere close to the asked question but We get these results in the least time among all which does not important if the results are not similar.
5 - In case of Universal Sentence encoder with Cosine Similarity we got best results out of all above models. In the top results we got results exactly what is asked for both the questions along with questions very much related to asked questions. Unlike above models this does not confuse with terms like list of lists with linked lists. This method also gives results in less than 1 sec which is 0.82 Seconds.

Step wise process of solving case study

1-Download the data from the StackOverflow archive from
https://archive.org/download/stackexchange (https://archive.org/download/stackexchange).
2-Preprocess the question title, text and tags also.
3-Train a word2vec model using all the words of title and text.
4-Convert all the preprocessed titles and text into 300 dimensions average word2vec vectors using a pre-trained word2vec model.
5 -Build a dictionary (Because they are many times faster than a list) which contains a word from title or text as a key and a list value. This list contains all the indexes of questions that contain at least word of the question.
6 -When given a question string for query:
A: Preprocess it.
B: Take all the keywords of it and check the indexes of all the documents which also contain any of these keywords with the help of a prebuild dictionary keyword, list of index dictionary.
C: Calculate any distance between query question title vector and all the above-selected question title vectors.
D: Take indexes corresponding to the k minimum cosine distances and return the documents present at those indexes as search results.
7- We try above method with all below given combination of vectorization methods and similarity methods

Other methods for vectorization and sentence similarity

2 - TF-IDF word2vec with Cosine Similarity
3 - Language Model DistillBert for vectorization and Cosine Similarity
4 - Topic Modelling With Jenson Shannon distance
5 - Doc2vec and Clustering
6 - Universal sentence encoding with cosine similarity

Since we don't have any method to quantify the best results (best similar titles) We have to see which methods give the best results

using our intuition

We get best results in case of "Universal sentence encoding with Cosine Similarity" in least time.

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In [ ]: