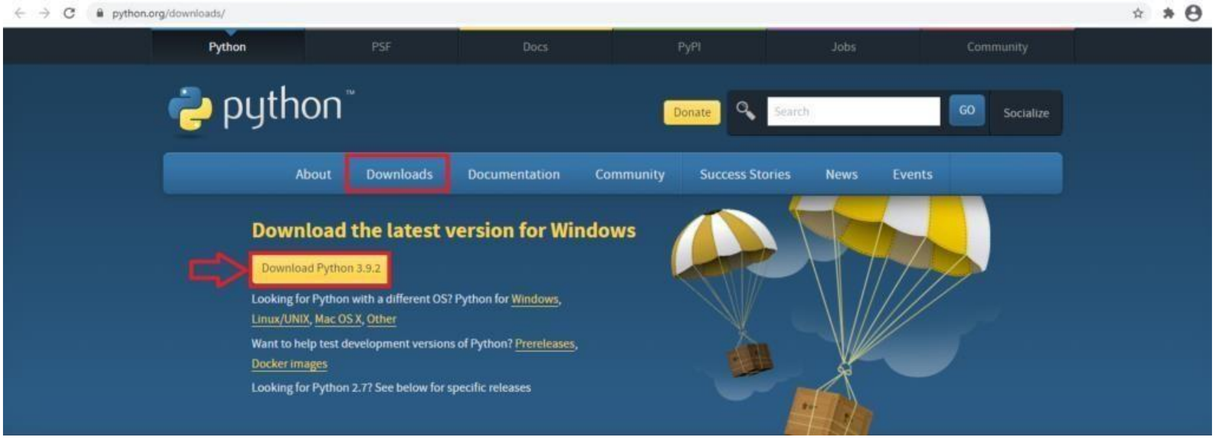
NLP Lab Manual

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.**



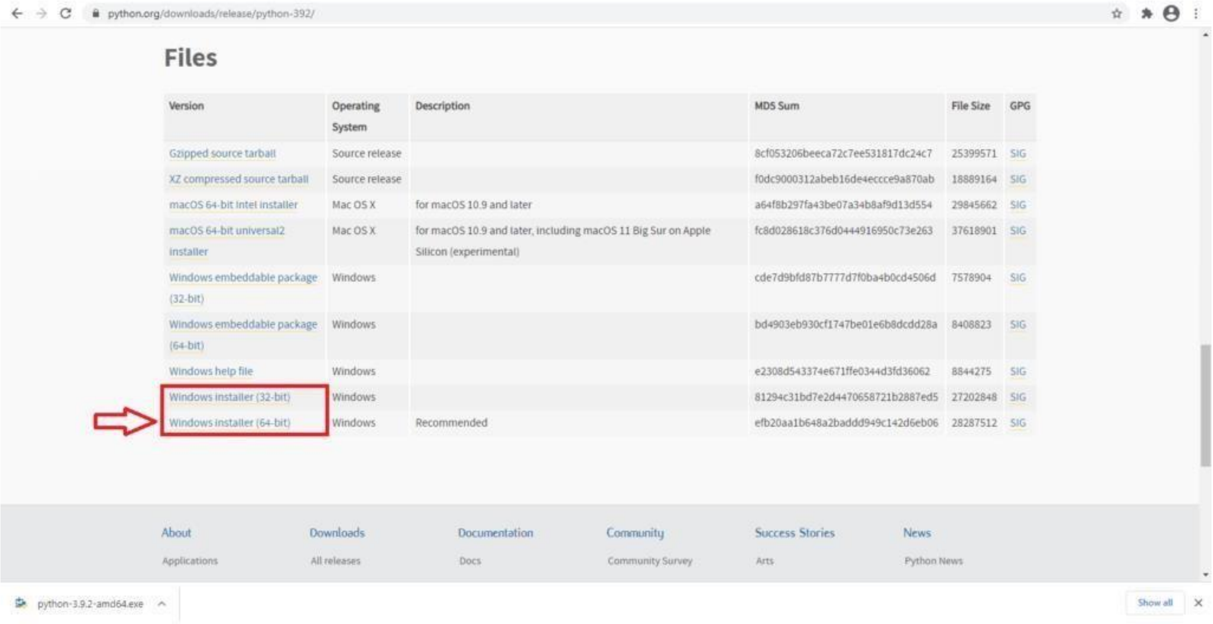
Download the latest version for Windows

Looking for Python with a different OS? Python for Windows, Linux/UNIX, Mac OS X, Other

Want to help test development versions of Python? Prereleases, Docker images

Looking for Python 2.7? See below for specific releases

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

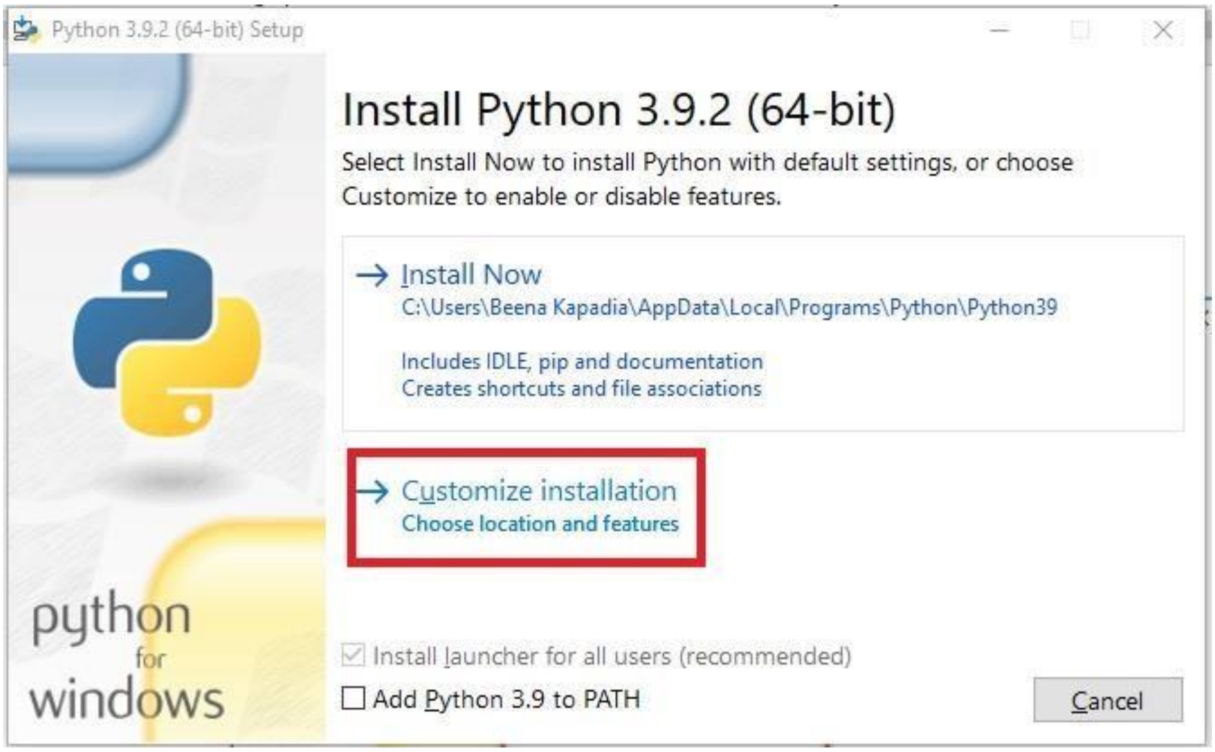


Files

Version	Operating System	Description	MD5 Sum	File Size	GPG
Gzipped source tarball	Source release		8cf053206beeca72c7ee531817dc24c7	25399571	SIG
XZ compressed source tarball	Source release		f0dc9000312abeb16de4eccce9a870ab	18889164	SIG
macOS 64-bit Intel installer	Mac OS X	for macOS 10.9 and later	a64f8b297fa43be07a34b8af9d13d554	29845662	SIG
macOS 64-bit universal2 installer	Mac OS X	for macOS 10.9 and later, including macOS 11 Big Sur on Apple Silicon (experimental)	fc8d028618c376d0444916950c73e263	37618901	SIG
Windows embeddable package (32-bit)	Windows		cde7d9bfd87b7777d7f0ba4b0cd4506d	7578904	SIG
Windows embeddable package (64-bit)	Windows		bd4903eb930cf1747be01e6b8dcdd28a	8408823	SIG
Windows help file	Windows		e2308d543374e671ffe0344d3fd36062	8844275	SIG
Windows installer (32-bit)	Windows		81294c31bd7e2d4470658721b2887ed5	27202848	SIG
Windows installer (64-bit)	Windows	Recommended	efb20aa1b648a2baddd949c142d6eb06	28287512	SIG

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

Step 3) Select Customize Installation



Python 3.9.2 (64-bit) Setup

Install Python 3.9.2 (64-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

→ Install Now
C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39

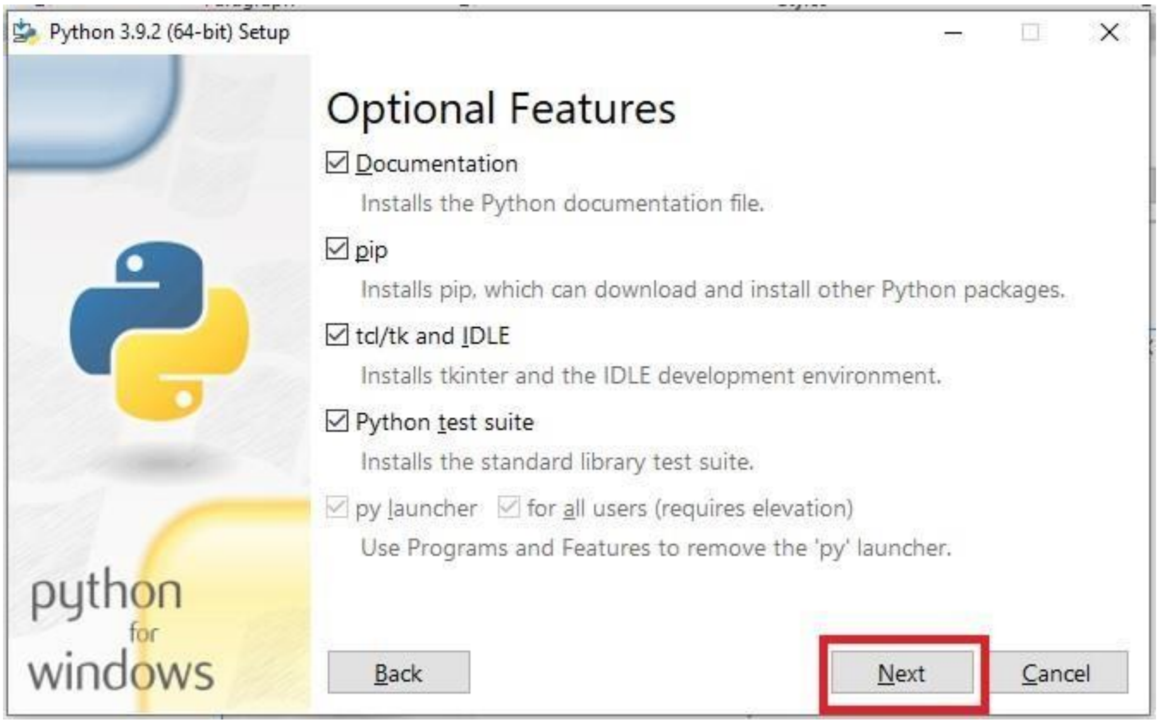
Includes IDLE, pip and documentation
Creates shortcuts and file associations

→ Customize installation
Choose location and features

☑ Install launcher for all users (recommended)

☐ Add Python 3.9 to PATH

Step 4) Click NEXT



Python 3.9.2 (64-bit) Setup

Optional Features

☑ Documentation
Installs the Python documentation file.

☑ pip
Installs pip, which can download and install other Python packages.

