



**GURU NANAK COLLEGE OF ARTS, SCIENCE &
COMMERCE**

G.T.B NAGAR, MUMBAI-400037

DEPARTMENT OF INFORMATION TECHNOLOGY

MSc(IT) PART I SEMESTER II

Practical Journal IN
NATURAL LANGUAGE PROCESSING

Submitted by
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GURU NANAK COLLEGE OF ARTS, SCIENCE & COMMERCE
G.T.B NAGAR, MUMBAI-400037

DEPARTMENT OF INFORMATION TECHNOLOGY

CERTIFICATE

This is to certify that Mr. / Miss. _____ Aniket Hinukale _____
of MSc(IT) Part-I Semester II Seat No. 2510261 has successfully completed the practical's in the subject
of **NATURAL LANGUAGE PROCESSING** as per the requirement of University Of Mumbai in part
fulfillment for the completion of Degree of Master of Science (INFORMATION TECHNOLOGY). It is
also to certify that this is the original work of the candidate done during the academic year 2021-2022.

Subject In-Charge

In-Charge, MSc(IT)

Date

College Seal

Examiner

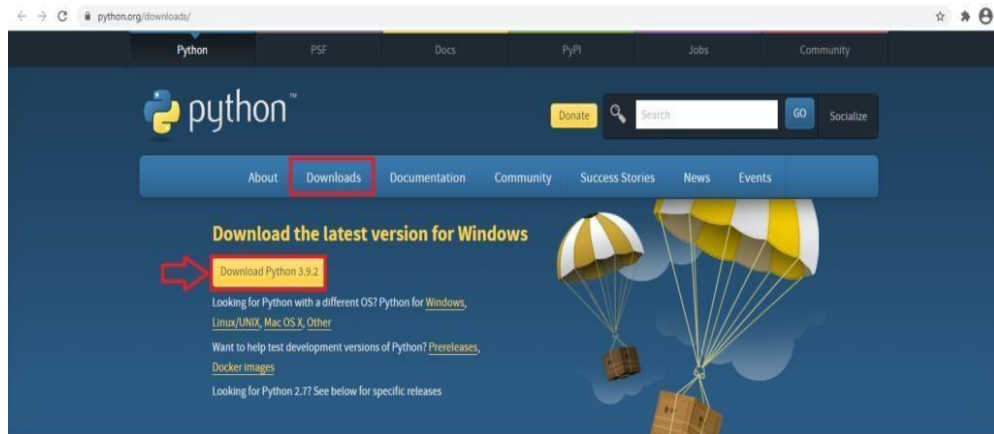
NLP Lab Manual

Practical No. 1:

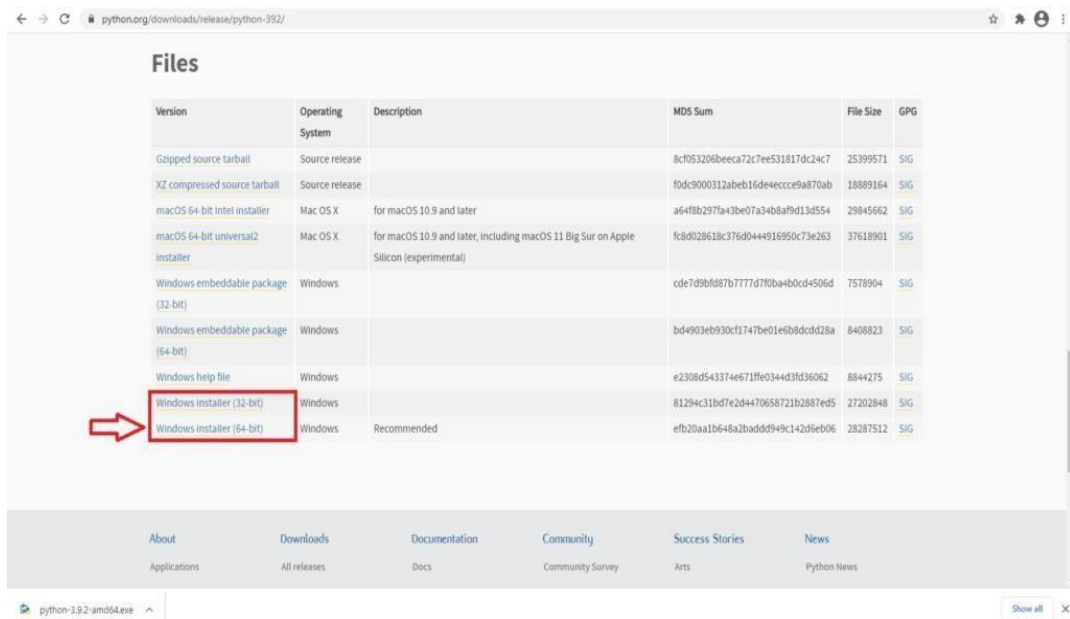
a) Install NLTK

Python 3.9.2 Installation on Windows

Step 1) Go to link <https://www.python.org/downloads/>, and select the latest version for windows.

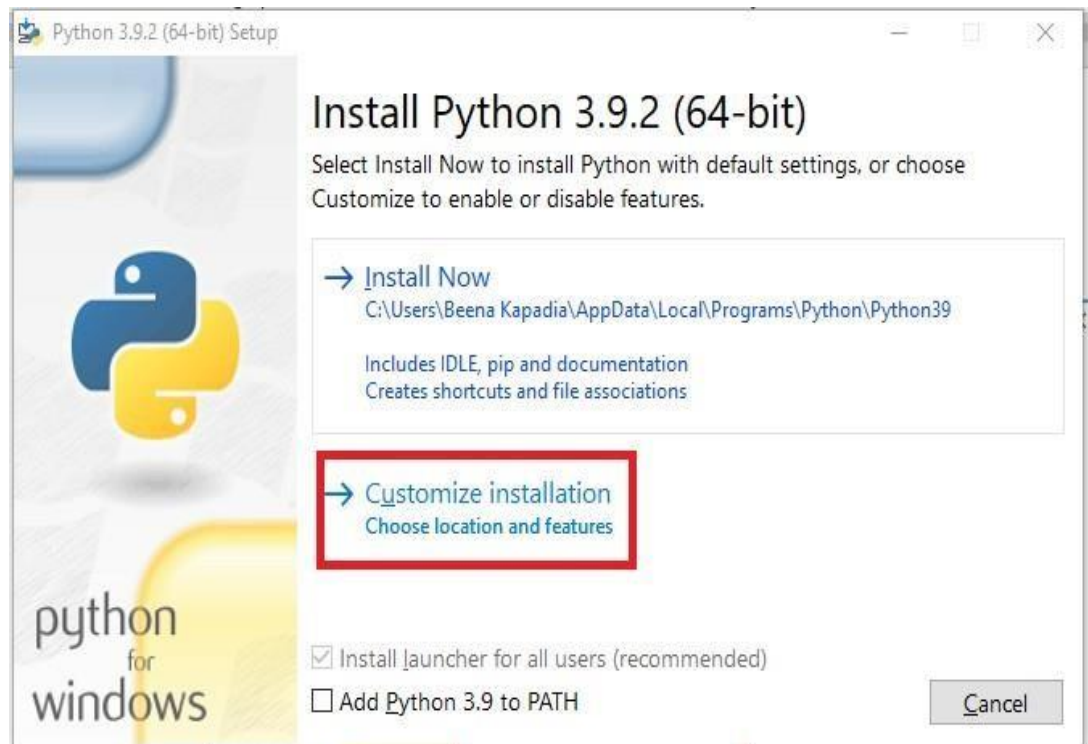


Note: If you don't want to download the latest version, you can visit the download tab and see all releases.

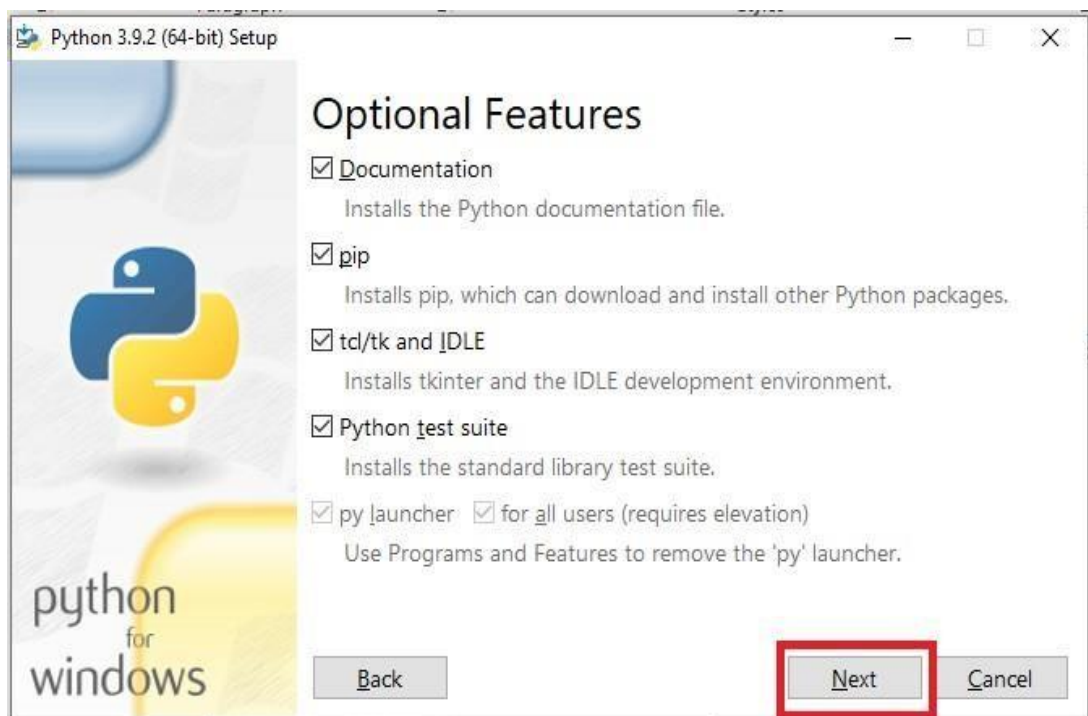


Step 2) Click on the Windows installer (64 bit)

Step 3) Select Customize Installation

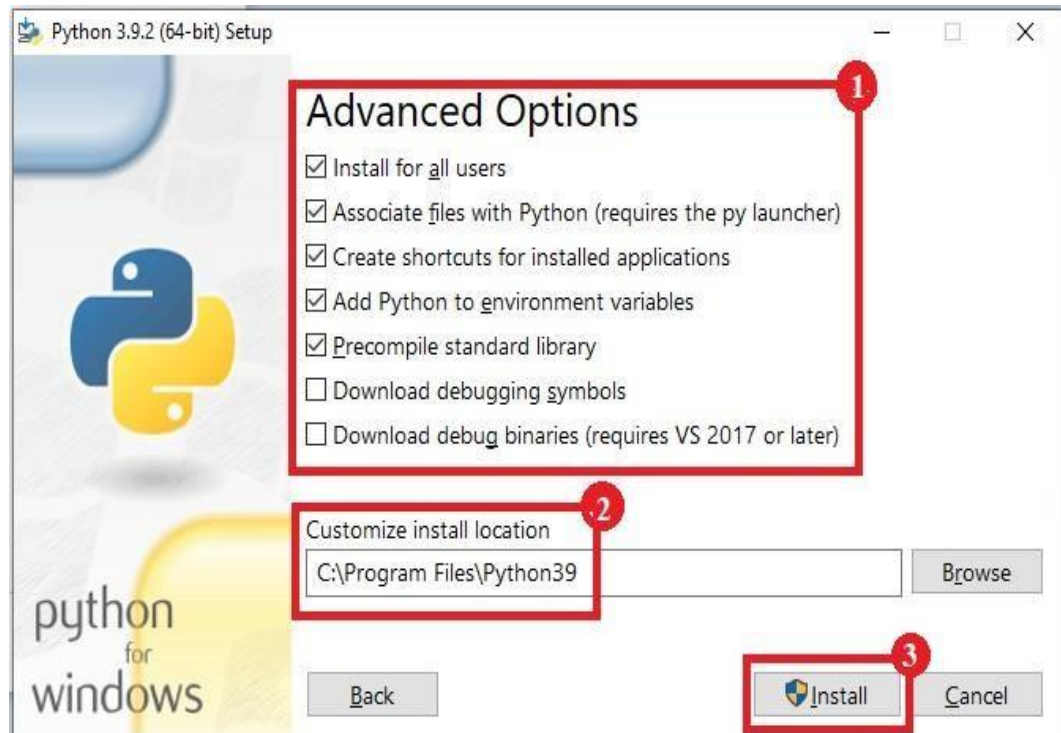


Step 4) Click NEXT



Step 5) In next screen

1. Select the advanced options
2. Give a Custom install location. Keep the default folder as c:\Programfiles\Python39
3. Click Install



Step 6) Click Close button once install is done.

