NLP Lab Manual

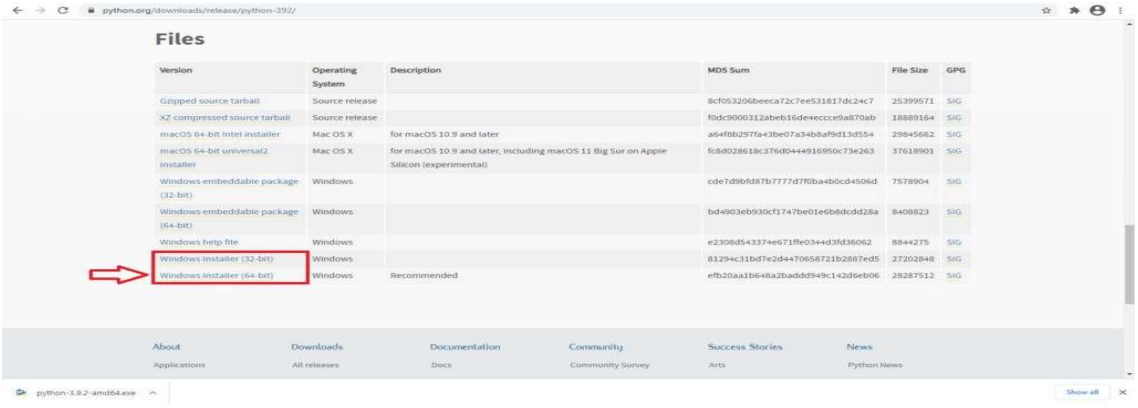
Practical No. 1:

a) Install NLTK

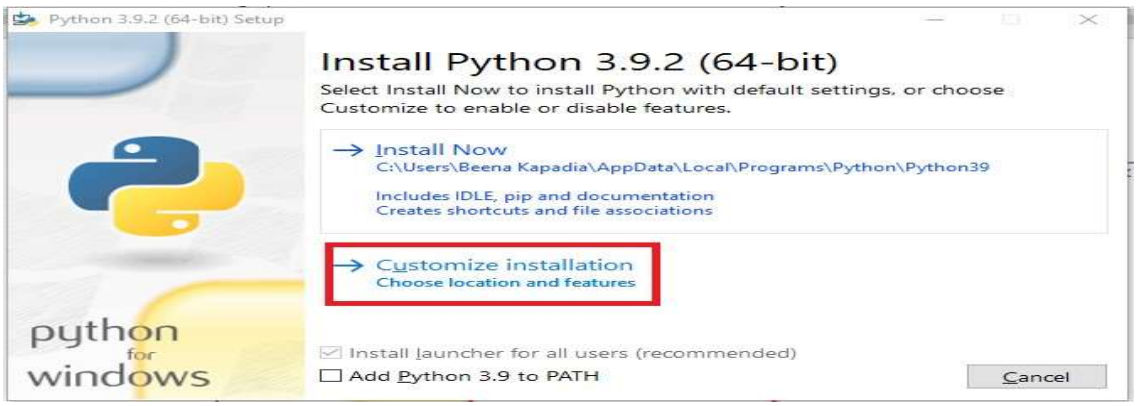
Python 3.9.2 Installation on Windows

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.



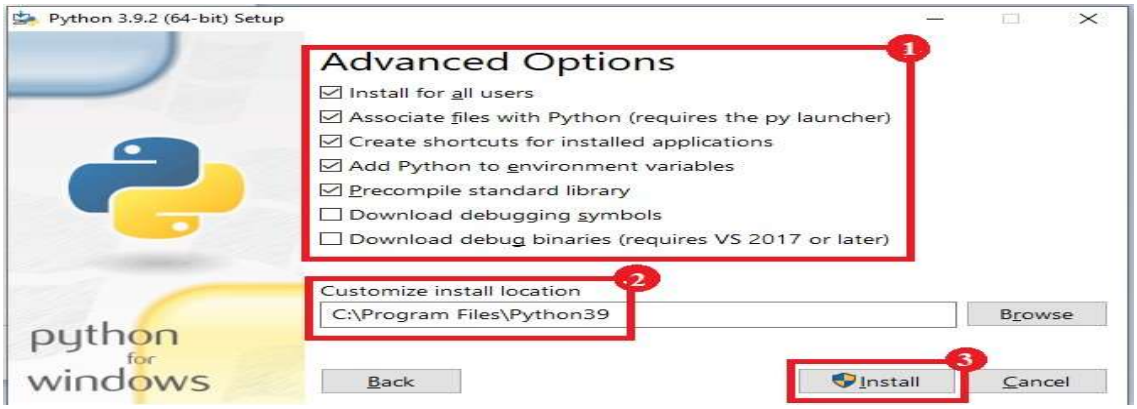
Step 2) Click on the Windows installer (64 bit)
Step 3) Select Customize Installation