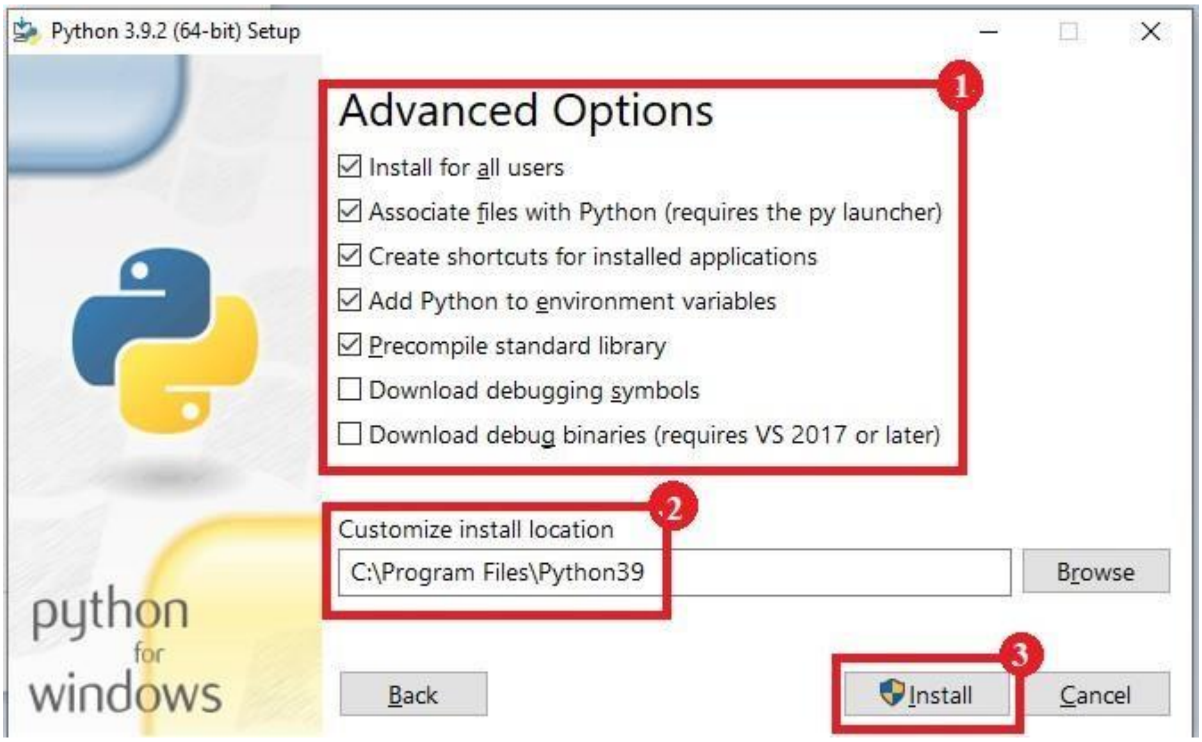
☑ tcl/tk and IDLE
Installs tkinter and the IDLE development environment.

☑ Python test suite
Installs the standard library test suite.

☑ py launcher ☑ for all users (requires elevation)
Use Programs and Features to remove the 'py' launcher.

Step 5) In next screen

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



Python 3.9.2 (64-bit) Setup

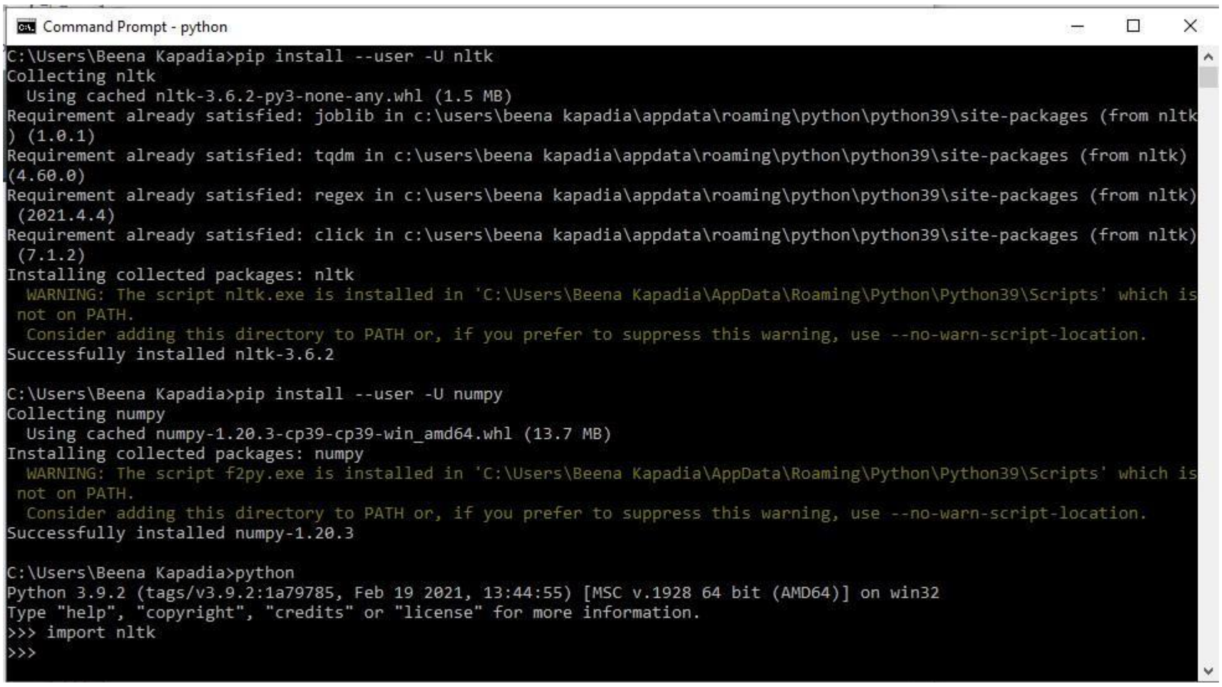
Advanced Options

☑ Install for all users
☑ Associate files with Python (requires the py launcher)
☑ Create shortcuts for installed applications
☑ Add Python to environment variables
☑ Precompile standard library
☐ Download debugging symbols
☐ Download debug binaries (requires VS 2017 or later)

Customize install location
C:\Program Files\Python39

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 numpy
C:\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
>>>
```

(Browse https://www.nltk.org/install.html for more details)

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 conversion

from 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:

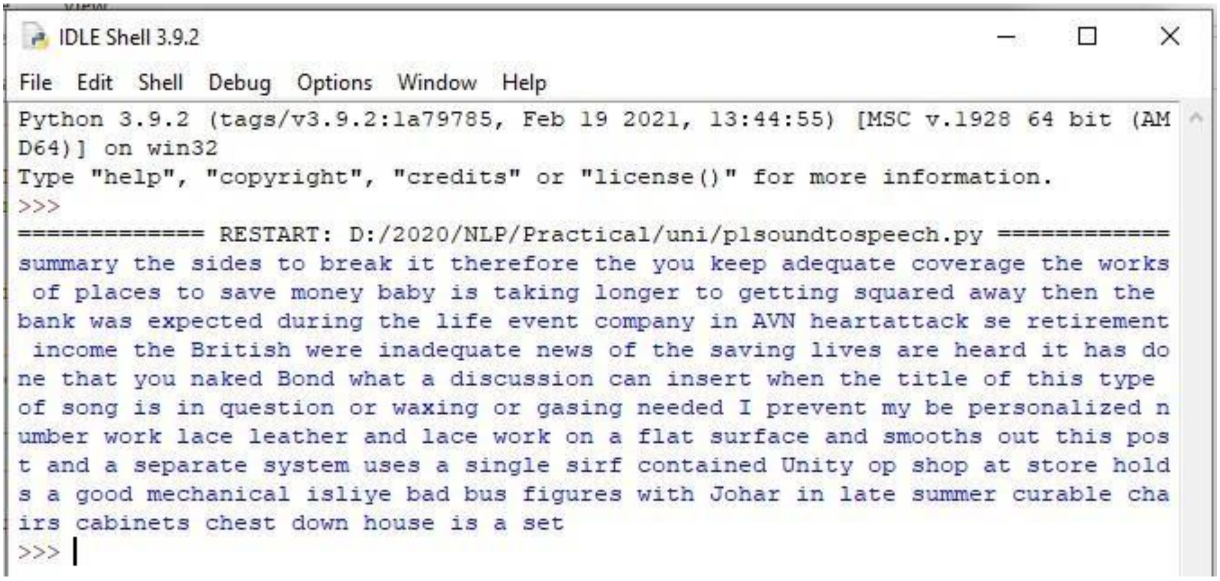
Note: required to store the input file "male.wav" in the current folder before running the program.

```
#pip3 install SpeechRecognition pydub

import speech_recognition as sr
filename = "male.wav"

# initialize the recognizer
r = 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:



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============= RESTART: D:/2020/NLP/Practical/uni/p1soundtospeech.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 filelds, 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.

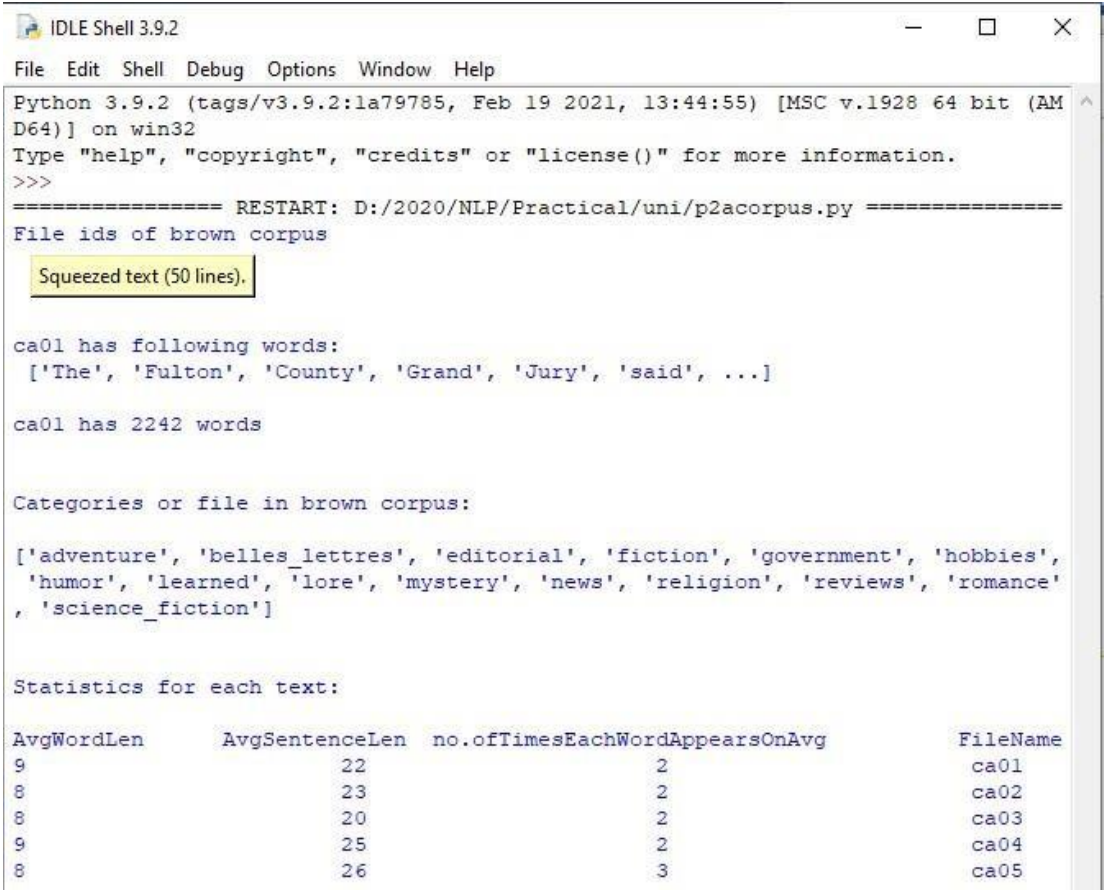
a. Study of various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fields, raw, words, sents, categories,