Step 7) open command prompt window and run the following commands:
 C:\Users\Beena Kapadia>pip install --upgrade pip
 C:\Users\Beena Kapadia> pip install --user -U nltk
 C:\Users\Beena Kapadia> >pip install --user -U
 numpyC:\Users\Beena Kapadia>python
 >>> import nltk
 >>>

```

Command Prompt - python
C:\Users\Beena Kapadia>pip install --user -U nltk
Collecting nltk
  Using cached nltk-3.6.2-py3-none-any.whl (1.5 MB)
Requirement already satisfied: joblib in c:\users\beena kapadia\appdata\roaming\python\python39\site-packages (from nltk) (1.0.1)
Requirement already satisfied: tqdm in c:\users\beena kapadia\appdata\roaming\python\python39\site-packages (from nltk) (4.60.0)
Requirement already satisfied: regex in c:\users\beena kapadia\appdata\roaming\python\python39\site-packages (from nltk) (2021.4.4)
Requirement already satisfied: click in c:\users\beena kapadia\appdata\roaming\python\python39\site-packages (from nltk) (7.1.2)
Installing collected packages: nltk
  WARNING: The script nltk.exe is installed in 'C:\Users\Beena Kapadia\AppData\Roaming\Python\Python39\Scripts' which is not on PATH.
  Consider adding this directory to PATH or, if you prefer to suppress this warning, use --no-warn-script-location.
Successfully installed nltk-3.6.2

C:\Users\Beena Kapadia>pip install --user -U numpy
Collecting numpy
  Using cached numpy-1.20.3-cp39-cp39-win_amd64.whl (13.7 MB)
Installing collected packages: numpy
  WARNING: The script f2py.exe is installed in 'C:\Users\Beena Kapadia\AppData\Roaming\Python\Python39\Scripts' which is not on PATH.
  Consider adding this directory to PATH or, if you prefer to suppress this warning, use --no-warn-script-location.
Successfully installed numpy-1.20.3

C:\Users\Beena Kapadia>python
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import nltk
>>>
  
```

b) Convert the given text to speech.Source code:

```
# text to  
  
speech# pip  
  
install gtts  
# pip install playsound  
  
from playsound import playsound  
  
# import required for text to speech  
  
conversionfrom gtts import gTTS  
mytext = "Welcome to Natural Language  
programming"language = "en"  
myobj = gTTS(text=mytext, lang=language,  
slow=False)myobj.save("myfile.mp3")  
playsound("myfile.mp3")
```

Output:

welcomeNLP.mp3 audio file is getting created and it plays the file with playsound()method, while running the program.

c) Convert audio file Speech to Text.Source code:

Note: required to store the input file "male.wav" in the current folder before running theprogram.

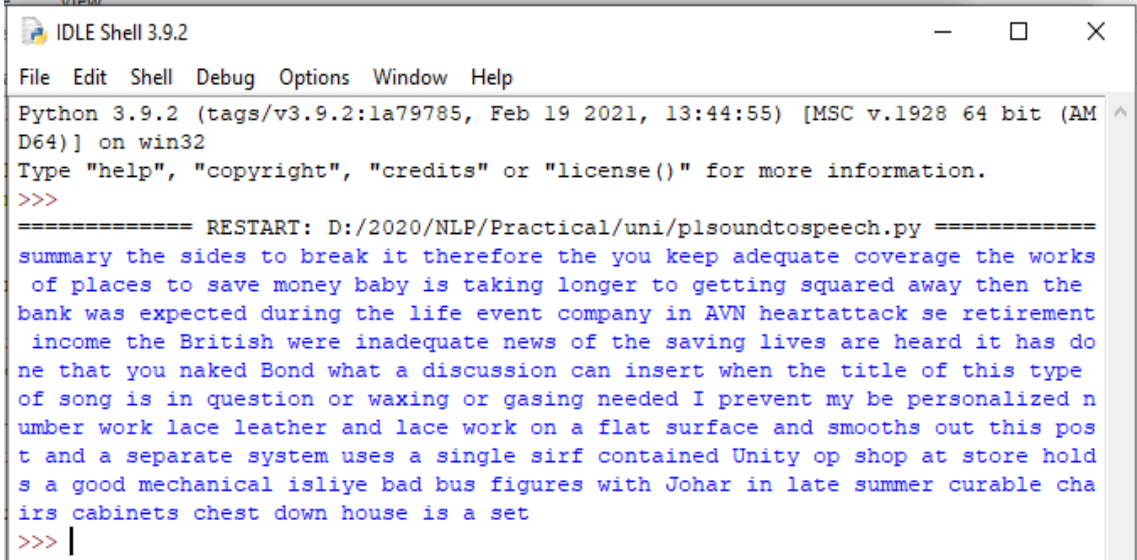
```
#pip3 install SpeechRecognition pydub  
  
import speech_recognition  
as srfilename = "male.wav"  
  
# initialize the  
recognizerr =  
sr.Recognizer()  
  
# open the file  
with sr.AudioFile(filename) as source:  
    # listen for the data (load audio to  
    memory)audio_data = r.record(source)  
    # recognize (convert from speech to  
    text)text =
```

```
r.recognize_google(audio_data)
print(text)
```

Input:

male.wav (any wav file)

Output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/plsoundtospeech.py =====
summary the sides to break it therefore the you keep adequate coverage the works
of places to save money baby is taking longer to getting squared away then the
bank was expected during the life event company in AVN heartattack se retirement
income the British were inadequate news of the saving lives are heard it has do
ne that you naked Bond what a discussion can insert when the title of this type
of song is in question or waxing or gasing needed I prevent my be personalized n
umber work lace leather and lace work on a flat surface and smooths out this pos
t and a separate system uses a single sirf contained Unity op shop at store hold
s a good mechanical isliye bad bus figures with Johar in late summer curable cha
irs cabinets chest down house is a set
>>> |
```

Practical No. 2:

- a. **Study of various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fileids, raw, words, sents, categories.**
- b. **Create and use your own corpora (plaintext, categorical)**
- c. **Study Conditional frequency distributions**
- d. **Study of tagged corpora with methods like tagged_sents, tagged_words.**
- e. **Write a program to find the most frequent noun tags.**
- f. **Map Words to Properties Using Python Dictionaries**
- g. **Study DefaultTagger, Regular expression tagger, UnigramTagger**
- h. **Find different words from a given plain text without any space by comparing this text with a given corpus of words. Also find the score of words.**

a. Study of various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fields, raw, words, sents, categories,

source code:

```
'''NLTK includes a small selection of texts from the Project brown electronic text archive, which contains some 25,000 free electronic books, hosted at http://www.brown.org/. We begin by getting the Python interpreter to load the NLTK package, then ask to see nltk.corpus.brown.fileids(), the file identifiers in this corpus:'''
```

```
import nltk
from nltk.corpus import brown
print ('File ids of brown corpus\n',brown.fileids())
```

```
'''Let's pick out the first of these texts — Emma by Jane Austen — and give it a short name, emma, then find out how many words it contains:'''
ca01 = brown.words('ca01')
```

```
# display first few words
print('\nca01 has following words:\n',ca01)
```

```
# total number of words in ca01
print('\nca01 has',len(ca01),'words')
```

```
#categories or files
print ('\n\nCategories or file in brown corpus:\n')
print (brown.categories())
```

```
'''display other information about each text, by looping over all the values of fileid corresponding to the brown file identifiers listed earlier and then computing statistics for each text.'''
print ('\n\nStatistics for each text:\n')
```

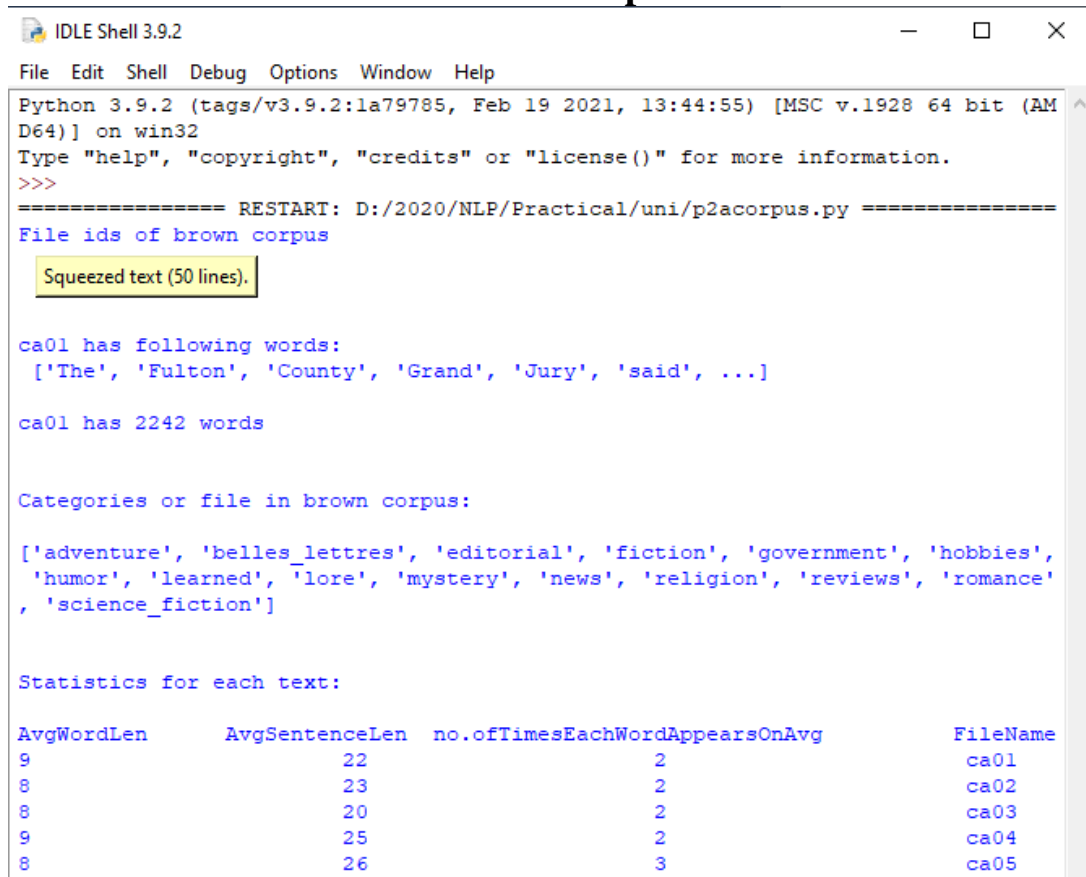


```

print('AvgWordLen\tAvgSentenceL
en\tno.ofTimesEachWordAppearsO
nAvg\t\tFileName') for fileid in
brown.fileids():
    num_chars = len(brown.raw(fileid))
    num_words = len(brown.words(fileid))
    num_sents = len(brown.sents(fileid))
    num_vocab = len(set([w.lower() for w in brown.words(fileid)]))
    print (int(num_chars/num_words), '\t\t\t', int(num_words/num_sents), '\t\t\t',
int(num_words/num_vocab), '\t\t\t', fileid)

```

output:



```

Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p2acorus.py =====
File ids of brown corpus
Squeezed text (50 lines).

ca01 has following words:
['The', 'Fulton', 'County', 'Grand', 'Jury', 'said', ...]