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:\Program files\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

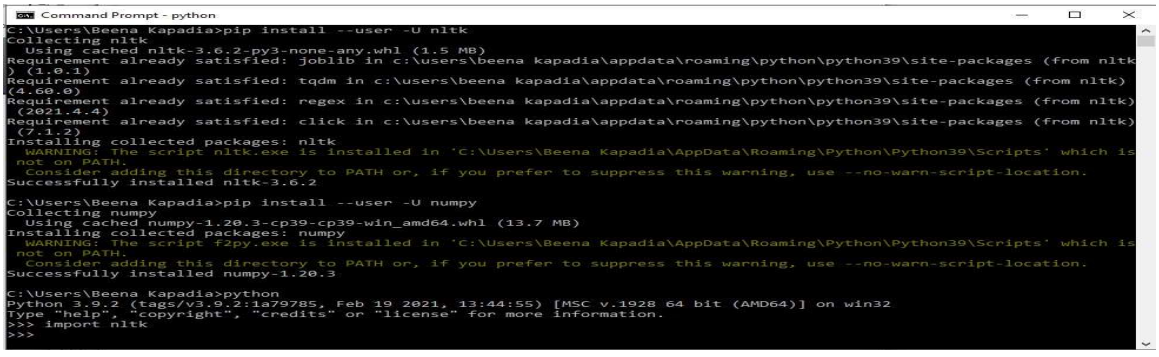
C:\Users\Beena Kapadia> pip install --user -U nltk

C:\Users\Beena Kapadia> >pip install --user -U numpy

C:\Users\Beena Kapadia>python

>>> 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:

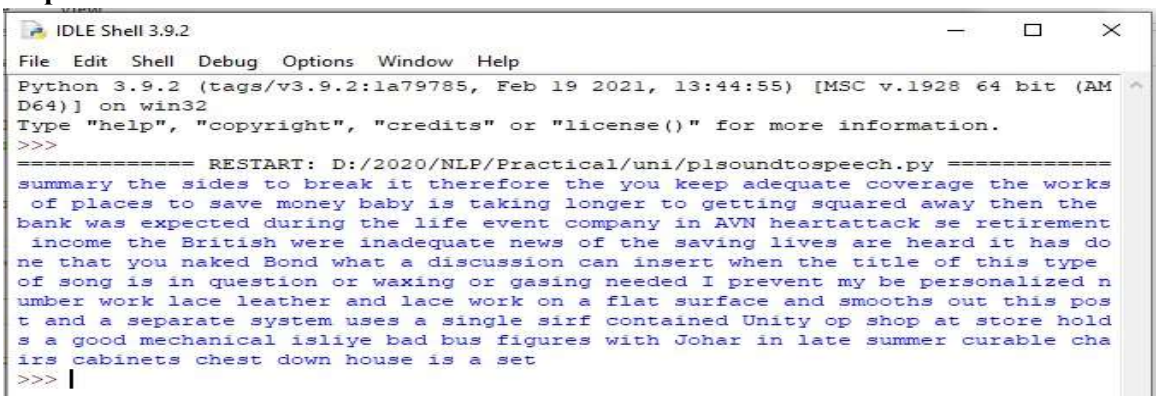
Note: required to store the input file "male.wav" in the current folder before running the program.

```
#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:



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)
```