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\tAvgSentenceLen\tno.ofTimesEachWordAppearsOnAvg\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 (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================ RESTART: D:/2020/NLP/Practical/uni/p2acorpus.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:

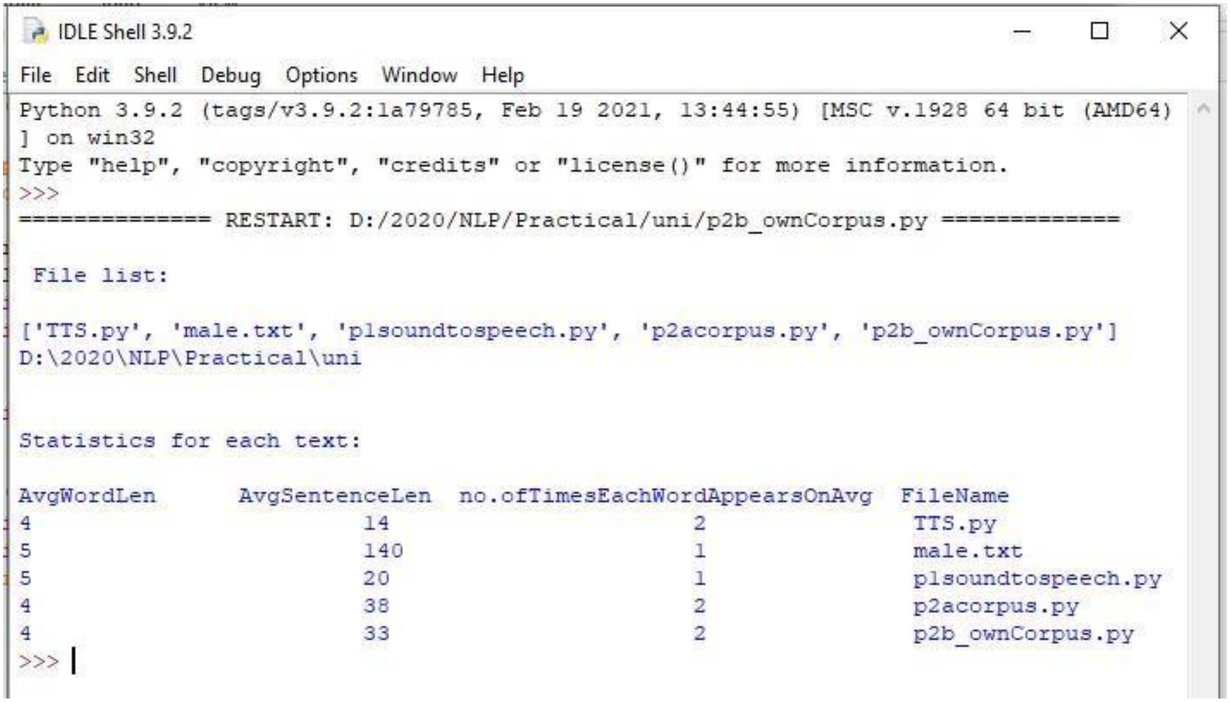
'''NLTK includes a small selection of texts from the Project filelist electronic text archive, which contains some 25,000 free electronic books, hosted at http://www.filelist.org/. We begin by getting the Python interpreter to load the NLTK package, then ask to see nltk.corpus.filelist.fileids(), the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



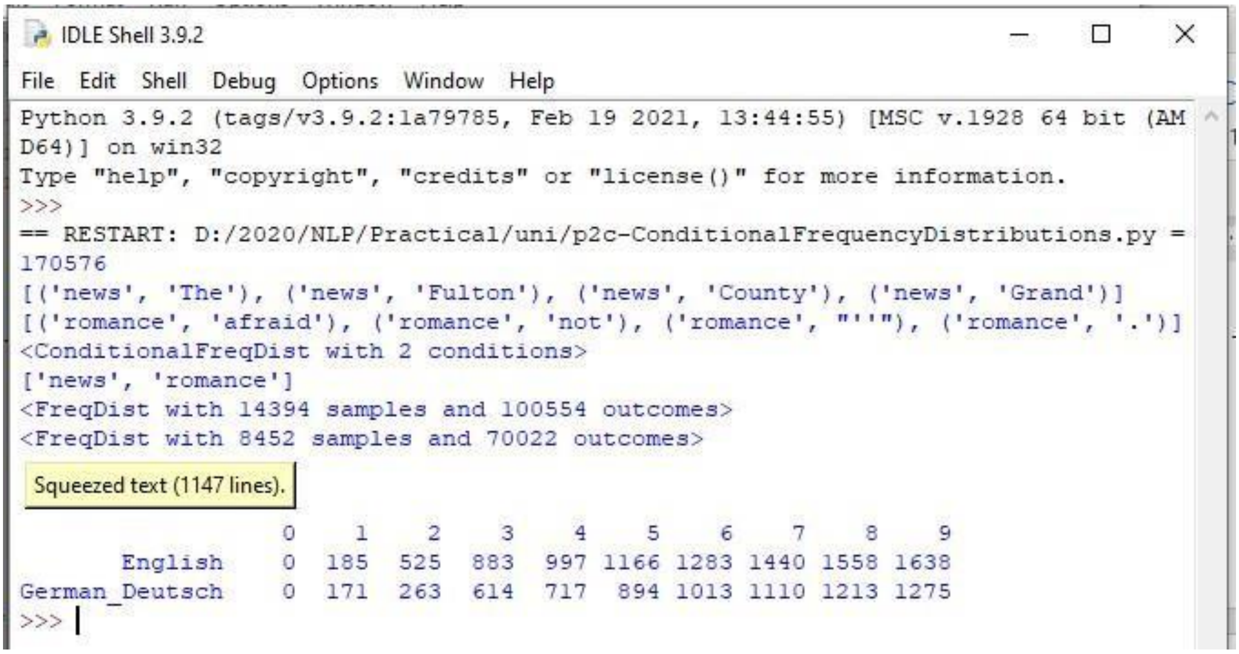
```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AMD64)
] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============== RESTART: D:/2020/NLP/Practical/uni/p2b_ownCorpus.py =============

 File list:

['TTS.py', 'male.txt', 'p1soundtospeech.py', 'p2acorpus.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                 p1soundtospeech.py
4                     38                        2                 p2acorpus.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_Inuktikut',
'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:



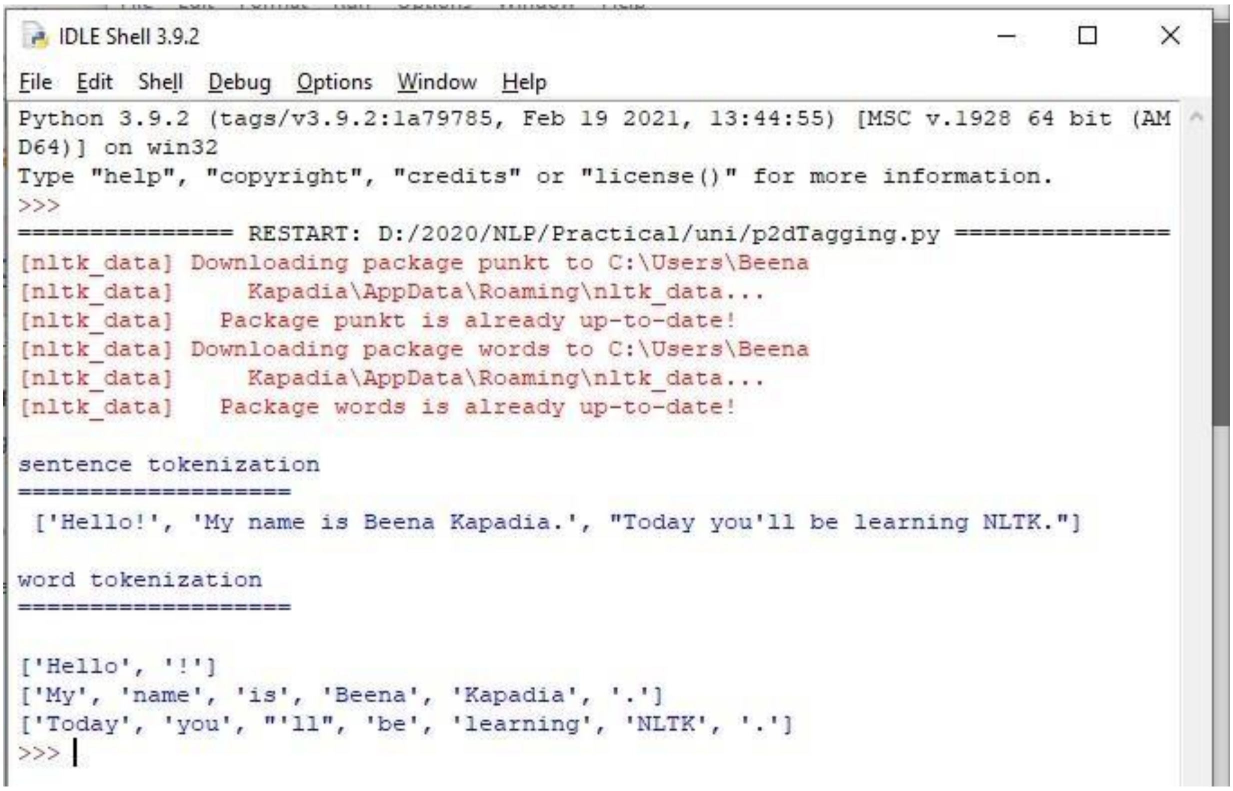
```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
== RESTART: D:/2020/NLP/Practical/uni/p2c-ConditionalFrequencyDistributions.py =
170576
[('news', 'The'), ('news', 'Fulton'), ('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>

                  0    1    2    3    4    5    6    7    8    9
       English    0  185  525  883  997 1166 1283 1440 1558 1638
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:



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] 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', '.']
>>>
```

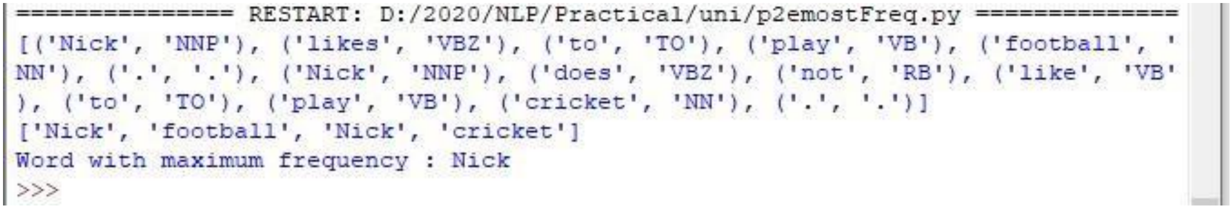
e. Write a program to find the most frequent noun tags.

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[wrd] += 1

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

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

output:

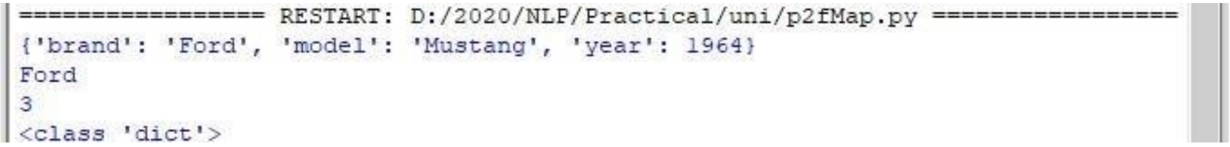