ca01 has 2242 words

Categories or file in brown corpus:

['adventure', 'belles_lettres', 'editorial', 'fiction', 'government', 'hobbies',
'humor', 'learned', 'lore', 'mystery', 'news', 'religion', 'reviews', 'romance',
'science_fiction']

Statistics for each text:

AvgWordLen      AvgSentenceLen  no.ofTimesEachWordAppearsOnAvg      FileName
9                22              2                                     ca01
8                23              2                                     ca02
8                20              2                                     ca03
9                25              2                                     ca04
8                26              3                                     ca05

```

b. Create and use your own corpora (plaintext, categorical)

source code:

""NLTK includes a small selection of texts from the Project filelist electronic text archive, which contains some 25,000 free electronic books, hosted at <http://www.filelist.org/>. We begin by getting the Python interpreter to load the NLTK package, then ask to see nltk.corpus.filelist.fileids(), the file identifiers in this corpus:"

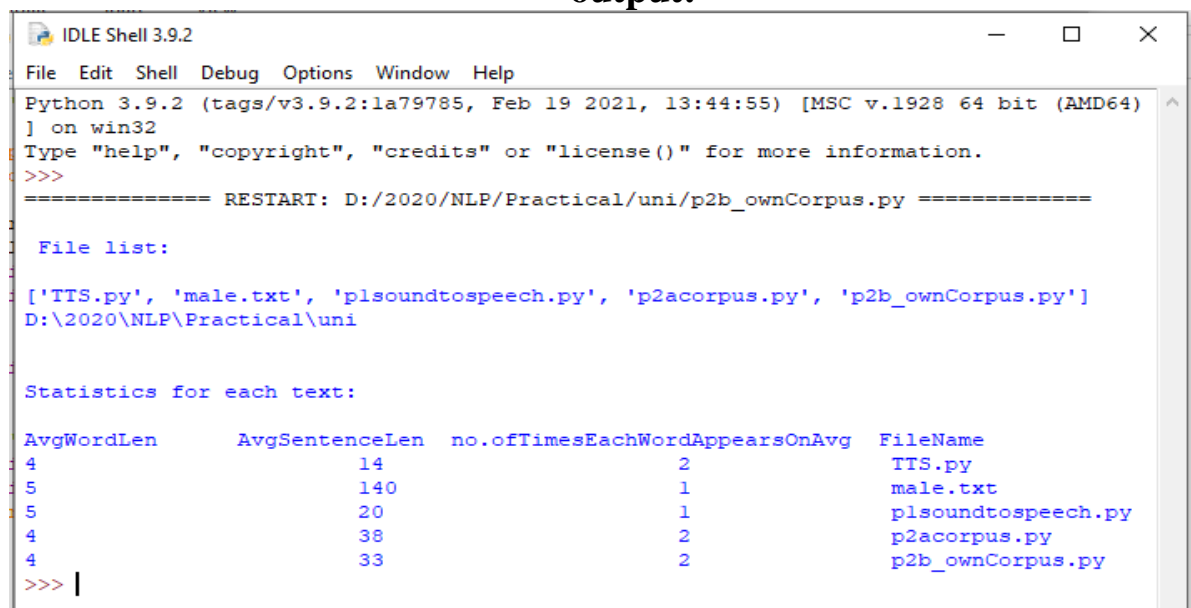
```
import nltk
from nltk.corpus import PlaintextCorpusReader
corpus_root = 'D:/2020/NLP/Practical/uni'
filelist = PlaintextCorpusReader(corpus_root, '.*')
print("\n File list: \n")
print(filelist.fileids())
```

```
print(filelist.root)
```

""display other information about each text, by looping over all the values of fileid corresponding to the filelist file identifiers listed earlier and then computing statistics for each text.""

```
print("\n\nStatistics for each text:\n")
print('AvgWordLen\tAvgSentenceL
en\tno.ofTimesEachWordAppearsO
nAvg\tFileName') for fileid in
filelist.fileids():
    num_chars = len(filelist.raw(fileid))
    num_words = len(filelist.words(fileid))
    num_sents = len(filelist.sents(fileid))
    num_vocab = len(set([w.lower() for w in filelist.words(fileid)]))
    print (int(num_chars/num_words),"\t\t\t", int(num_words/num_sents),"\t\t\t",
int(num_words/num_vocab),"\t\t", fileid)
```

output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p2b_ownCorpus.py =====

File list:

['TTS.py', 'male.txt', 'plsoundtospeech.py', 'p2acorporus.py', 'p2b_ownCorpus.py']
D:/2020/NLP/Practical/uni

Statistics for each text:

AvgWordLen      AvgSentenceLen  no.ofTimesEachWordAppearsOnAvg  FileName
4               14              2                                TTS.py
5               140             1                                male.txt
5               20              1                                plsoundtospeech.py
4               38              2                                p2acorporus.py
4               33              2                                p2b_ownCorpus.py
>>> |
```

c. Study Conditional frequency distributions

source code:

```
#process a sequence of pairs
text = ['The', 'Fulton', 'County', 'Grand', 'Jury', 'said', ...]
pairs = [('news', 'The'), ('news', 'Fulton'), ('news', 'County'), ...]
import nltk
from nltk.corpus import brown
fd = nltk.ConditionalFreqDist(
    (genre, word)
    for genre in brown.categories()
    for word in brown.words(categories=genre))

genre_word = [(genre, word)
               for genre in ['news', 'romance']
               for word in brown.words(categories=genre)]

print(len(genre_word))

print(genre_word[:4])

print(genre_word[-4:])

cfd = nltk.ConditionalFreqDist(genre_word)

print(cfd)

print(cfd.conditions())

print(cfd['news'])
print(cfd['romance'])
print(list(cfd['romance']))

from nltk.corpus import inaugural
cfd = nltk.ConditionalFreqDist(
    (target, fileid[:4])
    for fileid in inaugural.fileids()
    for w in inaugural.words(fileid)
    for target in ['america', 'citizen']
    if w.lower().startswith(target))

from nltk.corpus import udhr
languages = ['Chickasaw', 'English', 'German_Deutsch',
            'Greenlandic_Inuktitut', 'Hungarian_Magyar', 'Ibibio_Efik']
cfd = nltk.ConditionalFreqDist(
    (lang, len(word))
    for lang in languages
    for word in udhr.words(lang + '-Latin1'))

cfd.tabulate(conditions=['English', 'German_Deutsch'],
             samples=range(10), cumulative=True)
```

output:

```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
== RESTART: D:/2020/NLP/Practical/uni/p2c-ConditionalFrequencyDistributions.py =
170576
[('news', 'The'), ('news', 'Fulton'), ('news', 'County'), ('news', 'Grand')]
[('romance', 'afraid'), ('romance', 'not'), ('romance', ''), ('romance', '.')]
<ConditionalFreqDist with 2 conditions>
['news', 'romance']
<FreqDist with 14394 samples and 100554 outcomes>
<FreqDist with 8452 samples and 70022 outcomes>
Squeezed text (1147 lines).
      English      0   1   2   3   4   5   6   7   8   9
German_Deutsch    0  171 263 614 717 894 1013 1110 1213 1275
>>> |
```

d. Study of tagged corpora with methods like tagged_sents, tagged_words.

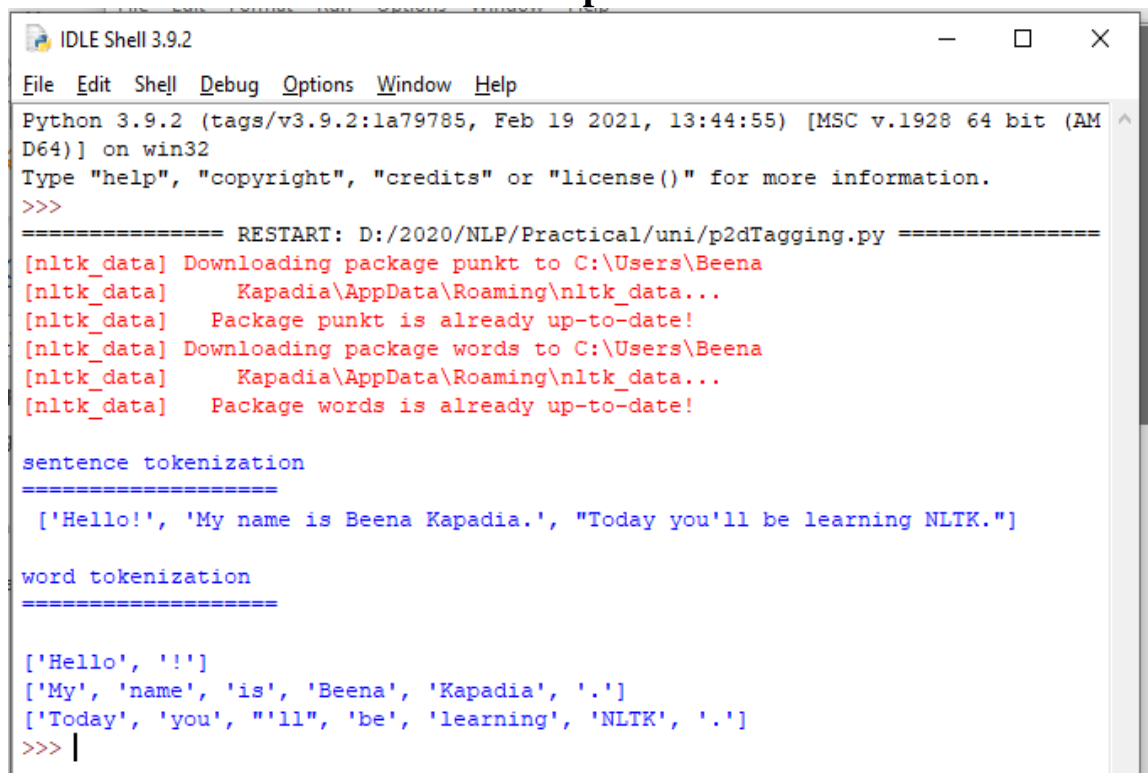
Source code:

```
import nltk
from nltk import tokenize
nltk.download('punkt')
nltk.download('words')

para = "Hello! My name is Beena Kapadia. Today you'll be learning NLTK."
sents = tokenize.sent_tokenize(para)
print("\nsentence tokenization\n=====\\n",sents)

# word tokenization
print("\nword tokenization\n=====\\n")
for index in range(len(sents)):
    words = tokenize.word_tokenize(sents[index])
    print(words)
```

output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p2dTagging.py =====
[nltk_data] Downloading package punkt to C:\Users\Beena
[nltk_data] Kapadia\AppData\Roaming\nltk_data...
[nltk_data] Package punkt is already up-to-date!
[nltk_data] Downloading package words to C:\Users\Beena
[nltk_data] Kapadia\AppData\Roaming\nltk_data...
[nltk_data] Package words is already up-to-date!

sentence tokenization
=====
['Hello!', 'My name is Beena Kapadia.', 'Today you'll be learning NLTK.']

word tokenization
=====

['Hello', '!']
['My', 'name', 'is', 'Beena', 'Kapadia', '.']
['Today', 'you', "'ll", 'be', 'learning', 'NLTK', '.']
>>> |
```

e. Write a program to find the most frequent noun tags.

Code:

```
import nltk
from collections import defaultdict
text = nltk.word_tokenize("Nick likes to play football. Nick does not like to play cricket.")
tagged = nltk.pos_tag(text)
print(tagged)

# checking if it is a noun or not
addNounWords = []
count=0
for words in tagged:
    val = tagged[count][1]
    if(val == 'NN' or val == 'NNS' or val == 'NNPS' or val == 'NNP'):
        addNounWords.append(tagged[count][0])
        count+=1

print (addNounWords)

temp = defaultdict(int)