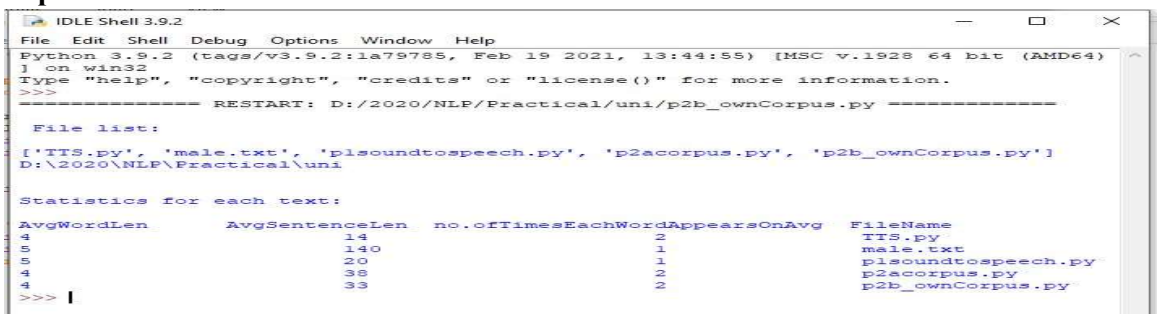
output:

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:



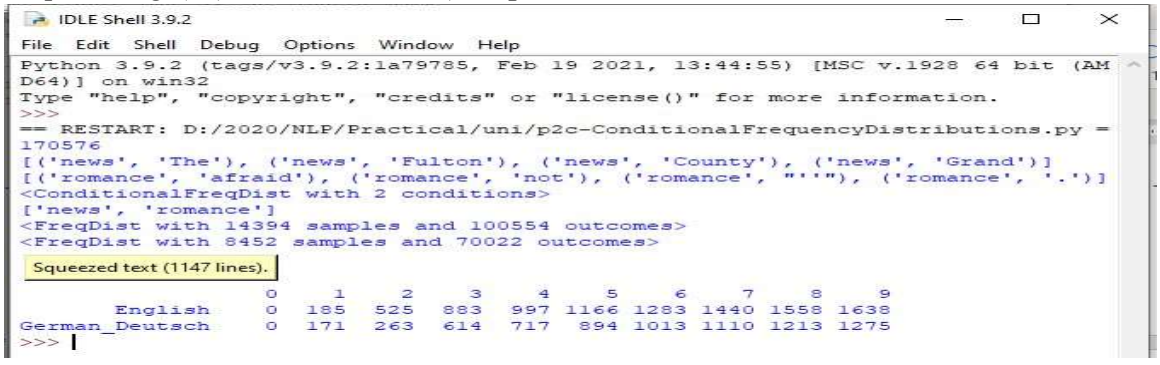
c. Study Conditional frequency distributions