```
================ RESTART: D:/2020/NLP/Practical/uni/p2emostFreq.py ==============
[('Nick', 'NNP'), ('likes', 'VBZ'), ('to', 'TO'), ('play', 'VB'), ('football', '
NN'), ('.', '.'), ('Nick', 'NNP'), ('does', 'VBZ'), ('not', 'RB'), ('like', 'VB'
), ('to', 'TO'), ('play', 'VB'), ('cricket', 'NN'), ('.',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

f. Map Words to Properties Using Python Dictionaries code:

```
#creating and printing a dictionay 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:



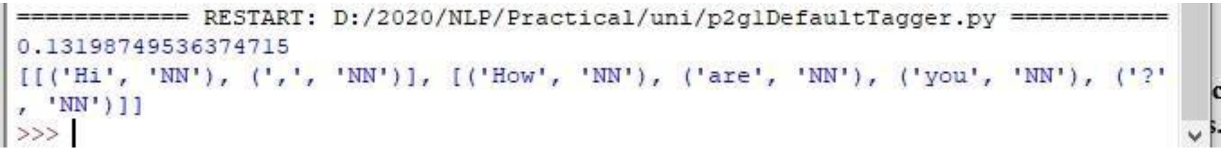
```
================= RESTART: D:/2020/NLP/Practical/uni/p2fMap.py =================
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}
Ford
3
<class 'dict'>
```

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

i) DefaultTagger 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

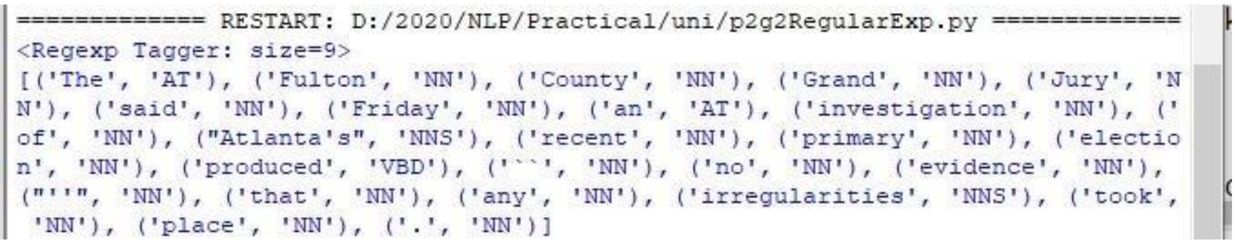


```
============ RESTART: D:/2020/NLP/Practical/uni/p2g1DefaultTagger.py ===========
0.13198749536374715
[[('Hi', 'NN'), (',', 'NN')], [('How', 'NN'), ('are', 'NN'), ('you', 'NN'), ('?'
, 'NN')]]
>>>
```

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:

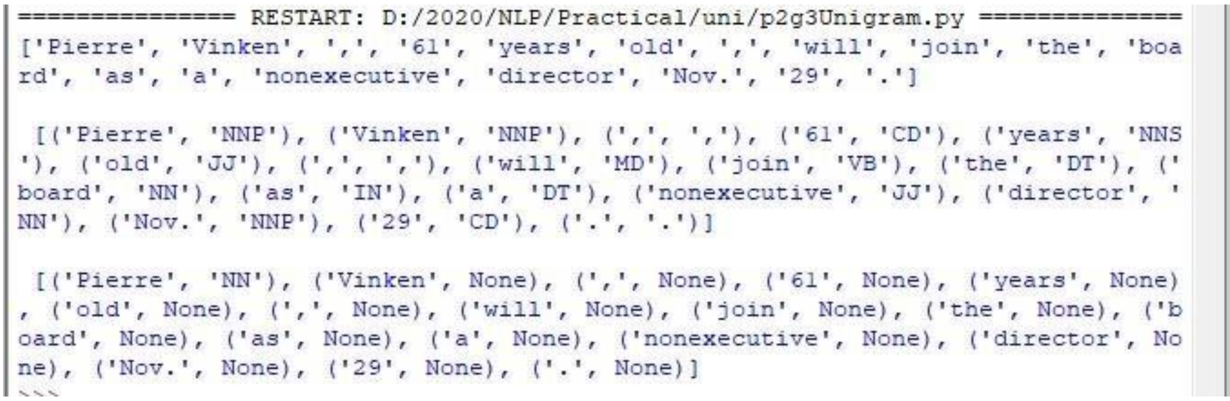


```
============= RESTART: D:/2020/NLP/Practical/uni/p2g2RegularExp.py =============
<Regexp Tagger: size=9>
[('The', 'AT'), ('Fulton', 'NN'), ('County', 'NN'), ('Grand', 'NN'), ('Jury', 'N
N'), ('said', 'NN'), ('Friday', 'NN'), ('an', 'AT'), ('investigation', 'NN'), ('
of', 'NN'), ("Atlanta's", 'NNS'),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

iii) UnigramTagger code:

```
# 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', 'boa
rd', '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), ('b
oard', None), ('as', None), ('a', None), ('nonexecutive', None), ('director', No
ne), ('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 ="".join([each for each in a if each not in splitwords]) 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)
```

Input:

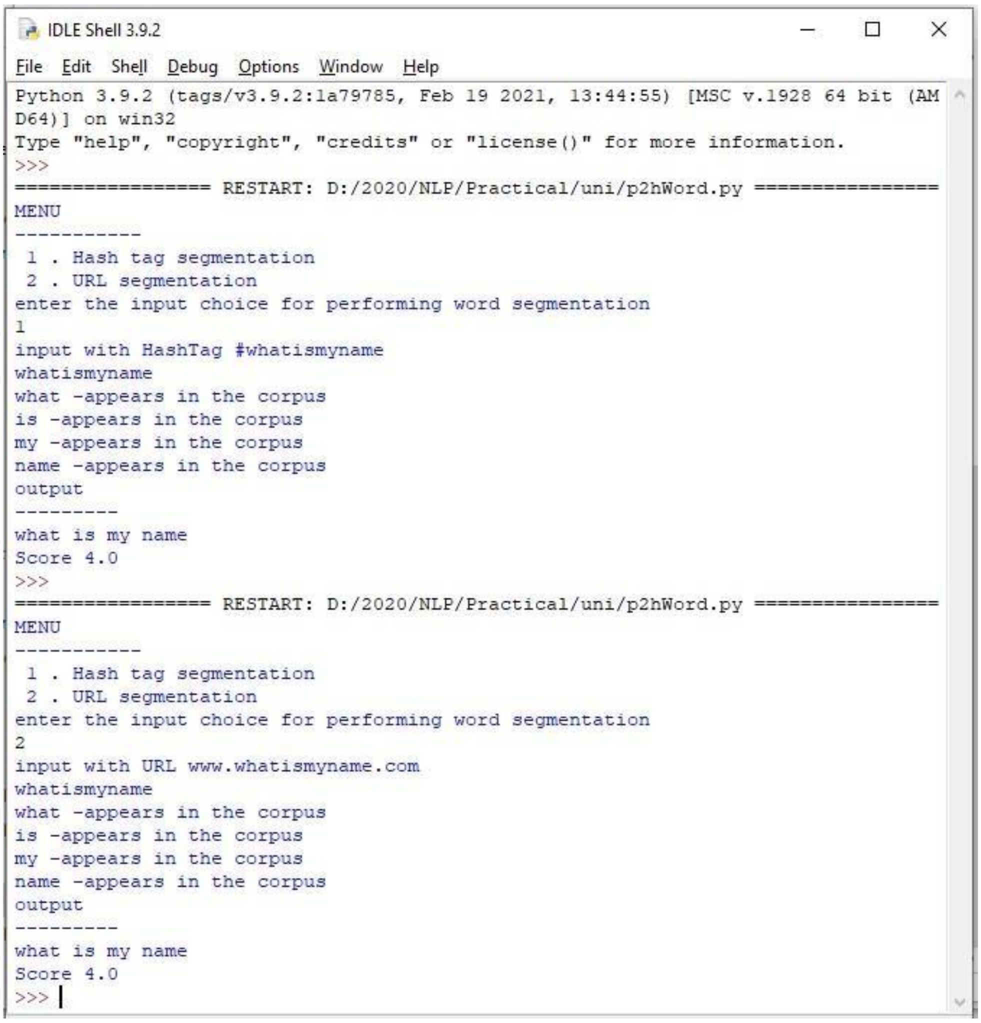
Words.txt

check
domain
big
rocks
name
cheap
being
human
current
rates
ought to
go

down
apple
domains
honesty
hour
follow

back
social
media
30
seconds
earth
this is
insane it
time
what is
my
name
let
us
go

Output:



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] 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
>>> |
```

Practical No. 3

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

Source code:

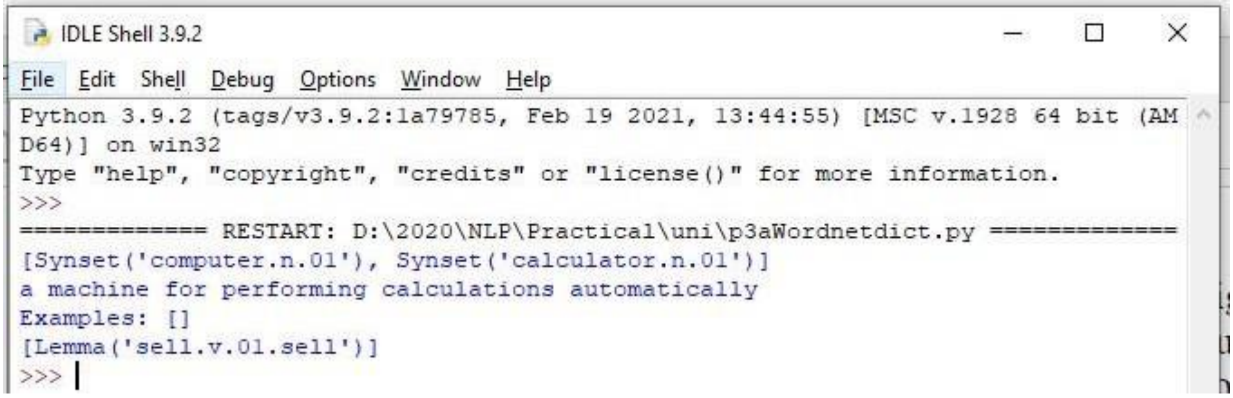
'''WordNet provides synsets which is the collection of synonym words also called
“lemmas”''' import nltk
from nltk.corpus import
wordnet
print(wordnet.synsets("computer"))

# 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



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] 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

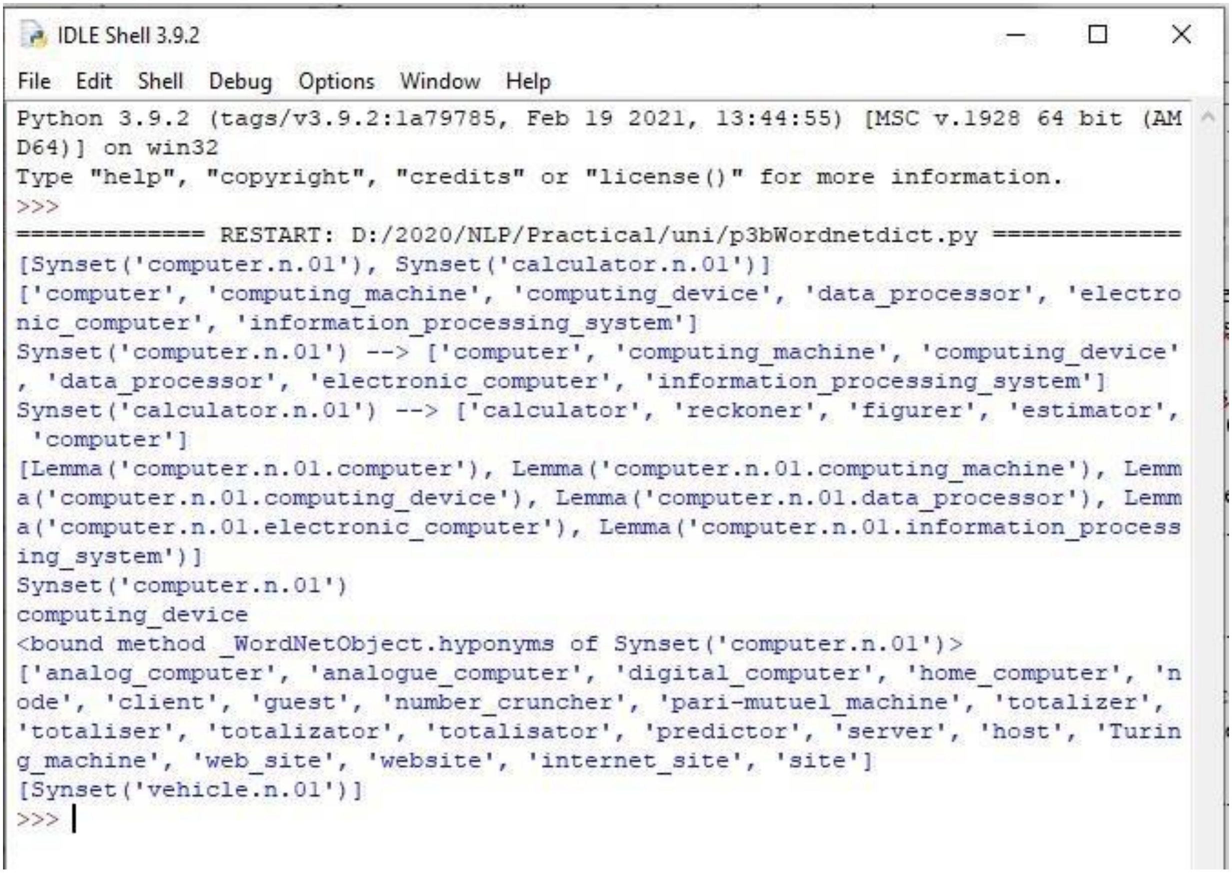
syn = wordnet.synset('computer.n.01') print(syn.hyponyms)

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_hypernyms(vehicle))

Output:



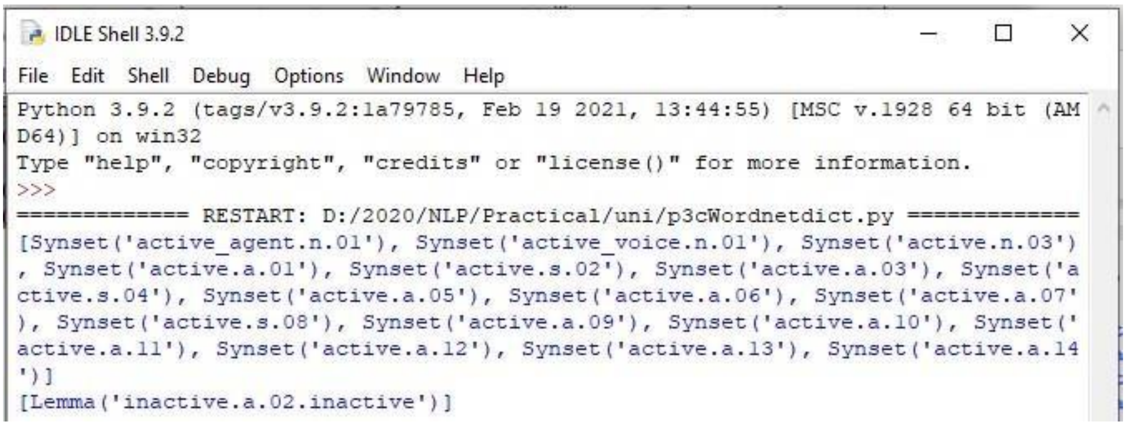
```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============= RESTART: D:/2020/NLP/Practical/uni/p3bWordnetdict.py =============
[Synset('computer.n.01'), Synset('calculator.n.01')]
['computer', 'computing_machine', 'computing_device', 'data_processor', 'electro
nic_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'), Lemm
a('computer.n.01.computing_device'), Lemma('computer.n.01.data_processor'), Lemm
a('computer.n.01.electronic_computer'), Lemma('computer.n.01.information_process
ing_system')]
Synset('computer.n.01')
computing_device
<bound method _WordNetObject.hyponyms of Synset('computer.n.01')>
['analog_computer', 'analogue_computer', 'digital_computer', 'home_computer', 'n
ode', 'client', 'guest', 'number_cruncher', 'pari-mutuel_machine', 'totalizer',
'totaliser', 'totalizator', 'totalisator', 'predictor', 'server', 'host', 'Turin
g_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:

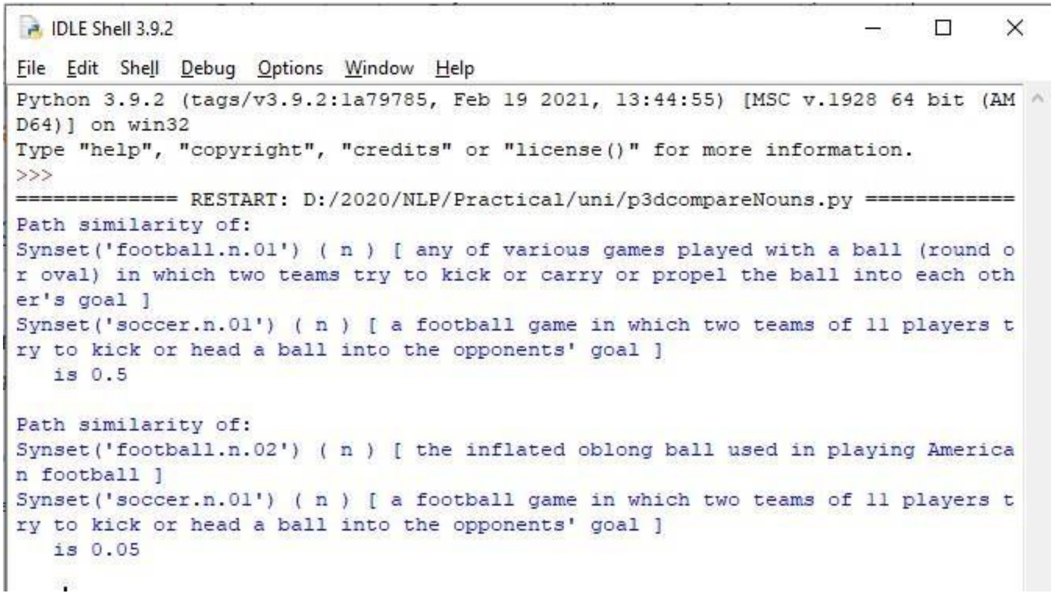


```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============= RESTART: D:/2020/NLP/Practical/uni/p3cWordnetdict.py =============
[Synset('active_agent.n.01'), Synset('active_voice.n.01'), Synset('active.n.03')
, Synset('active.a.01'), Synset('active.s.02'), Synset('active.a.03'), Synset('a
ctive.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:



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] 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 o
r oval) in which two teams try to kick or carry or propel the ball into each oth
er's goal ]
Synset('soccer.n.01') ( n ) [ a football game in which two teams of 11 players t
ry 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 America
n football ]
Synset('soccer.n.01') ( n ) [ a football game in which two teams of 11 players t
ry to kick or head a ball into the opponents' goal ]
   is 0.05
```

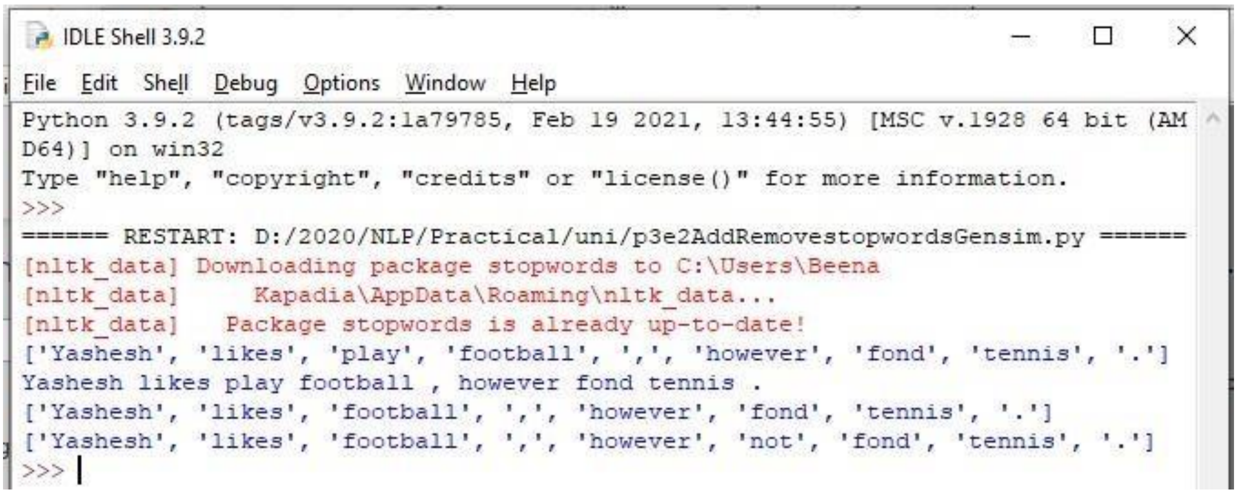
e. Handling stopword:

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

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



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] 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/
```

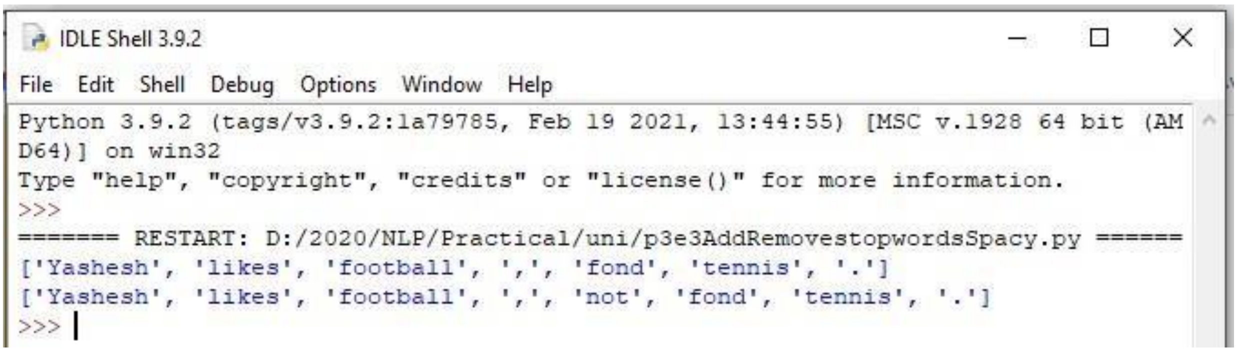
iii)Using Spacy Adding and Removing Stop Words in Default Spacy Stop Words List

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:



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] 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', '.']
>>>
```