# memoizing count
for sub in addNounWords:
    for wrd in sub.split():
        temp[wrds] += 1

# getting max frequency
res = max(temp, key=temp.get)

# printing result
print("Word with maximum frequency : " + str(res))
```

output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p2emostFreq.py =====
[('Nick', 'NNP'), ('likes', 'VBZ'), ('to', 'TO'), ('play', 'VB'), ('football', 'NN'), ('.', '.'), ('Nick', 'NNP'), ('does', 'VBZ'), ('not', 'RB'), ('like', 'VB'), ('to', 'TO'), ('play', 'VB'), ('cricket', 'NN'), ('.', '.')]
['Nick', 'football', 'Nick', 'cricket']
Word with maximum frequency : Nick
>>>
```

f. Map Words to Properties Using Python

Dictionariescode:

#creating and printing a dictionary by mapping word with its properties

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
print(thisdict)  
print(thisdict["brand"])  
print(len(thisdict))  
print(type(thisdict))
```

output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p2fMap.py =====  
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}  
Ford  
3  
<class 'dict'>
```

g. Study i) DefaultTagger, ii) Regular expression tagger, iii) UnigramTagger

i) Default Tagger

code:

```
import nltk
from nltk.tag import DefaultTagger
exptagger = DefaultTagger('NN')
from nltk.corpus import treebank
testsentences = treebank.tagged_sents() [1000:]
print(exptagger.evaluate (testsentences))
```

```
#Tagging a list of sentences
import nltk
from nltk.tag import DefaultTagger
exptagger = DefaultTagger('NN')
print(exptagger.tag_sents([[ 'Hi', ',' ], [ 'How', 'are', 'you', '?' ]]))
```

output

```
===== RESTART: D:/2020/NLP/Practical/uni/p2glDefaultTagger.py =====
0.13198749536374715
[[('Hi', 'NN'), (',', 'NN')], [('How', 'NN'), ('are', 'NN'), ('you', 'NN'), ('?'
, 'NN')]]
>>> |
```

ii) Regular expression tagger,

code:

```
from nltk.corpus import brown
from nltk.tag import RegexpTagger
test_sent = brown.sents(categories='news')[0]
regexp_tagger = RegexpTagger(
    [(r'^-?[0-9]+(\.[0-9]+)?$', 'CD'), # cardinal numbers
     (r'(The|the|A|a|An|an)$', 'AT'), # articles
     (r'.*able$', 'JJ'), # adjectives
     (r'.*ness$', 'NN'), # nouns formed from adjectives
     (r'.*ly$', 'RB'), # adverbs
     (r'.*s$', 'NNS'), # plural nouns
     (r'.*ing$', 'VBG'), # gerunds
     (r'.*ed$', 'VBD'), # past tense verbs
     (r'.*', 'NN') # nouns (default)
    ])
print(regexp_tagger)
print(regexp_tagger.tag(test_sent))
```

output:


```
===== RESTART: D:/2020/NLP/Practical/uni/p2g2RegularExp.py =====
<Regex Tagger: size=9>
[('The', 'AT'), ('Fulton', 'NN'), ('County', 'NN'), ('Grand', 'NN'), ('Jury', 'NN'), ('said', 'NN'), ('Friday', 'NN'), ('an', 'AT'), ('investigation', 'NN'), ('of', 'NN'), ('Atlanta's', 'NNS'), ('recent', 'NN'), ('primary', 'NN'), ('election', 'NN'), ('produced', 'VBD'), ('', 'NN'), ('no', 'NN'), ('evidence', 'NN'), ('', 'NN'), ('that', 'NN'), ('any', 'NN'), ('irregularities', 'NNS'), ('took', 'NN'), ('place', 'NN'), ('.', 'NN')]
```

iii) UnigramT aggercode:

```
# Loading Libraries
from nltk.tag import UnigramTagger
from nltk.corpus import treebank

# Training using first 10 tagged sentences of the treebank corpus as data.
# Using data
train_sents = treebank.tagged_sents()[10]

# Initializing
tagger = UnigramTagger(train_sents)

# Lets see the first sentence
# (of the treebank corpus) as list
print(treebank.sents()[0])
print("\n", tagger.tag(treebank.sents()[0]))

# Finding the tagged results after training.
tagger.tag(treebank.sents()[0])

# Overriding the context model
tagger = UnigramTagger(model={'Pierre': 'NN'})
print("\n", tagger.tag(treebank.sents()[0]))
```

output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p2g3Unigram.py =====
['Pierre', 'Vinken', ',', '61', 'years', 'old', ',', 'will', 'join', 'the', 'board', 'as', 'a', 'nonexecutive', 'director', 'Nov.', '29', '.']

[('Pierre', 'NNP'), ('Vinken', 'NNP'), (',', ','), ('61', 'CD'), ('years', 'NNS'), ('old', 'JJ'), (',', ','), ('will', 'MD'), ('join', 'VB'), ('the', 'DT'), ('board', 'NN'), ('as', 'IN'), ('a', 'DT'), ('nonexecutive', 'JJ'), ('director', 'NN'), ('Nov.', 'NNP'), ('29', 'CD'), ('.', '.')]

[('Pierre', 'NN'), ('Vinken', None), (',', None), ('61', None), ('years', None), ('old', None), (',', None), ('will', None), ('join', None), ('the', None), ('board', None), ('as', None), ('a', None), ('nonexecutive', None), ('director', None), ('Nov.', None), ('29', None), ('.', None)]
```

h. Find different words from a given plain text without any space by comparing this text with a given corpus of words. Also find the score of words.

Question:

Initialize the hash tag test data or URL test data and convert to plain text without any space.. Read a text file of different words and compare the plain text data with the words exist in that text file and find out different words available in that plain text. Also find out how many words could be found. (for example, text = "#whatismyname" or text = www.whatismyname.com. Convert that to plain text without space as: whatismyname and read text file as words.txt. Now compare plain text with words given in a file and find the words form the plain text and the count of words which could be found)

Source code:

```
from __future__ import with_statement #with statement for reading file
import re # Regular expression

words = [] # corpus file words
testword = [] # test words
ans = [] # words matches with corpus

print("MENU")
print(".....")
print(" 1 . Hash tag segmentation ")
print(" 2 . URL segmentation ")
print("enter the input choice for performing word segmentation")
choice = int(input())

if choice == 1:
    text = "#whatismyname" # hash tag test data to segment
    print("input with HashTag",text)
    pattern=re.compile("[^\w]")
    a = pattern.sub("", text)
elif choice == 2:
    text = "www.whatismyname.com" # url test data to segment
    print("input with URL",text)
    a=re.split('\s|(?<!\d)[.](?!\d)', text)
    splitwords = ["www","com","in"] # remove the words which is containg in the list
    a=""
    for each in a:
        if each not in splitwords:
            a+=each+" "
    print(a)
else:
    print("wrong choice...try again")
print(a)

for each in a:
    testword.append(each) #test word
test_lenth = len(testword) # lenth of the test data

# Reading the corpus
with open('words.txt', 'r') as f:
    lines = f.readlines()
    words =[(e.strip()) for e in lines]
```

```

def Seg(a,lenth):
    ans=[]
    for k in range(0,lenth+1): # this loop checks char by char in the corpus

        if a[0:k] in words:
            print(a[0:k],"-appears in the corpus")
            ans.append(a[0:k])
            break
    if ans != []:
        g = max(ans,key=len)
        return g

test_tot_itr = 0 #each iteration value
answer = [] # Store the each word contains the corpus
Score = 0 # initial value for score
N = 37 # total no of corpus
M = 0
C = 0
while test_tot_itr < test_lenth:
    ans_words = Seg(a,test_lenth)
    if ans_words != 0:
        test_itr = len(ans_words)
        answer.append(ans_words)
        a = a[test_itr:test_lenth]
        test_tot_itr += test_itr

Aft_Seg = " ".join([each for each in answer])
# print segmented words in the list
print("output")
print(" ----- ")
print(Aft_Seg) # print After segmentation the input

# Calculating Score
C = len(answer)
-----
score = C * N / N # Calculate the score
print("Score",score)

```

Output:

```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p2hWord.py =====
MENU
-----
1 . Hash tag segmentation
2 . URL segmentation
enter the input choice for performing word segmentation
1
input with HashTag #whatismyname
whatismyname
what -appears in the corpus
is -appears in the corpus
my -appears in the corpus
name -appears in the corpus
output
-----
what is my name
Score 4.0
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p2hWord.py =====
MENU
-----
1 . Hash tag segmentation
2 . URL segmentation
enter the input choice for performing word segmentation
2
input with URL www.whatismyname.com
whatismyname
what -appears in the corpus
is -appears in the corpus
my -appears in the corpus
name -appears in the corpus
output
-----
what is my name
Score 4.0
>>> |
```

3. a. Study of Wordnet Dictionary with methods as synsets, definitions, examples, antonyms

Source code:

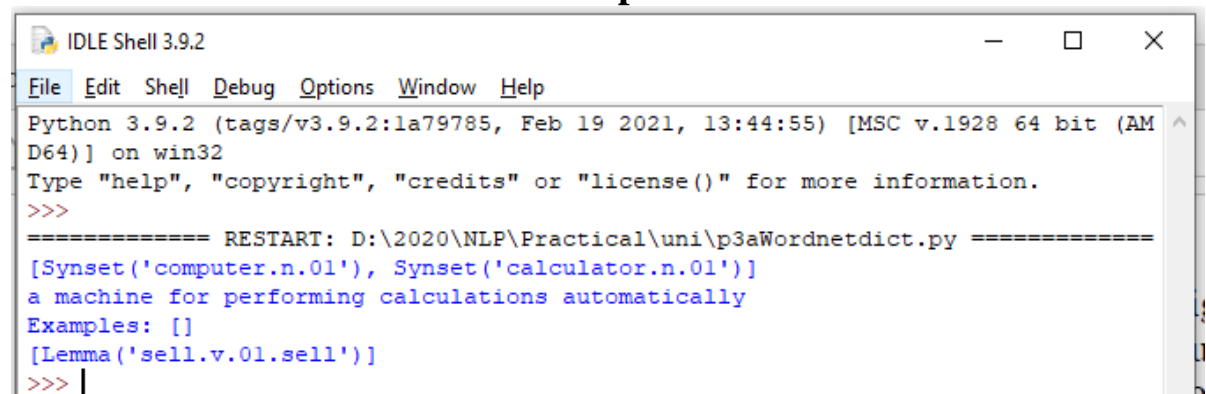
```
"""WordNet provides synsets which is the collection of synonym words also called
"lemmas"""
import nltk
from nltk.corpus import wordnet
print(wordnet.synsets("computer"))

# definition and example of the word 'computer'
print(wordnet.synset("computer.n.01").definition())

#examples
print("Examples:", wordnet.synset("computer.n.01").examples())

#get Antonyms
print(wordnet.lemma("buy.v.01.buy").antonyms())
```

output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:\2020\NLP\Practical\uni\p3aWordnetdict.py =====
[Synset('computer.n.01'), Synset('calculator.n.01')]
a machine for performing calculations automatically
Examples: []
[Lemma('sell.v.01.sell')]
>>> |
```

b. Study lemmas, hyponyms, hypernyms.

Source code:

```
import nltk
from nltk.corpus import wordnet
print(wordnet.synsets("computer"))
print(wordnet.synset("computer.n.01").lemma_names())
#all lemmas for each synset.
for e in wordnet.synsets("computer"):
    print(f'{e} --> {e.lemma_names()}')

#print all lemmas for a given synset
print(wordnet.synset('computer.n.01').lemmas())

#get the synset corresponding to lemma
print(wordnet.lemma('computer.n.01.computing_device').synset())

#Get the name of the lemma
print(wordnet.lemma('computer.n.01.computing_device').name())
```

```

#Hyponyms give abstract concepts of the word that are much more specific
#the list of hyponyms words of the computer

syn = wordnet.synset('computer.n.01')
print(syn.hyponyms)

print([lemma.name() for synset in syn.hyponyms() for lemma in synset.lemmas()])

#the semantic similarity in WordNet
vehicle = wordnet.synset('vehicle.n.01')
car = wordnet.synset('car.n.01')

print(car.lowest_common_hyponyms(vehicle))

```

Output:

```

IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p3bWordnetdict.py =====
[Synset('computer.n.01'), Synset('calculator.n.01')]
['computer', 'computing_machine', 'computing_device', 'data_processor', 'electronic_computer', 'information_processing_system']
Synset('computer.n.01') --> ['computer', 'computing_machine', 'computing_device', 'data_processor', 'electronic_computer', 'information_processing_system']
Synset('calculator.n.01') --> ['calculator', 'reckoner', 'figurer', 'estimator', 'computer']
[Lemma('computer.n.01.computer'), Lemma('computer.n.01.computing_machine'), Lemma('computer.n.01.computing_device'), Lemma('computer.n.01.data_processor'), Lemma('computer.n.01.electronic_computer'), Lemma('computer.n.01.information_processing_system')]
Synset('computer.n.01')
computing_device
<bound method _WordNetObject.hyponyms of Synset('computer.n.01')>
['analog_computer', 'analogue_computer', 'digital_computer', 'home_computer', 'node', 'client', 'guest', 'number_cruncher', 'pari-mutuel_machine', 'totalizer', 'totaliser', 'totalizator', 'totalisator', 'predictor', 'server', 'host', 'Turing_machine', 'web_site', 'website', 'internet_site', 'site']
[Synset('vehicle.n.01')]
>>> |

```

- c. Write a program using python to find synonym and antonym of word "active" using Wordnet.

Source code:

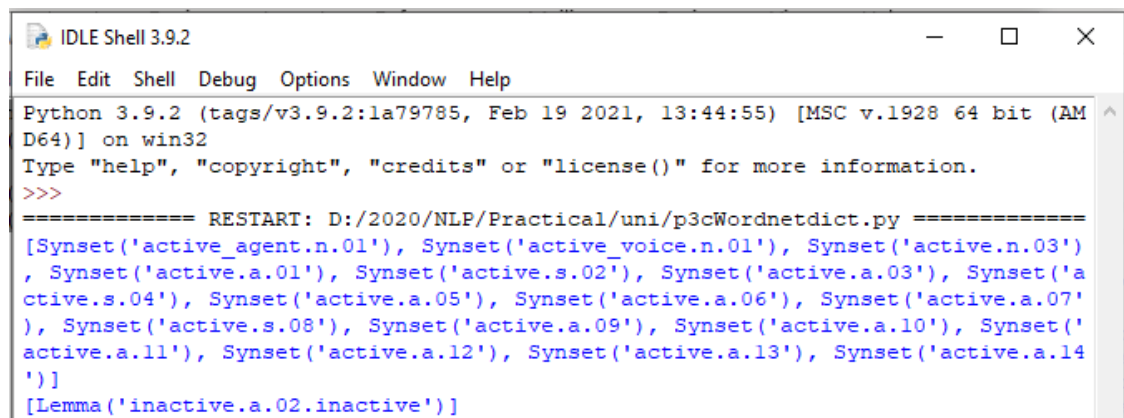
```

from nltk.corpus import wordnet
print(wordnet.synsets("active"))

print(wordnet.lemma('active.a.01.active').antonyms())

```

Output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p3cWordnetdict.py =====
[Synset('active_agent.n.01'), Synset('active_voice.n.01'), Synset('active.n.03'),
, Synset('active.a.01'), Synset('active.s.02'), Synset('active.a.03'), Synset('active.s.04'), Synset('active.a.05'), Synset('active.a.06'), Synset('active.a.07'), Synset('active.s.08'), Synset('active.a.09'), Synset('active.a.10'), Synset('active.a.11'), Synset('active.a.12'), Synset('active.a.13'), Synset('active.a.14')]
[Lemma('inactive.a.02.inactive')]
```

d. Compare two nouns

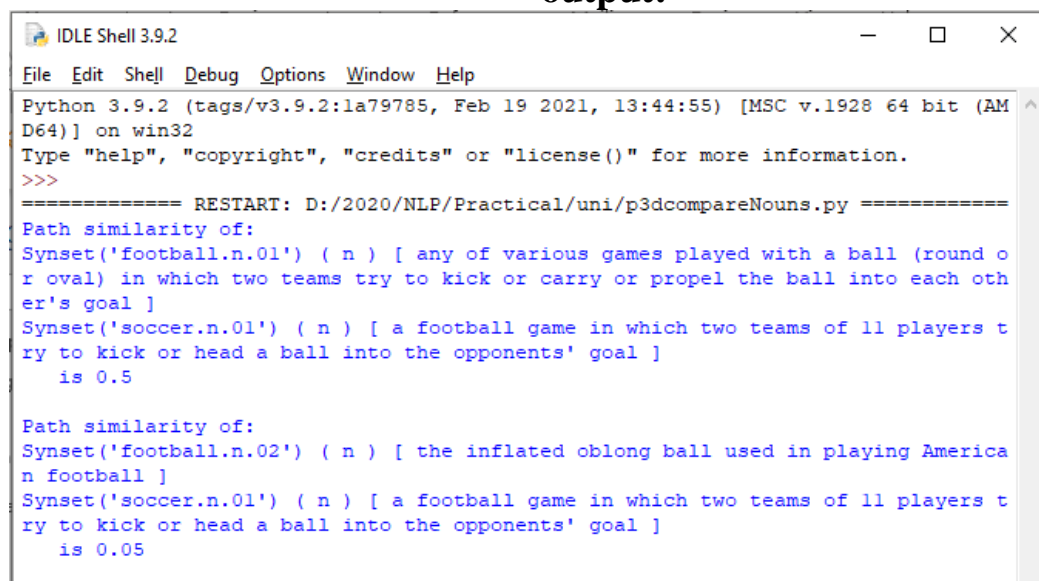
source code:

```
import nltk
from nltk.corpus import wordnet

syn1 = wordnet.synsets('football')
syn2 = wordnet.synsets('soccer')

# A word may have multiple synsets, so need to compare each synset of word1
# with synset of word2
for s1 in syn1:
    for s2 in syn2:
        print("Path similarity of: ")
        print(s1, '(', s1.pos(), ')', '[', s1.definition(), ']')
        print(s2, '(', s2.pos(), ')', '[', s2.definition(), ']')
        print(" is", s1.path_similarity(s2))
        print()
```

output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p3dcompareNouns.py =====
Path similarity of:
Synset('football.n.01') ( n ) [ any of various games played with a ball (round or oval) in which two teams try to kick or carry or propel the ball into each other's goal ]
Synset('soccer.n.01') ( n ) [ a football game in which two teams of 11 players try to kick or head a ball into the opponents' goal ]
is 0.5

Path similarity of:
Synset('football.n.02') ( n ) [ the inflated oblong ball used in playing American football ]
Synset('soccer.n.01') ( n ) [ a football game in which two teams of 11 players try to kick or head a ball into the opponents' goal ]
is 0.05
```

e. Handling stopwords:

i) Using nltk Adding or Removing Stop Words in NLTK's Default Stop WordList

code:

```
import nltk
from nltk.corpus import stopwords
nltk.download('stopwords')
from nltk.tokenize import word_tokenize

text = "Yashesh likes to play football, however he is not too fond of tennis."
text_tokens = word_tokenize(text)

tokens_without_sw = [word for word in text_tokens if not word in
                     stopwords.words()]

print(tokens_without_sw)

#add the word play to the NLTK stop word collection
all_stopwords = stopwords.words('english')
all_stopwords.append('play')

text_tokens = word_tokenize(text)
tokens_without_sw = [word for word in text_tokens if not word in all_stopwords]

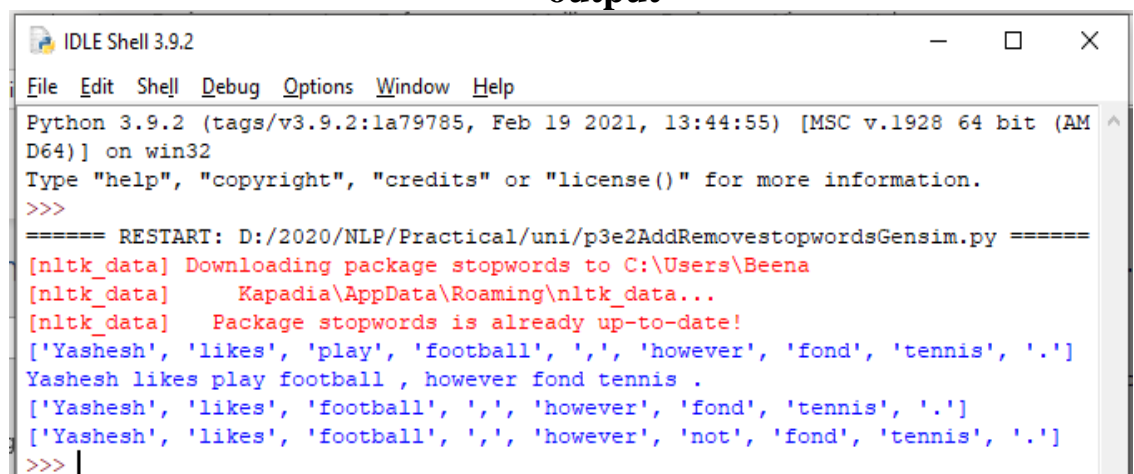
print(tokens_without_sw)

#remove 'not' from stop word collection
all_stopwords.remove('not')

text_tokens = word_tokenize(text)
tokens_without_sw = [word for word in text_tokens if not word in all_stopwords]

print(tokens_without_sw)
```

output



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p3e2AddRemovestopwordsGensim.py =====
[nltk_data] Downloading package stopwords to C:\Users\Beena
[nltk_data]   Kapadia\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
['Yashesh', 'likes', 'play', 'football', ',', 'however', 'fond', 'tennis', '.']
Yashesh likes play football , however fond tennis .
['Yashesh', 'likes', 'football', ',', 'however', 'fond', 'tennis', '.']
['Yashesh', 'likes', 'football', ',', 'however', 'not', 'fond', 'tennis', '.']
>>> |
```


ii) Using Gensim Adding and Removing Stop Words in Default Gensim Stop Words List

code:

```
#pip install gensim
import gensim
from gensim.parsing.preprocessing import remove_stopwords

text = "Yashesh likes to play football, however he is not too fond of tennis."
filtered_sentence = remove_stopwords(text)

print(filtered_sentence)

all_stopwords = gensim.parsing.preprocessing.STOPWORDS
print(all_stopwords)

"""The following script adds likes and play to the list of stop words in Gensim:""

from gensim.parsing.preprocessing import STOPWORDS

all_stopwords_gensim = STOPWORDS.union(set(['likes', 'play']))

text = "Yashesh likes to play football, however he is not too fond of tennis."
text_tokens = word_tokenize(text)
tokens_without_sw = [word for word in text_tokens if not word in
    all_stopwords_gensim]

print(tokens_without_sw)

"""Output:

['Yashesh', 'football', ',', 'fond', 'tennis', '.']