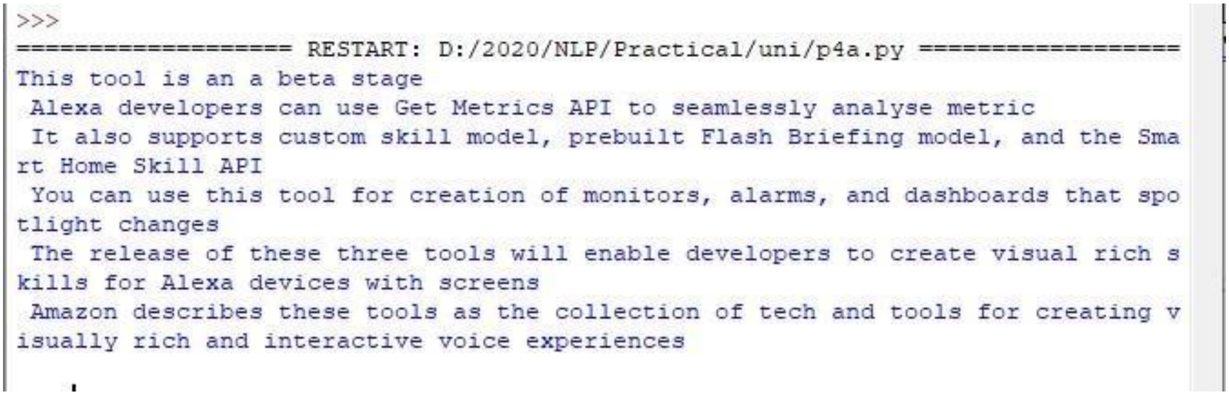
Practical No. 4

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 Sma
rt Home Skill API
 You can use this tool for creation of monitors, alarms, and dashboards that spo
tlight changes
 The release of these three tools will enable developers to create visual rich s
kills for Alexa devices with screens
 Amazon describes these tools as the collection of tech and tools for creating v
isually rich and interactive voice experiences
```

b. Tokenization using Regular Expressions (RegEx)

code:

import nltk

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

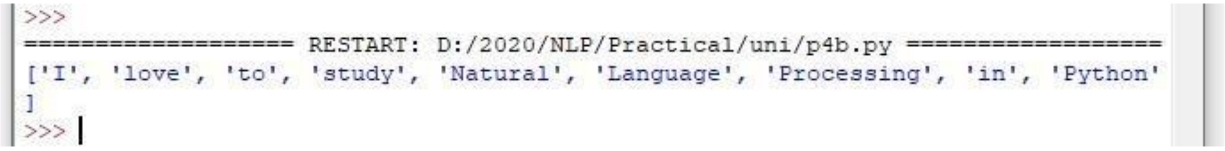
# Create a reference variable for Class RegexpTokenizer tk
= RegexpTokenizer('\s+', gaps = True)

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

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

print(tokens)

output:



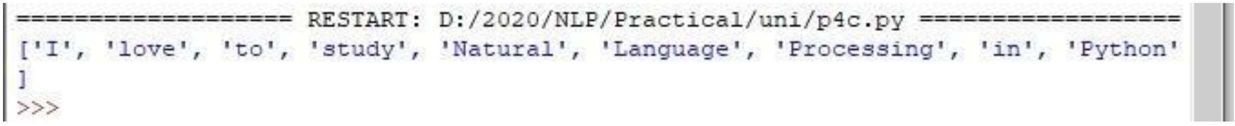
```
>>>
=================== RESTART: D:/2020/NLP/Practical/uni/p4b.py ==================
['I', 'love', 'to', 'study', 'Natural', 'Language', 'Processing', 'in', 'Python'
]
>>> |
```

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:



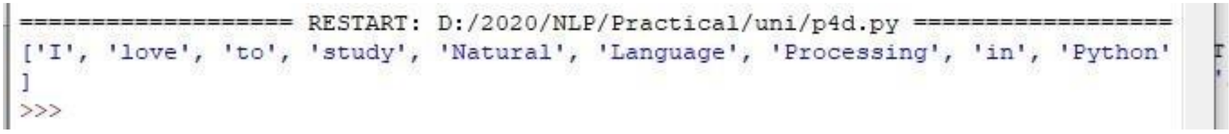
```
=================== RESTART: D:/2020/NLP/Practical/uni/p4c.py ==================
['I', 'love', 'to', 'study', 'Natural', 'Language', 'Processing', 'in', 'Python'
]
>>>
```

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:



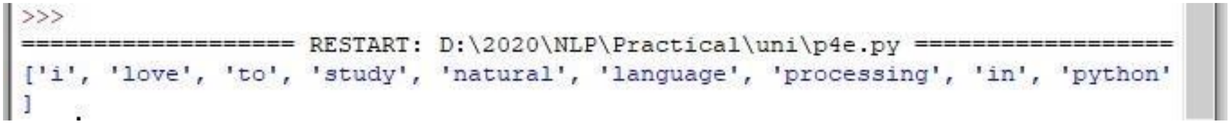
```
=================== RESTART: D:/2020/NLP/Practical/uni/p4d.py ==================
['I', 'love', 'to', 'study', 'Natural', 'Language', 'Processing', 'in', 'Python'
]
>>>
```

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/
```

Practical No. 5

5. Import NLP Libraries for Indian Languages and perform:

Note: Execute this practical in https://colab.research.google.com/ **a) word tokenization in Hindi Source 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 = "Learning a natural language is very exciting. """

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

output

```
['Natural', 'Language', 'Learning', 'A lot', 'Tilchasp', 'Is', 'Is', ". ']
```

b) Generate similar sentences from a given Hindi text input Source 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('I'm very happy today', 5,

'he') print(output)
```

Output:

```
['I am very happy nowadays', 'I am very happy today', 'I am very happy right now', 'I
am very happy here', 'I am very happy here']
```

c) Identify the Indian language of a text Source 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 Lnaguage of given text
identify_language('Bina Kapadia')
```

Output: gujarati

Practical No. 6

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:

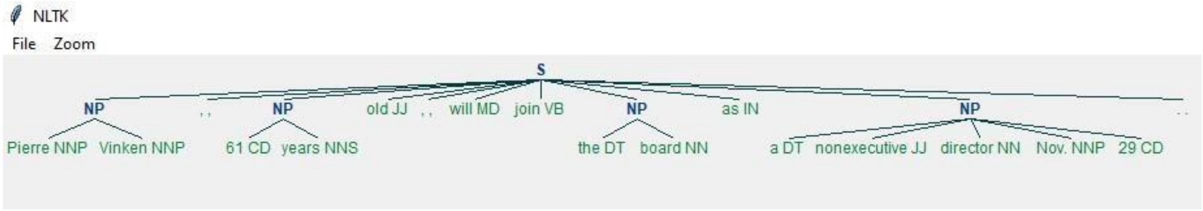
```
Noun phrases: ['Sebastian Thrun', 'self-driving cars', 'Google', 'few people', 'the
company', 'him', 'I', 'you', 'very senior CEOs', 'major American car companies', 'my
hand', 'I', 'Thrun', 'an interview', 'Recode']
Verbs: ['start', 'work', 'drive', 'take', 'tell', 'shake', 'turn', 'be', 'talk', '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:



Practical No. 7

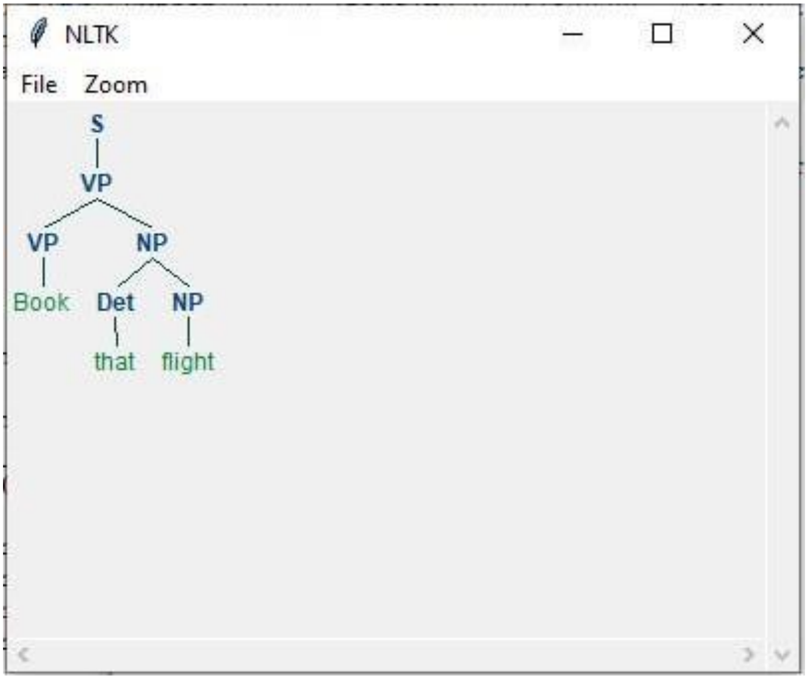
7. Finite state automata

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))
```

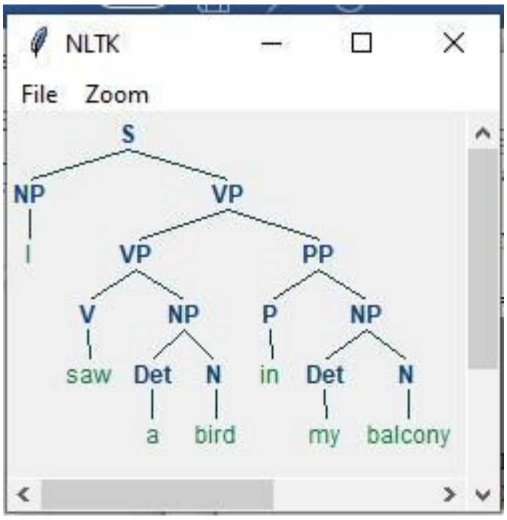
output:

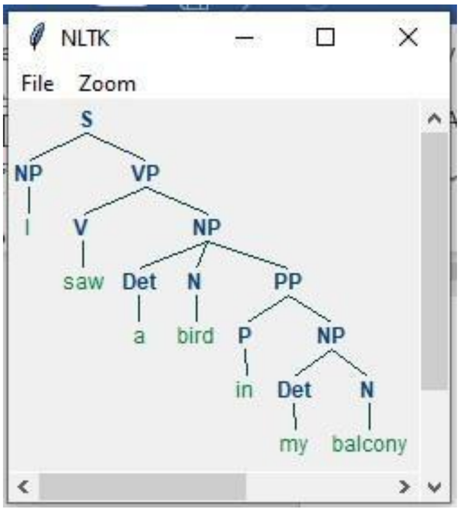
```
Rejected
Rejected
Accepted
Accepted
Rejected
Rejected
Rejected
Rejected
Accepted
```

d) Implementation of Deductive Chart Parsing using context free grammar and a given 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 | 'I'
   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:


NLTK
File
Zoom
S
NP
VP
I
VP
PP
V
NP
P
NP
saw
Det
N
in
Det
N
a
bird
my
balcony


NLTK
File
Zoom
S
NP
VP
I
V
NP
saw
Det
N
PP
a
bird
P
NP
in
Det
N
my
balcony

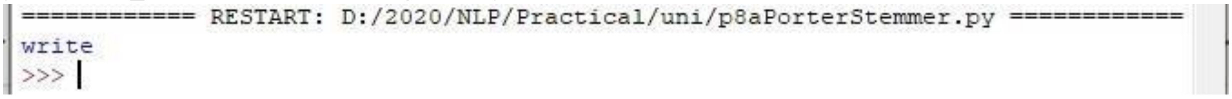
Practical No. 8

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'))
```

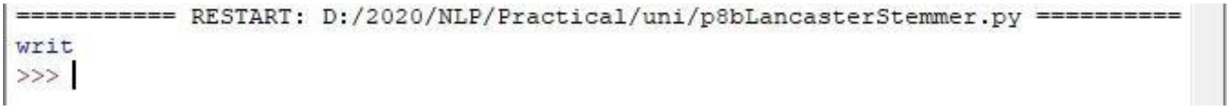
Output:



```
============ 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'))
```

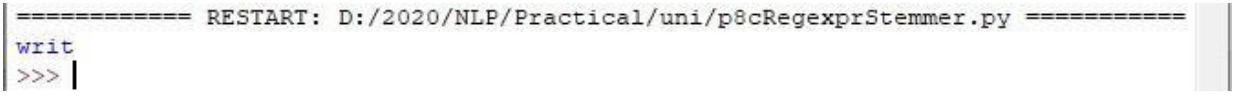
Output:



```
=========== 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'))
```

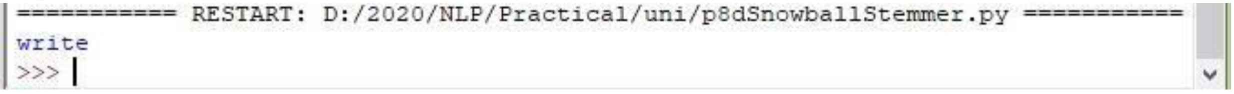
output