The following script removes the word "not" from the set of stop words in
Gensim:""

from gensim.parsing.preprocessing import STOPWORDS

all_stopwords_gensim = STOPWORDS
sw_list = {"not"}
all_stopwords_gensim = STOPWORDS.difference(sw_list)

text = "Yashesh likes to play football, however he is not too fond of tennis."
text_tokens = word_tokenize(text)
tokens_without_sw = [word for word in text_tokens if not word in
    all_stopwords_gensim]

print(tokens_without_sw)
```

output

Microsoft Visual C++ 14.0 is required. Get it with "Build Tools for Visual Studio":
<https://visualstudio.microsoft.com/downloads/>

iii) Using Spacy Adding and Removing Stop Words in Default Spacy Stop WordsList

code:

```
#pip install spacy
#python -m spacy download en_core_web_sm
#python -m spacy download en

import spacy
import nltk
from nltk.tokenize import word_tokenize

sp = spacy.load('en_core_web_sm')

#add the word play to the NLTK stop word collection
all_stopwords = sp.Defaults.stop_words
all_stopwords.add("play")

text = "Yashesh likes to play football, however he is not too fond of tennis."
text_tokens = word_tokenize(text)
tokens_without_sw = [word for word in text_tokens if not word in all_stopwords]

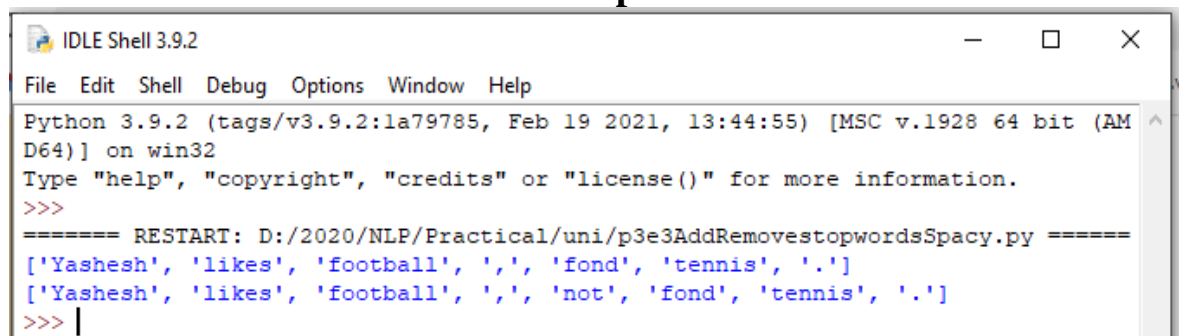
print(tokens_without_sw)

#remove 'not' from stop word collection
all_stopwords.remove('not')

tokens_without_sw = [word for word in text_tokens if not word in all_stopwords]

print(tokens_without_sw)
```

output:



```
IDLE Shell 3.9.2
File Edit Shell Debug Options Window Help
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p3e3AddRemovestopwordsSpacy.py =====
['Yashesh', 'likes', 'football', ',', 'fond', 'tennis', '.']
['Yashesh', 'likes', 'football', ',', 'not', 'fond', 'tennis', '.']
>>> |
```

4. Text Tokenization

a. Tokenization using python's split() function code:

```
text = """ This tool is an a beta stage. Alexa developers can use Get Metrics API to seamlessly analyse metric. It also supports custom skill model, prebuilt Flash Briefing model, and the Smart Home Skill API. You can use this tool for creation of monitors, alarms, and dashboards that spotlight changes. The release of these three tools will enable developers to create visual rich skills for Alexa devices with screens. Amazon describes these tools as the collection of tech and tools for creating visually rich and interactive voice experiences. """
```

```
data = text.split('.')
for i in data:
    print (i)
```

output:

```
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p4a.py =====
This tool is an a beta stage
Alexa developers can use Get Metrics API to seamlessly analyse metric
It also supports custom skill model, prebuilt Flash Briefing model, and the Smart Home Skill API
You can use this tool for creation of monitors, alarms, and dashboards that spotlight changes
The release of these three tools will enable developers to create visual rich skills for Alexa devices with screens
Amazon describes these tools as the collection of tech and tools for creating visually rich and interactive voice experiences
.
```

b. Tokenization using Regular Expressions (RegEx)

code:

```
import nltk
# import RegexpTokenizer() method from nltk
from nltk.tokenize import RegexpTokenizer

# Create a reference variable for Class RegexpTokenizer
tk = RegexpTokenizer("\s+", gaps = True)

# Create a string input
str = "I love to study Natural Language Processing in Python"

# Use tokenize method
tokens = tk.tokenize(str)

print(tokens)
```

output:

```
>>>
===== RESTART: D:/2020/NLP/Practical/uni/p4b.py =====
['I', 'love', 'to', 'study', 'Natural', 'Language', 'Processing', 'in', 'Python']
>>> |
```

c. Tokenization using NLTK

code:

```
import nltk
from nltk.tokenize import word_tokenize

# Create a string input
str = "I love to study Natural Language Processing in Python"

# Use tokenize method
print(word_tokenize(str))
```

output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p4c.py =====
['I', 'love', 'to', 'study', 'Natural', 'Language', 'Processing', 'in', 'Python']
>>>
```

d. Tokenization using the spaCy library

code:

```
import spacy
nlp = spacy.blank("en")

# Create a string input
str = "I love to study Natural Language Processing in Python"

# Create an instance of document;
# doc object is a container for a sequence of Token objects.
doc = nlp(str)

# Read the words; Print the words
#
words = [word.text for word in doc]
print(words)
```

output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p4d.py =====
['I', 'love', 'to', 'study', 'Natural', 'Language', 'Processing', 'in', 'Python']
>>>
```

e. Tokenization using Keras

code:

```
#pip install keras
#pip install tensorflow
import keras
from keras.preprocessing.text import text_to_word_sequence
```

Create a string input

```
str = "I love to study Natural Language Processing in Python"
```

tokenizing the text

```
tokens = text_to_word_sequence(str)
```

```
print(tokens)
```

output:

```
>>>
===== RESTART: D:\2020\NLP\Practical\uni\p4e.py =====
['i', 'love', 'to', 'study', 'natural', 'language', 'processing', 'in', 'python']
```

f. Tokenization using Gensim

code:

```
#pip install gensim
```

```
from gensim.utils import tokenize
```

Create a string input

```
str = "I love to study Natural Language Processing in Python"
```

tokenizing the text

```
list(tokenize(str))
```

output:

Microsoft Visual C++ 14.0 is required. Get it with "Build Tools for Visual Studio":

<https://visualstudio.microsoft.com/downloads/>

5. Import NLP Libraries for Indian Languages and perform:

Note: Execute this practical in <https://colab.research.google.com/>

a) word tokenization in HindiSource

code:

```
!pip install torch==1.3.1+cpu -f https://download.pytorch.org/whl/torch\_stable.html
```

```
!pip install inltk
```

```
!pip install tornado==4.5.3
```

```
from inltk.inltk import setup  
setup('hi')
```

```
from inltk.inltk import tokenize
```

```
hindi_text = """"एक ठिक भाषा सीखना बहुत तिलचस्प है।"""
```

```
# tokenize(input text, language code)  
tokenize(hindi_text, "hi")
```

output

```
['_लकृ ित क', '_भाष ा', '_सीखना', '_बहुत', '_ित लचस्प', '_है', '।']
```

b) Generate similar sentences from a given Hindi text inputSource code:

```
!pip install torch==1.3.1+cpu -f https://download.pytorch.org/whl/torch\_stable.html
```

```
!pip install inltk
```

```
!pip install tornado==4.5.3
```

```
from inltk.inltk import setup  
setup('hi')
```

```
from inltk.inltk import get_similar_sentences
```

```
# get similar sentences to the one given in hindi
```

```
output = get_similar_sentences('मैं आज बहुत खश हूँ', 5, 'hi')
```

```
print(output)
```

Output:

```
['मैं आजकल बहुत ख,श हूँ', 'मैं आज अि्यित क ख  
,श हूँ', 'मैं अभी बहुत ख,श हूँ', 'मैं वत मान बहुत  
ख,श हूँ', 'मैं वत मान बहुत ख,श हूँ']
```

c) Identify the Indian language of a textSource code:

```
!pip install torch==1.3.1+cpu -f https://download.pytorch.org/whl/torch\_stable.html
```

```
!pip install inltk
```

```
!pip install tornado==4.5.3
```

```
from inltk.inltk import setup  
setup('gu')
```

```
from inltk.inltk import identify_language  
#Identify the Language of given text  
identify_language('ગુજરાતી કાપડિયા')
```

Output:

Gujarati

6. Illustrate part of speech tagging.

a. Part of speech Tagging and chunking of user defined text.

b. Named Entity recognition of user defined text.

c. Named Entity recognition with diagram using NLTK corpus – treebank

POS Tagging, chunking and NER:

a) sentence tokenization, word tokenization, Part of speech Tagging and chunking of user defined text.

Source code:

```
import nltk  
from nltk import tokenize  
nltk.download('punkt')  
from nltk import tag  
from nltk import chunk  
nltk.download('averaged_perceptron_tagger')  
nltk.download('maxent_ne_chunker')  
nltk.download('words')
```

```
para = "Hello! My name is Beena Kapadia. Today you'll be learning NLTK."  
sents = tokenize.sent_tokenize(para)  
print("\nsentence tokenization\n===== \n",sents)
```

```
# word tokenization  
print("\nword tokenization\n===== \n")  
for index in range(len(sents)):  
    words = tokenize.word_tokenize(sents[index])  
    print(words)
```



```
# POS Tagging

tagged_words = []
for index in range(len(sents)):
    tagged_words.append(tag.pos_tag(words))
print("\nPOS Tagging\n=====\n",tagged_words)

# chunking

tree = []
for index in range(len(sents)):
    tree.append(chunk.ne_chunk(tagged_words[index]))
print("\nchunking\n=====\n")
print(tree)
```

Output:

sentence tokenization

=====

['Hello!', 'My name is Beena Kapadia.', "Today you'll be learning NLTK."]

word tokenization

=====

['Hello', '!']

['My', 'name', 'is', 'Beena', 'Kapadia', '.']

['Today', 'you', "'ll", 'be', 'learning', 'NLTK', '.']

POS Tagging

=====

[[('Today', 'NN'), ('you', 'PRP'), ("ll", 'MD'), ('be', 'VB'), ('learning', 'VBG'), ('NLTK', 'NNP'), (',', '.')], [('Today', 'NN'), ('you', 'PRP'), ("ll", 'MD'), ('be', 'VB'), ('learning', 'VBG'), ('NLTK', 'NNP'), (',', '.')], [('Today', 'NN'), ('you', 'PRP'), ("ll", 'MD'), ('be', 'VB'), ('learning', 'VBG'), ('NLTK', 'NNP'), (',', '.')]]

chunking

=====

[Tree('S', [('Today', 'NN'), ('you', 'PRP'), ("ll", 'MD'), ('be', 'VB'), ('learning', 'VBG'), Tree('ORGANIZATION', [('NLTK', 'NNP')]), (',', '.')]), Tree('S', [('Today', 'NN'), ('you', 'PRP'), ("ll", 'MD'), ('be', 'VB'), ('learning', 'VBG'), Tree('ORGANIZATION', [('NLTK', 'NNP')]), (',', '.')]), Tree('S', [('Today', 'NN'), ('you', 'PRP'), ("ll", 'MD'), ('be', 'VB'), ('learning', 'VBG'), Tree('ORGANIZATION', [('NLTK', 'NNP')]), (',', '.')])]

b) Named Entity recognition using user defined text.Source code:

```
!pip install -U spacy
!python -m spacy download en_core_web_sm
import spacy

# Load English tokenizer, tagger, parser and NER
nlp = spacy.load("en_core_web_sm")

# Process whole documents
text = ("When Sebastian Thrun started working on self-driving cars at "
        "Google in 2007, few people outside of the company took him "
        "seriously. "I can tell you very senior CEOs of major American "
        "car companies would shake my hand and turn away because I wasn't "
        "worth talking to," said Thrun, in an interview with Recode earlier "
        "this week.")
doc = nlp(text)

# Analyse syntax
print("Noun phrases:", [chunk.text for chunk in doc.noun_chunks])
print("Verbs:", [token.lemma_ for token in doc if token.pos_ == "VERB"])
```

Output:

Noun phrases: ['Sebastian Thrun', 'self-driving cars', 'Google', 'few people', 'the company', 'him', 'I', 'you', 'very senior CEOs', 'major American car companies', 'my hand', 'I', 'Thrun', 'an interview', 'Recode']

Verbs: ['start', 'work', 'drive', 'take', 'tell', 'shake', 'turn', 'be', 'talk', 'say']

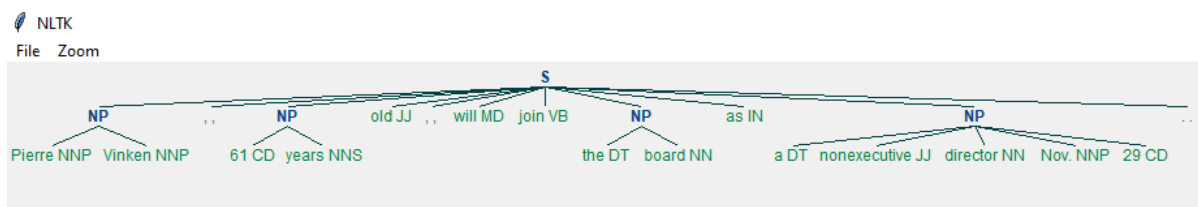
c) Named Entity recognition with diagram using NLTK corpus – treebank.Source code:

Note: It runs on Python IDLE

```
import nltk
nltk.download('treebank')
from nltk.corpus import treebank_chunk
treebank_chunk.tagged_sents()[0]

treebank_chunk.chunked_sents()[0]
treebank_chunk.chunked_sents()[0].draw()
```

Output:



7. Finite state automata

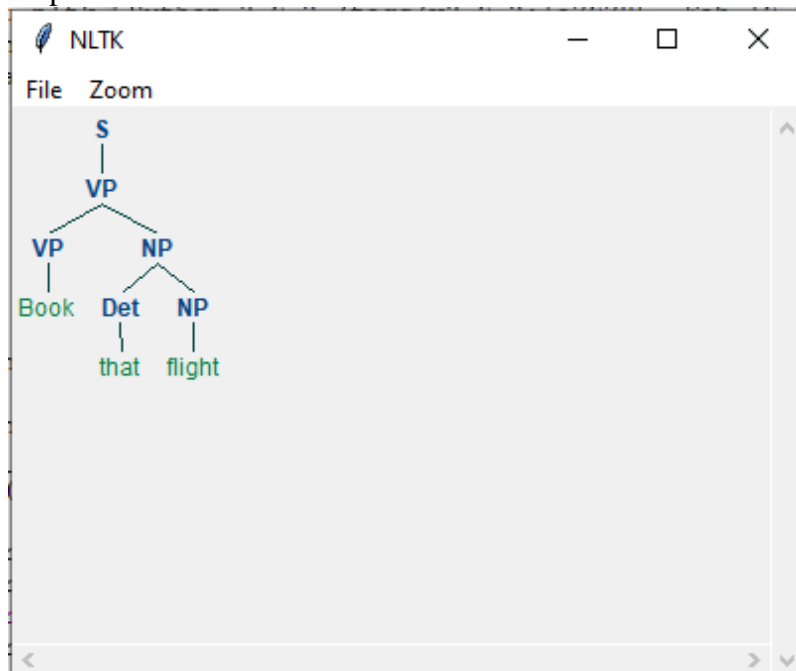
a) Define grammar using nltk. Analyze a sentence using the same.Code:

```
import nltk
from nltk import tokenize
grammar1 = nltk.CFG.fromstring("""
    S -> VP
    VP -> VP NP
    NP -> Det NP
    Det -> 'that'
    NP -> singular Noun
    NP -> 'flight'
    VP -> 'Book'
    """)
sentence = "Book that flight"

for index in range(len(sentence)):
    all_tokens = tokenize.word_tokenize(sentence)
    print(all_tokens)

parser = nltk.ChartParser(grammar1)
for tree in parser.parse(all_tokens):
    print(tree)
    tree.draw()
```

output:



b) Accept the input string with Regular expression of Finite Automaton: 101+.Source code:

```
def FA(s):
    #if the length is less than 3 then it can't be accepted, Therefore end the process.
    if len(s)<3:
        return "Rejected"
    #first three characters are fixed. Therefore, checking them using index
    if s[0]!='1':
        if s[1]!='0':
            if s[2]!='1':
                # After index 2 only "1" can appear. Therefore break the process if any other
                character is detected
                for i in range(3,len(s)):
                    if s[i]!='1':
                        return "Rejected"
                return "Accepted" # if all 4 nested if true
            return "Rejected" # else of 3rd if
        return "Rejected" # else of 2nd if
    return "Rejected" # else of 1st if
inputs=['1','10101','101','10111','01010','100',",",'10111101','1011111']
for i in inputs:
    print(FA(i))
```

Output:

```
Rejected
Rejected
Accepted
Accepted
Rejected
Rejected
Rejected
Rejected
Accepted
```

c) Accept the input string with Regular expression of FA: (a+b)*bba.Code:

```
def FA(s):
    size=0
    #scan complete string and make sure that it contains only 'a' & 'b'
    for i in s:
        if i=='a' or i=='b':
            size+=1
        else:
            return "Rejected"
    #After checking that it contains only 'a' & 'b'
    #check it's length it should be 3 atleast
    if size>=3:
        #check the last 3 elements
        if s[size-3]=='b':
```

```

        if s[size-2]=='b':
            if s[size-1]=='a':
                return "Accepted" # if all 4 if true
            return "Rejected" # else of 4th if
        return "Rejected" # else of 3rd if
    return "Rejected" # else of 2nd if
return "Rejected" # else of 1st if

inputs=['bba', 'ababbba', 'abba', 'abb', 'baba', 'bbb', '']
for i in inputs:
    print(FA(i))

```

output:

```

Rejected
Rejected
Accepted
Accepted
Rejected
Rejected
Rejected
Rejected
Accepted

```

d) Implementation of Deductive Chart Parsing using context free grammar and agiven sentence.

Source code:

```

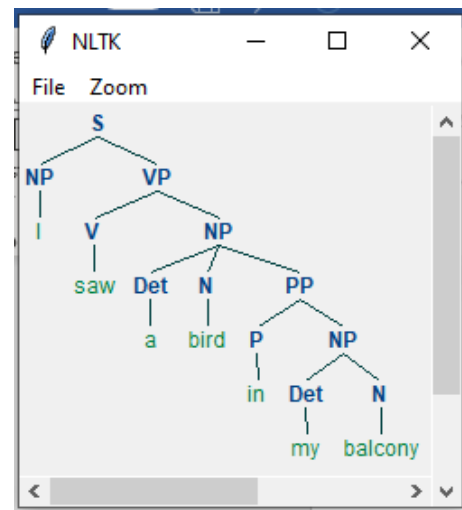
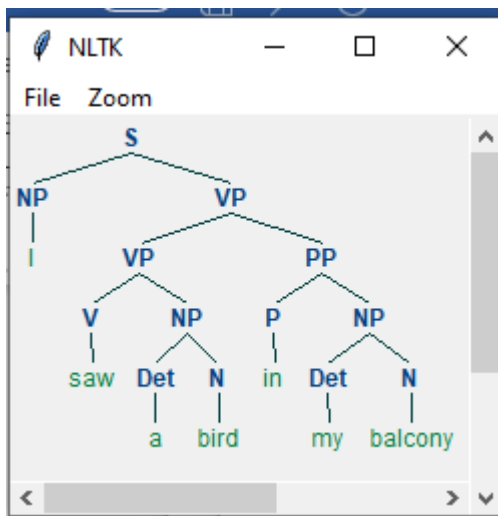
import nltk
from nltk import tokenize
grammar1 = nltk.CFG.fromstring("""
S -> NP VP
PP -> P NP
NP -> Det N | Det N PP | T
VP -> V NP | VP PP
Det -> 'a' | 'my'
N -> 'bird' | 'balcony'
V -> 'saw'
P -> 'in'
""")
sentence = "I saw a bird in my balcony"

for index in range(len(sentence)):
    all_tokens = tokenize.word_tokenize(sentence)
    print(all_tokens)

# all_tokens = ['I', 'saw', 'a', 'bird', 'in', 'my', 'balcony']
parser = nltk.ChartParser(grammar1)
for tree in parser.parse(all_tokens):
    print(tree)
    tree.draw()

```

output:



8. Study PorterStemmer, LancasterStemmer, RegexpStemmer, SnowballStemmer Study WordNetLemmatizer

Code:

PorterStemmer

```
import nltk
from nltk.stem import PorterStemmer
word_stemmer = PorterStemmer()
print(word_stemmer.stem('writing'))
```

Output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p8aPorterStemmer.py =====
write
>>> |
```

#LancasterStemmer

```
import nltk
from nltk.stem import LancasterStemmer
Lanc_stemmer = LancasterStemmer()
print(Lanc_stemmer.stem('writing'))
```

Output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p8bLancasterStemmer.py =====
writ
>>> |
```

#RegexpStemmer

```
import nltk
from nltk.stem import RegexpStemmer
Reg_stemmer = RegexpStemmer('ing$|s$|e$|able$', min=4)
print(Reg_stemmer.stem('writing'))
```

output

```
===== RESTART: D:/2020/NLP/Practical/uni/p8cRegexprStemmer.py =====
writ
>>> |
```

#SnowballStemmer

```
import nltk
from nltk.stem import SnowballStemmer
english_stemmer = SnowballStemmer('english')
print(english_stemmer.stem('writing'))
```

output

```
===== RESTART: D:/2020/NLP/Practical/uni/p8dSnowballStemmer.py =====
write
>>> |
```

#WordNetLemmatizer

```
from nltk.stem import WordNetLemmatizer
```

```
lemmatizer = WordNetLemmatizer()
```

```
print("word :\tlemma")
```

```
print("rocks :", lemmatizer.lemmatize("rocks"))
```

```
print("corpora :", lemmatizer.lemmatize("corpora"))
```

```
# a denotes adjective in "pos"
```

```
print("better :", lemmatizer.lemmatize("better", pos="a"))
```

Output:

```
===== RESTART: D:/2020/NLP/Practical/uni/p8eWordNetLemmatizer.py =====  
word : lemma  
rocks : rock  
corpora : corpus  
better : good  
>>> |
```


9. Implement Naive Bayes

classifierCode:

```
#pip install pandas
#pip install sklearn

import pandas as pd
import numpy as np

sms_data = pd.read_csv("spam.csv", encoding='latin-1')

import re
import nltk
from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer

stemming = PorterStemmer()
corpus = []
for i in range (0,len(sms_data)):
    s1 = re.sub('[^a-zA-Z]',repl = ' ',string = sms_data['v2'])[i])
    s1.lower()
    s1 = s1.split()
    s1 = [stemming.stem(word) for word in s1 if word not in
set(stopwords.words('english'))]
    s1 = ' '.join(s1)
    corpus.append(s1)

from sklearn.feature_extraction.text import CountVectorizer
countvectorizer =CountVectorizer()

x = countvectorizer.fit_transform(corpus).toarray()
print(x)

y = sms_data['v1'].values
print(y)

from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size = 0.3,
stratify=y,random_state=2)

#Multinomial Naïve Bayes.
from sklearn.naive_bayes import MultinomialNB
multinomialnb = MultinomialNB()
multinomialnb.fit(x_train,y_train)

# Predicting on test data:

y_pred = multinomialnb.predict(x_test)
print(y_pred)

#Results of our Models
```

```
print(classification_report(y_test,y_pred))
print("accuracy_score: ",accuracy_score(y_test,y_pred))
```

input:

spam.csv file from github

output:

```
=====
RESTART: D:\2020\NLP\Practical\uni\p9NaiveBayesClassifier.py
[[0 0 1 0 0 0 1 0 0 1 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0
  1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 2 0 2 1 1 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 1 1 0 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0]
[0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0
  0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
  0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
  0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 1 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 2 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 1 0 0 1 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0
  1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
[0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 2 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0
  0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
['ham' 'ham' 'spam' 'ham' 'ham' 'spam' 'ham' 'ham' 'spam']
['ham' 'ham' 'ham']

precision    recall  f1-score   support

   ham         0.67       1.00       0.80         2
  spam         0.00       0.00       0.00         1

 accuracy         0.67         3
 macro avg       0.33       0.50       0.40         3
weighted avg       0.44       0.67       0.53         3

accuracy_score: 0.6666666666666666
>>>
```

10. a. Speech Tagging:

i. Speech tagging using spacy

code

```
import spacy
sp = spacy.load('en_core_web_sm')
sen = sp(u"I like to play football. I hated it in my childhood though")
print(sen.text)
print(sen[7].pos_)
print(sen[7].tag_)
print(spacy.explain(sen[7].tag_))
for word in sen:
    print(f'{word.text:{12}} {word.pos_: {10}} {word.tag_: {8}}'
          {spacy.explain(word.tag_)})

sen = sp(u'Can you google it?')
word = sen[2]

print(f'{word.text:{12}} {word.pos_: {10}} {word.tag_: {8}}'
      {spacy.explain(word.tag_)})
sen = sp(u'Can you search it on google?')
word = sen[5]

print(f'{word.text:{12}} {word.pos_: {10}} {word.tag_: {8}}'
      {spacy.explain(word.tag_)})