```
============ 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

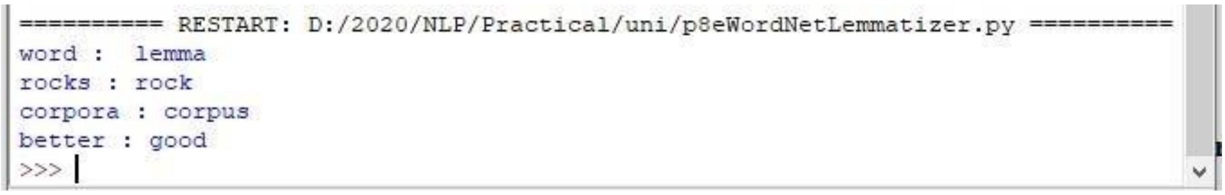


```
=========== RESTART: D:/2020/NLP/Practical/uni/p8dSnowballStemmer.py ===========
write
>>> 
```

```
#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
>>> 
```

Practical No. 9

9. Implement Naive Bayes classifier

Code:

```
#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:

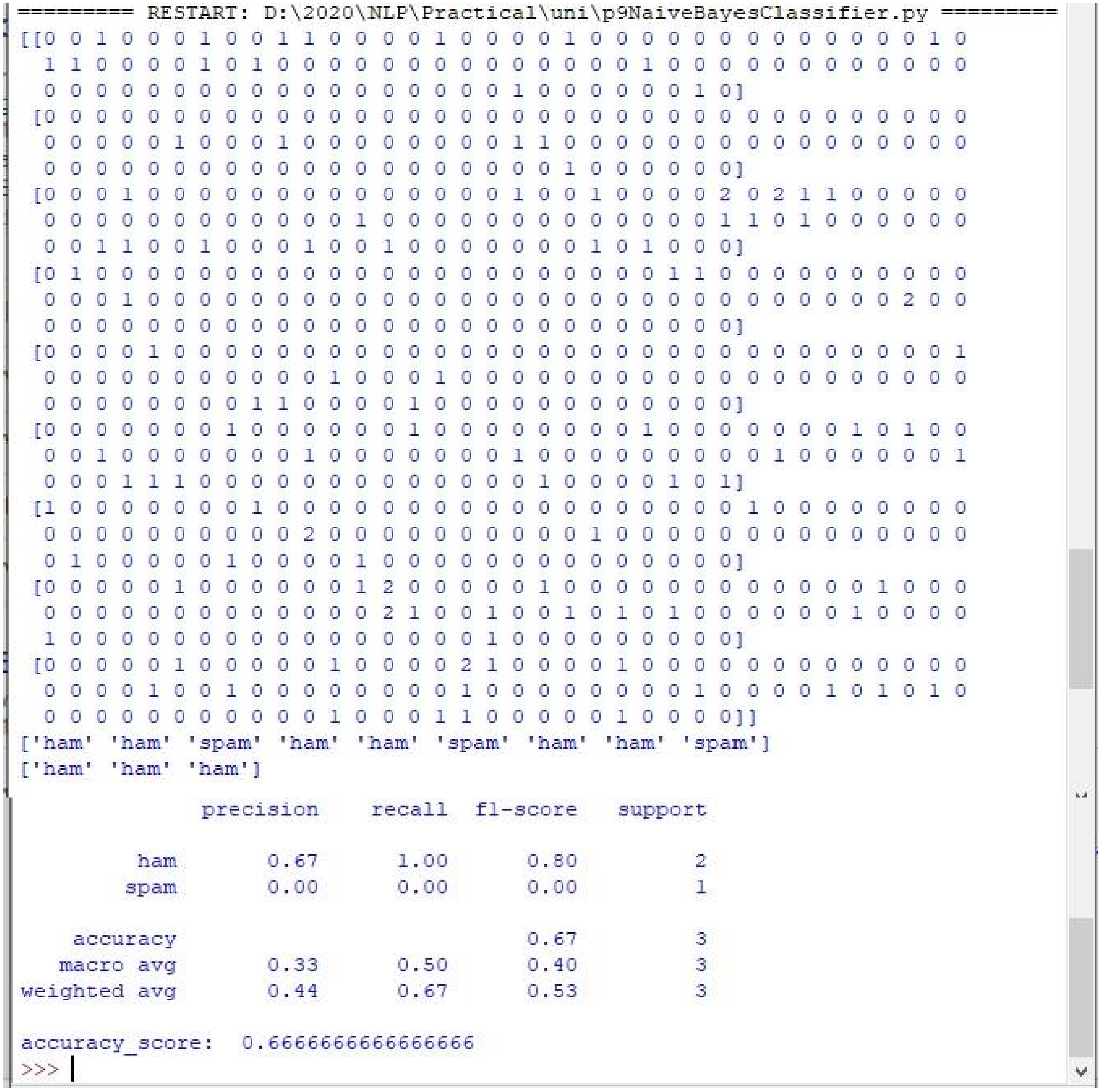
y_pred = multinomialnb.predict(x_test) print(y_pred)

#Results of our Models
from sklearn.metrics import classification_report, confusion_matrix from sklearn.metrics import accuracy_score

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 0 1 0
  1 1 0 0 0 0 1 0 1 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 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 1 0 0 0 1 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 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 1 0 0 1 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 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1 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 1 0 1 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 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 2 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 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 0 0 1 1 0 0 0 0 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 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1 0 0
  0 0 1 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 1 0 0 0 0 0 0 1
  0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 1]
 [1 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 1 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 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  0 1 0 0 0 0 0 1 0 0 0 0 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 1 2 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 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 1 0 0 0 0
  1 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 1 0 0 0 0 0 1 0 0 0 0 2 1 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 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 1 0 1 0
  0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 1 0 0 0 0 0 1 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
>>> 
```

Practical No. 10

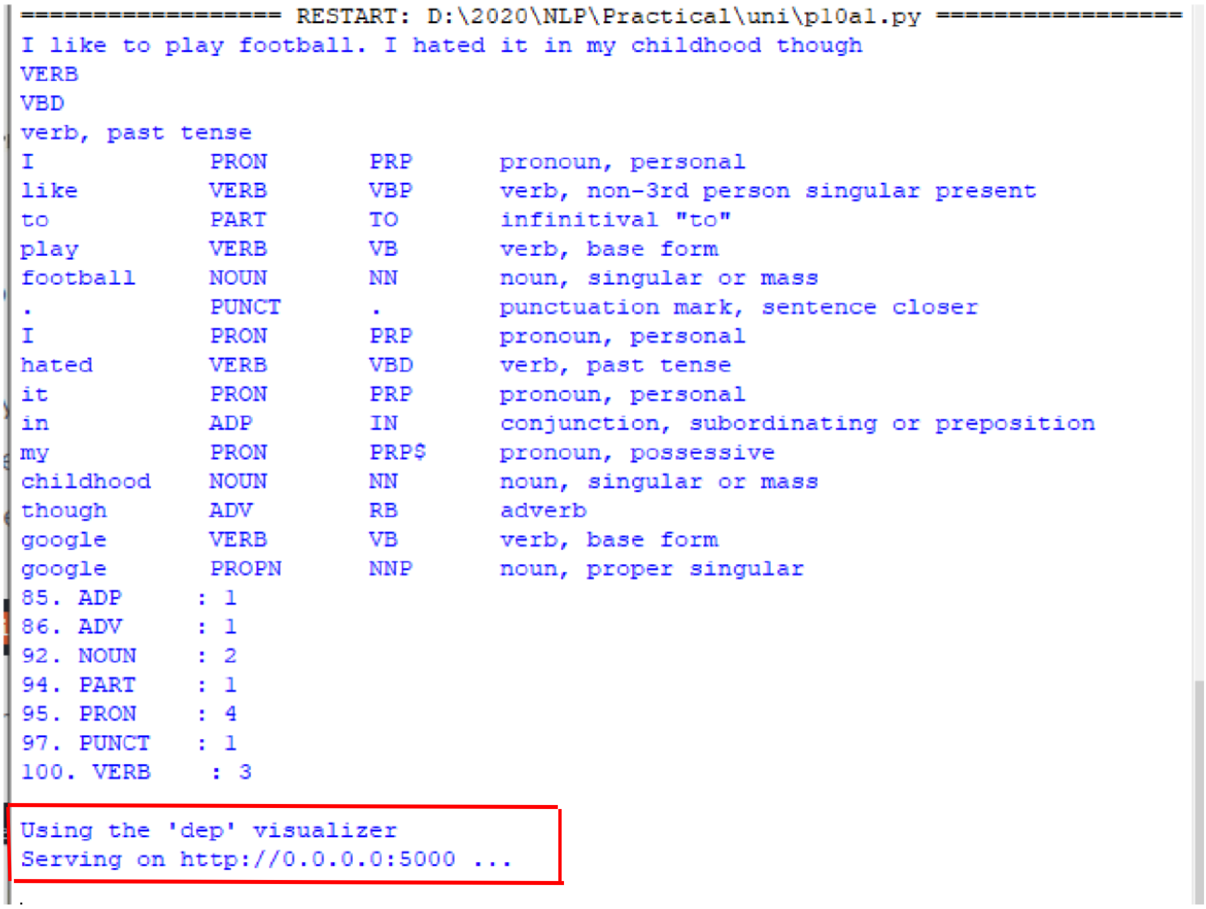
10. a. Speech Tagging:

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\p10a1.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        PROPN      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 ...
```

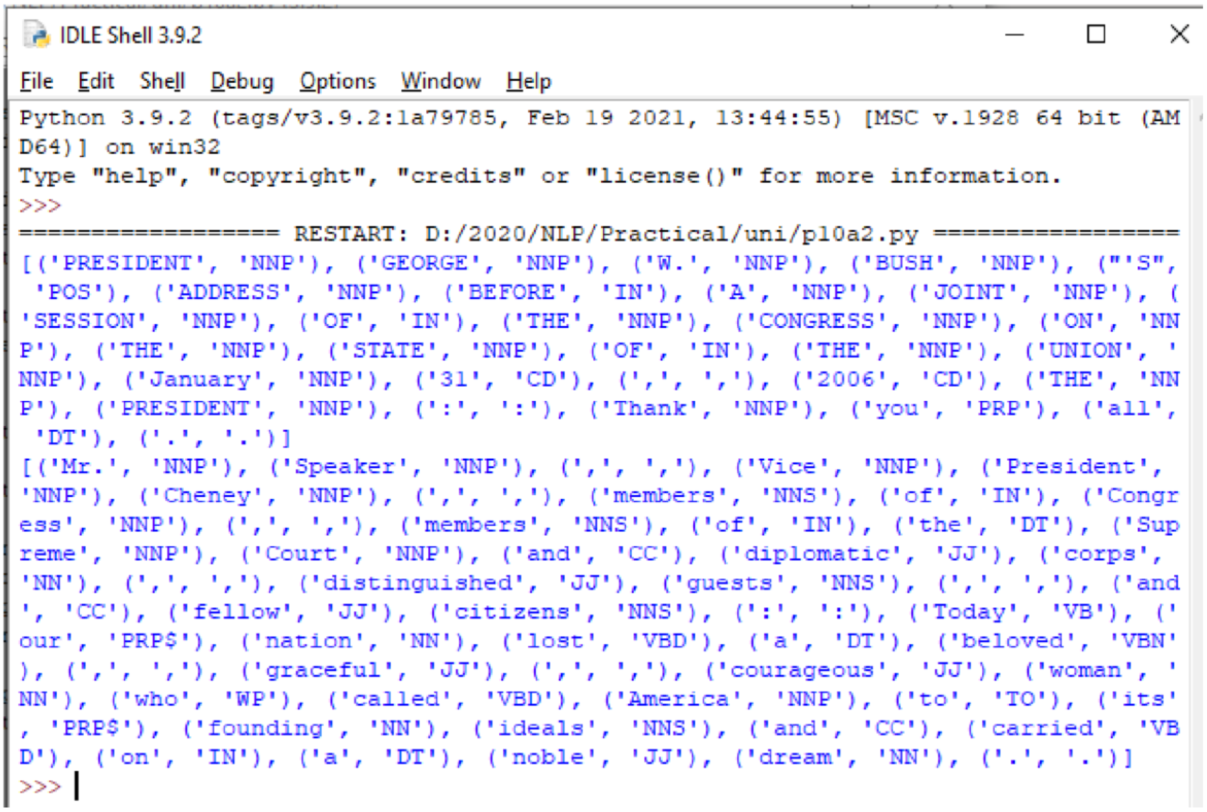
To view the dependency tree, type the following address in your browser: http://127.0.0.1:5000/. You will see the following dependency tree:

ii. Speech tagging using nktl

code:

```
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()
```



```
Python 3.9.2 (tags/v3.9.2:1a79785, Feb 19 2021, 13:44:55) [MSC v.1928 64 bit (AM
D64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================== RESTART: D:/2020/NLP/Practical/uni/p10a2.py =================
[('PRESIDENT', 'NNP'), ('GEORGE', 'NNP'), ('W.', 'NNP'), ('BUSH', 'NNP'), ("'S",
 'POS'), ('ADDRESS', 'NNP'), ('BEFORE', 'IN'), ('A', 'NNP'), ('JOINT', 'NNP'), (
'SESSION', 'NNP'), ('OF', 'IN'), ('THE', 'NNP'), ('CONGRESS', 'NNP'), ('ON', 'NN
P'), ('THE', 'NNP'), ('STATE', 'NNP'), ('OF', 'IN'), ('THE', 'NNP'), ('UNION', '
NNP'), ('January', 'NNP'), ('31', 'CD'), (',', ','), ('2006', 'CD'), ('THE', 'NN
P'), ('PRESIDENT', 'NNP'), (':', ':'), ('Thank', 'NNP'), ('you', 'PRP'), ('all',
 'DT'), ('.', '.')]
[('Mr.', 'NNP'), ('Speaker', 'NNP'), (',', ','), ('Vice', 'NNP'), ('President',
'NNP'), ('Cheney', 'NNP'), (',', ','), ('members', 'NNS'), ('of', 'IN'), ('Congr
ess', 'NNP'), (',', ','), ('members', 'NNS'), ('of', 'IN'), ('the', 'DT'), ('Sup
reme', 'NNP'), ('Court', 'NNP'), ('and', 'CC'), ('diplomatic', 'JJ'), ('corps',
'NN'), (',', ','), ('distinguished', 'JJ'), ('guests', 'NNS'), (',', ','), ('and
', 'CC'), ('fellow', 'JJ'), ('citizens', 'NNS'), (':', ':'), ('Today', 'VB'), ('
our', 'PRP$'), ('nation', 'NN'), ('lost', 'VBD'), ('a', 'DT'), ('beloved', 'VBN'
), (',', ','), ('graceful', 'JJ'), (',', ','), ('courageous', 'JJ'), ('woman', '
NN'), ('who', 'WP'), ('called', 'VBD'), ('America', 'NNP'), ('to', 'TO'), ('its'
, 'PRP$'), ('founding', 'NN'), ('ideals', 'NNS'), ('and', 'CC'), ('carried', 'VB
D'), ('on', 'IN'), ('a', 'DT'), ('noble', 'JJ'), ('dream', 'NN'), ('.', '.')]
>>>
```

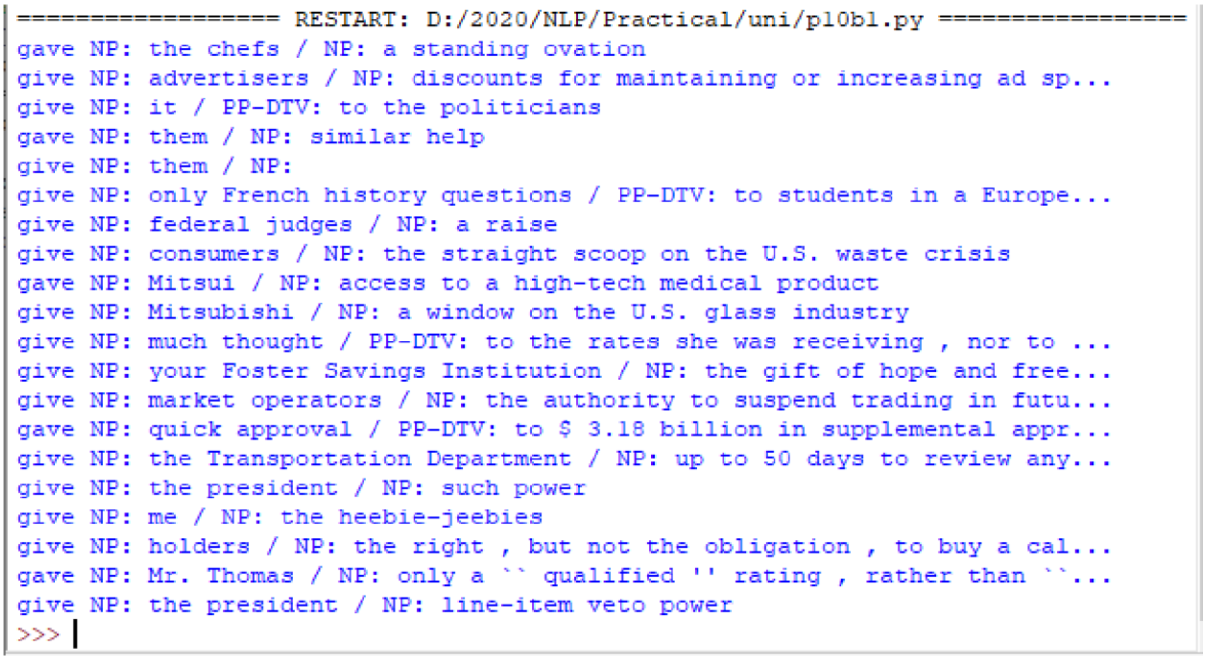
output:

b. Statistical parsing:

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

```
#probabilitistic 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/p10b1.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
>>> 
```

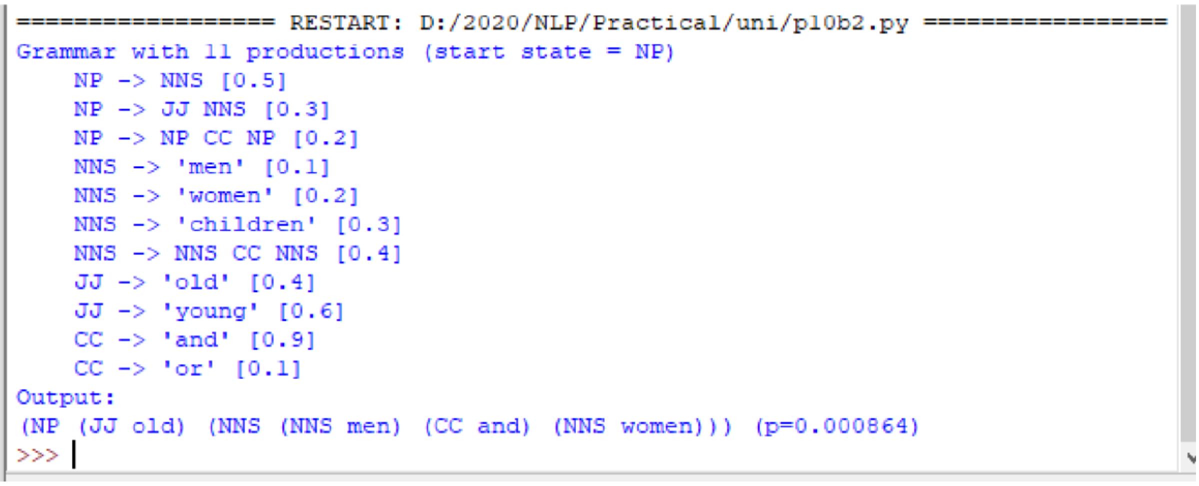
Output:

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:
```



```
================== RESTART: D:/2020/NLP/Practical/uni/p10b2.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)
>>> 
```

```
print(x)
```

Output:

c. Malt parsing:

Parse a sentence and draw a tree using malt parsing.

Note: 1) Java should be installed.

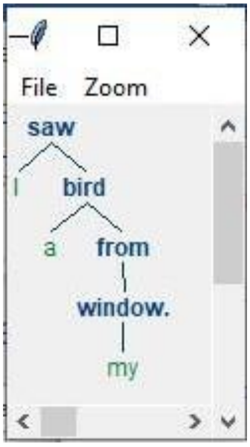
2) maltparser-1.7.2 zip file should be copied in C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39 folder and should be extracted in the same folder.

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))))
```

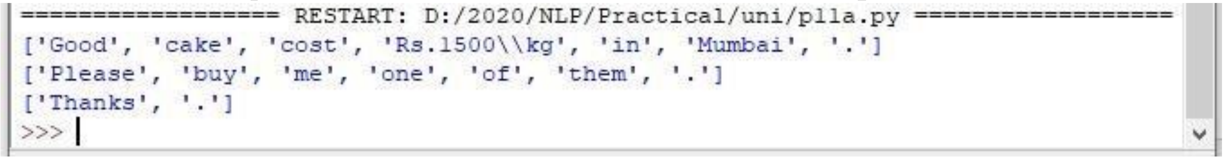


Practical No. 11

11. a) Multiword Expressions in NLP Source 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/p11a.py ==================
['Good', 'cake', 'cost', 'Rs.1500\\kg', 'in', 'Mumbai', '.']
['Please', 'buy', 'me', 'one', 'of', 'them', '.']
['Thanks', '.']
>>> 
```

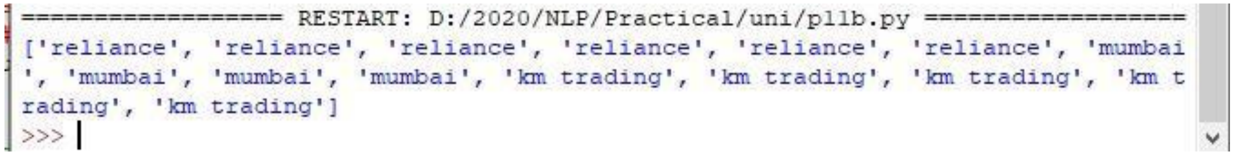
b) Normalized Web Distance and Word Similarity Source code:

```
# Normalized Web Distance and Word Similarity

#convert

#Reliance supermarket
#Reliance hypermarket
#Reliance
#Reliance
#Reliance downtown
#Relianc 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.argmin()]
return [centers[i] for i in clustering.labels_]
```

```
print(group_texts(texts))
```

Output:

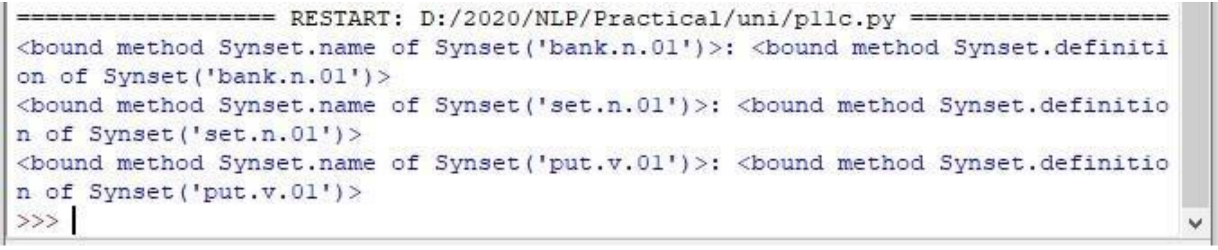


```
================== RESTART: D:/2020/NLP/Practical/uni/p11b.py ==================
['reliance', 'reliance', 'reliance', 'reliance', 'reliance', 'reliance', 'mumbai
', 'mumbai', 'mumbai', 'mumbai', 'km trading', 'km trading', 'km trading', 'km t
rading', 'km trading']
>>> 
```

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/p11c.py ==================
<bound method Synset.name of Synset('bank.n.01')>: <bound method Synset.definiti
on of Synset('bank.n.01')>
<bound method Synset.name of Synset('set.n.01')>: <bound method Synset.definitio
n of Synset('set.n.01')>
<bound method Synset.name of Synset('put.v.01')>: <bound method Synset.definitio
n of Synset('put.v.01')>
>>> 
```