#Finding the Number of POS Tags
sen = sp(u"I like to play football. I hated it in my childhood though")

num_pos = sen.count_by(spacy.attrs.POS)
num_pos

for k,v in sorted(num_pos.items()):
    print(f'{k}. {sen.vocab[k].text:{8}}: {v}')

#Visualizing Parts of Speech Tags
from spacy import displacy

sen = sp(u"I like to play football. I hated it in my childhood though")
displacy.serve(sen, style='dep', options={'distance': 120})
```

output:

```

===== RESTART: D:\2020\NLP\Practical\uni\pl0a1.py =====
I like to play football. I hated it in my childhood though
VERB
VBD
verb, past tense
I          PRON      PRP      pronoun, personal
like       VERB      VBP      verb, non-3rd person singular present
to         PART      TO       infinitival "to"
play       VERB      VB       verb, base form
football   NOUN      NN       noun, singular or mass
.          PUNCT     .       punctuation mark, sentence closer
I          PRON      PRP      pronoun, personal
hated      VERB      VBD      verb, past tense
it         PRON      PRP      pronoun, personal
in         ADP       IN       conjunction, subordinating or preposition
my         PRON      PRP$     pronoun, possessive
childhood  NOUN      NN       noun, singular or mass
though     ADV        RB       adverb
google     VERB      VB       verb, base form
google     PROPON     NNP      noun, proper singular
85. ADP    : 1
86. ADV    : 1
92. NOUN   : 2
94. PART   : 1
95. PRON   : 4
97. PUNCT  : 1
100. VERB  : 3

Using the 'dep' visualizer
Serving on http://0.0.0.0:5000 ...

```

To view the dependency tree, type the following address in your browser:
<http://127.0.0.1:5000/>. You will see the following dependency tree:

ii. Speech tagging

using nltkcode:

```

import nltk
from nltk.corpus import state_union
from nltk.tokenize import PunktSentenceTokenizer

#create our training and testing data:
train_text = state_union.raw("2005-GWBush.txt")
sample_text = state_union.raw("2006-GWBush.txt")

#train the Punkt tokenizer like:
custom_sent_tokenizer = PunktSentenceTokenizer(train_text)

# tokenize:
tokenized = custom_sent_tokenizer.tokenize(sample_text)

def process_content():
    try:
        for i in tokenized[:2]:
            words = nltk.word_tokenize(i)
            tagged = nltk.pos_tag(words)

```

```
print(tagged)
```

```
except Exception as e:  
    print(str(e))
```

```
process_content()
```

output:



b. Statistical parsing:

i. Usage of Give and Gave in the Penn Treebank sample

Source code:

```
#probabilistic parser
```

```
#Usage of Give and Gave in the Penn Treebank sample
```

```
import nltk  
import nltk.parse.viterbi  
import nltk.parse.pchart
```

```
def give(t):
```

```
    return t.label() == 'VP' and len(t) > 2 and t[1].label() == 'NP\  
        and (t[2].label() == 'PP-DTV' or t[2].label() == 'NP')\  
        and ('give' in t[0].leaves() or 'gave' in t[0].leaves())
```

```
def sent(t):
```

```
    return ''.join(token for token in t.leaves() if token[0] not in '*-0')
```

```

def print_node(t, width):
    output = "%s %s: %s / %s: %s" %\
        (sent(t[0]), t[1].label(), sent(t[1]), t[2].label(), sent(t[2]))
    if len(output) > width:
        output = output[:width] + "..."
    print (output)

for tree in nltk.corpus.treebank.parsed_sents():
    for t in tree.subtrees(give):
        print_node(t, 72)

```

```

===== RESTART: D:/2020/NLP/Practical/uni/pl0bl.py =====
gave NP: the chefs / NP: a standing ovation
give NP: advertisers / NP: discounts for maintaining or increasing ad sp...
give NP: it / PP-DTV: to the politicians
gave NP: them / NP: similar help
give NP: them / NP:
give NP: only French history questions / PP-DTV: to students in a Europe...
give NP: federal judges / NP: a raise
give NP: consumers / NP: the straight scoop on the U.S. waste crisis
gave NP: Mitsui / NP: access to a high-tech medical product
give NP: Mitsubishi / NP: a window on the U.S. glass industry
give NP: much thought / PP-DTV: to the rates she was receiving , nor to ...
give NP: your Foster Savings Institution / NP: the gift of hope and free...
give NP: market operators / NP: the authority to suspend trading in futu...
gave NP: quick approval / PP-DTV: to $ 3.18 billion in supplemental appr...
give NP: the Transportation Department / NP: up to 50 days to review any...
give NP: the president / NP: such power
give NP: me / NP: the heebie-jeebies
give NP: holders / NP: the right , but not the obligation , to buy a cal...
gave NP: Mr. Thomas / NP: only a `` qualified '' rating , rather than ``...
give NP: the president / NP: line-item veto power
>>> |

```

ii. probabilistic parser

Source code:

```

import nltk
from nltk import PCFG

grammar = PCFG.fromstring("""
NP -> NNS [0.5] | JJ NNS [0.3] | NP CC NP [0.2]
NNS -> "men" [0.1] | "women" [0.2] | "children" [0.3] | NNS CC NNS [0.4]
JJ -> "old" [0.4] | "young" [0.6]
CC -> "and" [0.9] | "or" [0.1]
""")

print(grammar)

viterbi_parser = nltk.ViterbiParser(grammar)

token = "old men and women".split()

obj = viterbi_parser.parse(token)

```

```
print("Output: ")
for x in obj:
    print(x)
```

```
===== RESTART: D:/2020/NLP/Practical/uni/pl0b2.py =====
Grammar with 11 productions (start state = NP)
NP -> NNS [0.5]
NP -> JJ NNS [0.3]
NP -> NP CC NP [0.2]
NNS -> 'men' [0.1]
NNS -> 'women' [0.2]
NNS -> 'children' [0.3]
NNS -> NNS CC NNS [0.4]
JJ -> 'old' [0.4]
JJ -> 'young' [0.6]
CC -> 'and' [0.9]
CC -> 'or' [0.1]
Output:
(NP (JJ old) (NNS (NNS men) (CC and) (NNS women))) (p=0.000864)
>>> |
```

c. Malt parsing:

Parse a sentence and draw a tree using malt parsing.

Note: 1) Java should be installed.

2) maltparser-1.7.2 zip file should be copied in C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39 folder and should be extracted in the same folder.

3) engmalt.linear-1.7.mco file should be copied to C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39 folder

Source code:

copy maltparser-1.7.2(unzipped version) and engmalt.linear-1.7.mco files to C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39 folder

java should be installed

environment variables should be set - MALT_PARSER - C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39\maltparser-1.7.2 and MALT_MODEL - C:\Users\Beena

Kapadia\AppData\Local\Programs\Python\Python39\engmalt.linear-1.7.mco

```
from nltk.parse import malt
```

```
mp = malt.MaltParser('maltparser-1.7.2', 'engmalt.linear-1.7.mco')#file
```

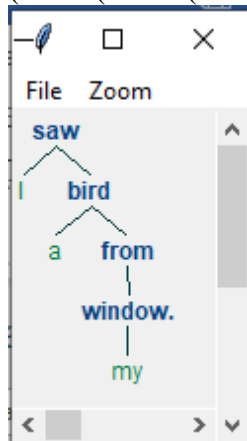
```
t = mp.parse_one('I saw a bird from my window.'.split()).tree()
```

```
print(t)
```

```
t.draw()
```

Output:

(saw I (bird a (from (window. my))))



11. a) Multiword Expressions in NLP

code:

```
# Multiword Expressions in NLP
```

```
from nltk.tokenize import MWETokenizer
from nltk import sent_tokenize, word_tokenize
s = "Good cake cost Rs.1500\kg in Mumbai. Please buy me one of them.\n\nThanks."
mwe = MWETokenizer([('New', 'York'), ('Hong', 'Kong')], separator='_')
for sent in sent_tokenize(s):
    print(mwe.tokenize(word_tokenize(sent)))
```

Output:

```
===== RESTART: D:/2020/NLP/Practical/uni/plla.py =====
['Good', 'cake', 'cost', 'Rs.1500\\kg', 'in', 'Mumbai', '.']
['Please', 'buy', 'me', 'one', 'of', 'them', '.']
['Thanks', '.']
>>> |
```

b) Normalized Web Distance and Word Similarity

Source code:

```
# Normalized Web Distance and Word Similarity
```

```
#convert
```

```
#Reliance supermarket
#Reliance hypermarket
#Reliance
#Reliance
#Reliance downtown
#Reliance market
#Mumbai
#Mumbai Hyper
#Mumbai dxb
#mumbai airport
#k.m trading
#KM Trading
#KM trade
#K.M. Trading
#KM.Trading
```

```
#into
```

```
#Reliance
#Reliance
#Reliance
#Reliance
#Reliance
#Reliance
#Mumbai
#Mumbai
#Mumbai
```

```

#Mumbai
#KM Trading
#KM Trading
#KM Trading
#KM Trading
#KM Trading

import numpy as np
import re
import textdistance # pip install textdistance
# we will need scikit-learn>=0.21
import sklearn #pip install sklearn
from sklearn.cluster import AgglomerativeClustering

texts = [
    'Reliance supermarket', 'Reliance hypermarket', 'Reliance', 'Reliance', 'Reliance
downtown', 'Relianc market',
    'Mumbai', 'Mumbai Hyper', 'Mumbai dxb', 'mumbai airport',
    'k.m trading', 'KM Trading', 'KM trade', 'K.M. Trading', 'KM.Trading'
]

def normalize(text):
    """ Keep only lower-cased text and numbers"""
    return re.sub('[^a-z0-9]+', '', text.lower())

def group_texts(texts, threshold=0.4):
    """ Replace each text with the representative of its cluster"""
    normalized_texts = np.array([normalize(text) for text in texts])
    distances = 1 - np.array([
        [textdistance.jaro_winkler(one, another) for one in normalized_texts]
        for another in normalized_texts
    ])
    clustering = AgglomerativeClustering(
        distance_threshold=threshold, # this parameter needs to be tuned carefully
        affinity="precomputed", linkage="complete", n_clusters=None
    ).fit(distances)
    centers = dict()
    for cluster_id in set(clustering.labels_):
        index = clustering.labels_ == cluster_id
        centrality = distances[:, index][index].sum(axis=1)
        centers[cluster_id] = normalized_texts[index][centrality.argmax()]
    return [centers[i] for i in clustering.labels_]

print(group_texts(texts))

```

Output:

```

===== RESTART: D:/2020/NLP/Practical/uni/pllb.py =====
['reliance', 'reliance', 'reliance', 'reliance', 'reliance', 'reliance', 'mumbai',
 'mumbai', 'mumbai', 'mumbai', 'km trading', 'km trading', 'km trading', 'km t
rading', 'km trading']
>>> |

```

c) Word Sense Disambiguation

Source code:

```
#Word Sense Disambiguation
from nltk.corpus import wordnet as wn
```

```
def get_first_sense(word, pos=None):
    if pos:
        synsets = wn.synsets(word,pos)
    else:
        synsets = wn.synsets(word)
    return synsets[0]
```

```
best_synset = get_first_sense('bank')
print ('%s: %s' % (best_synset.name, best_synset.definition))
best_synset = get_first_sense('set','n')
print ('%s: %s' % (best_synset.name, best_synset.definition))
best_synset = get_first_sense('set','v')
print ('%s: %s' % (best_synset.name, best_synset.definition))
```

Output:

```
===== RESTART: D:/2020/NLP/Practical/uni/pllc.py =====
<bound method Synset.name of Synset('bank.n.01')>: <bound method Synset.definition of Synset('bank.n.01')>
<bound method Synset.name of Synset('set.n.01')>: <bound method Synset.definition of Synset('set.n.01')>
<bound method Synset.name of Synset('put.v.01')>: <bound method Synset.definition of Synset('put.v.01')>
>>> |
```