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)
```

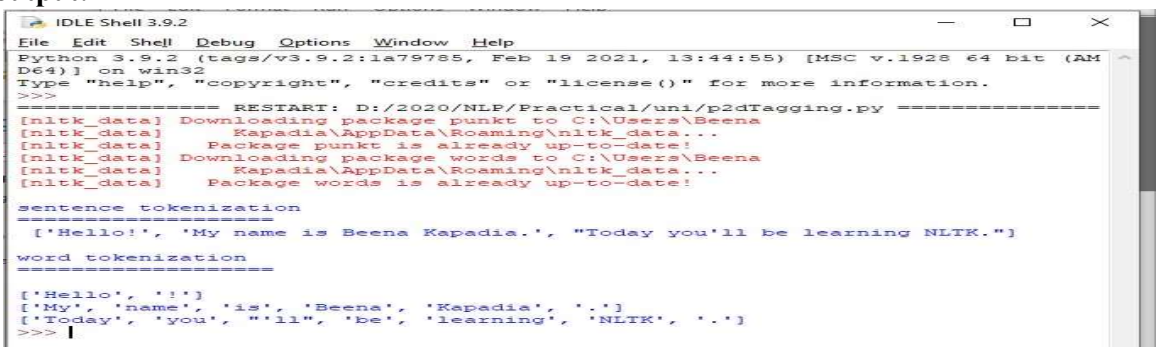
output:



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:



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/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 =============
<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

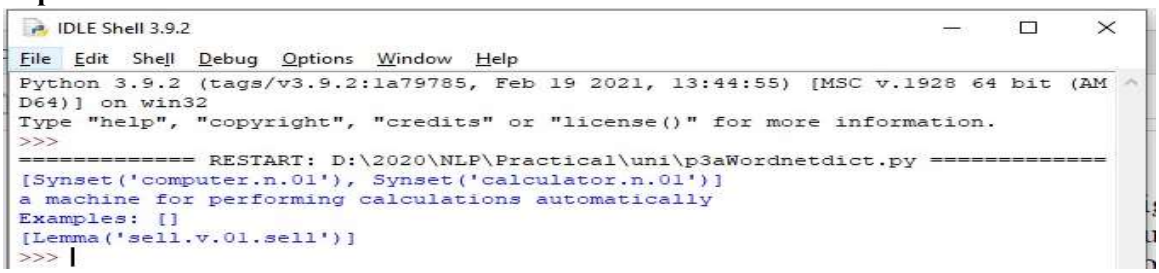
Output:

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:

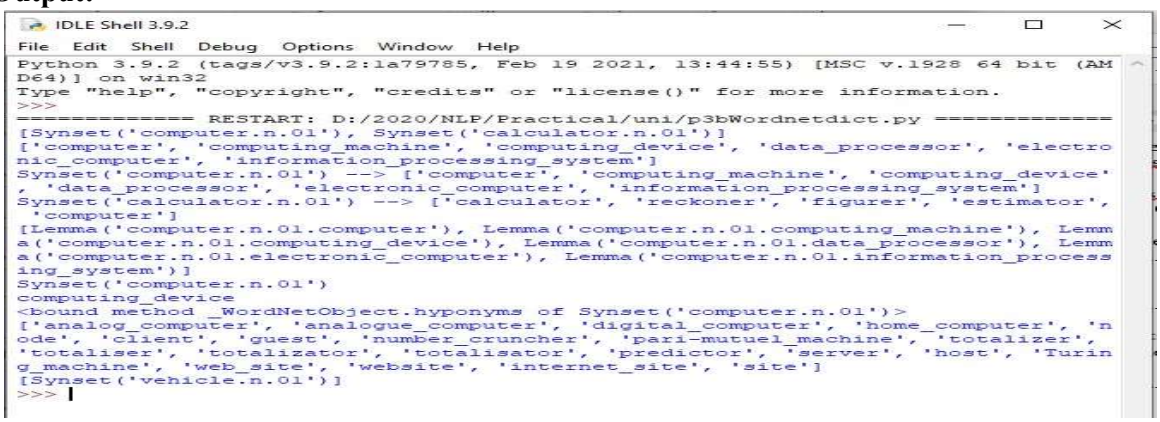


b. Study lemmas, hyponyms, hypernyms.

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:

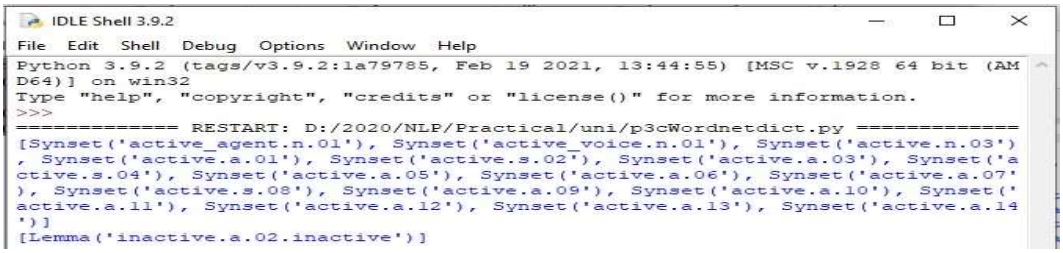


c. Write a program using python to find synonym and antonym of word "active" using Wordnet.

Source code:

```
from nltk.corpus
import wordnet print(
wordnet.synsets("active"))
    print(wordnet.lemma('active.a.01.active').antonyms())
```

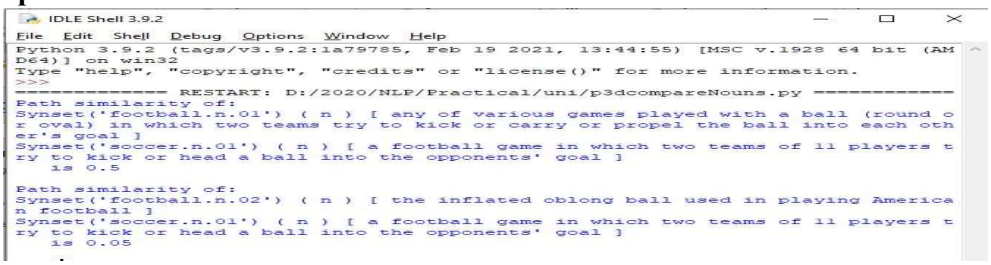
Output:



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:



e. Handling stopword:

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

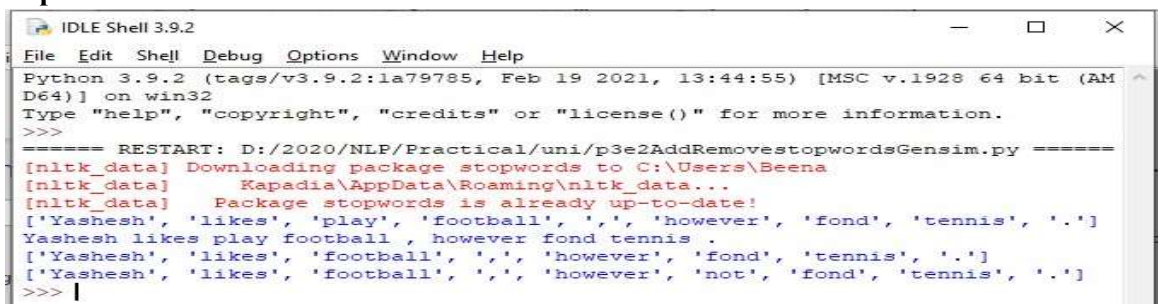
code:

```
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



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/

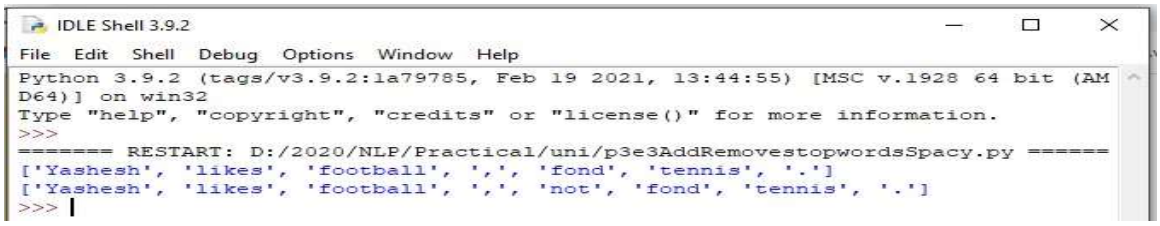
iii) Using Spacy Adding and Removing Stop Words in Default Spacy Stop Words List

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:



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/

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 = """प्राकृ तिक भाषा सीखना बहुि तिलचस्प है।"""
# tokenize(input text, language code) tokenize(hindi_text, "hi"
```

output

['_प्राकृ तिक', '_भाषा', '_सीखना', '_बहुि', '_तिलचस्प', '_है', '।']

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('मैं आज बहुि खुश हूं', 5, 'hi')
print(output)
```

Output:

['मैं आजकल बहुि खुश हूं', 'मैं आज अत्यतिक खुश हूं', 'मैं अभी बहुि खुश हूं', 'मैं वितमान बहुि खुश हूं', 'मैं वितमान बहुि खुश हूं']

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('બીના 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:

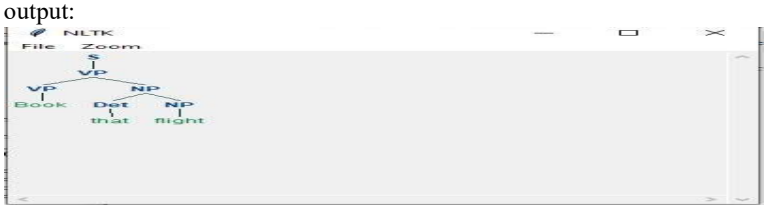
7. Finite state automata

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))
```

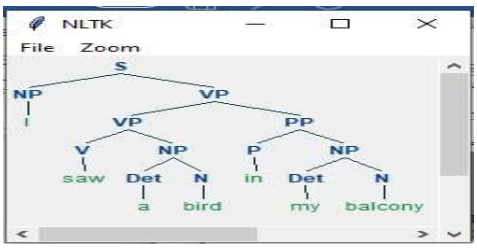
output:

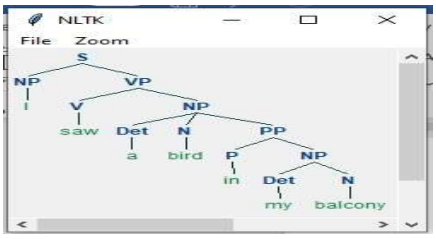
```
Rejected
Accepted
Accepted
Rejected
Rejected
Rejected
Rejected
Accepted
```

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:





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 classifier

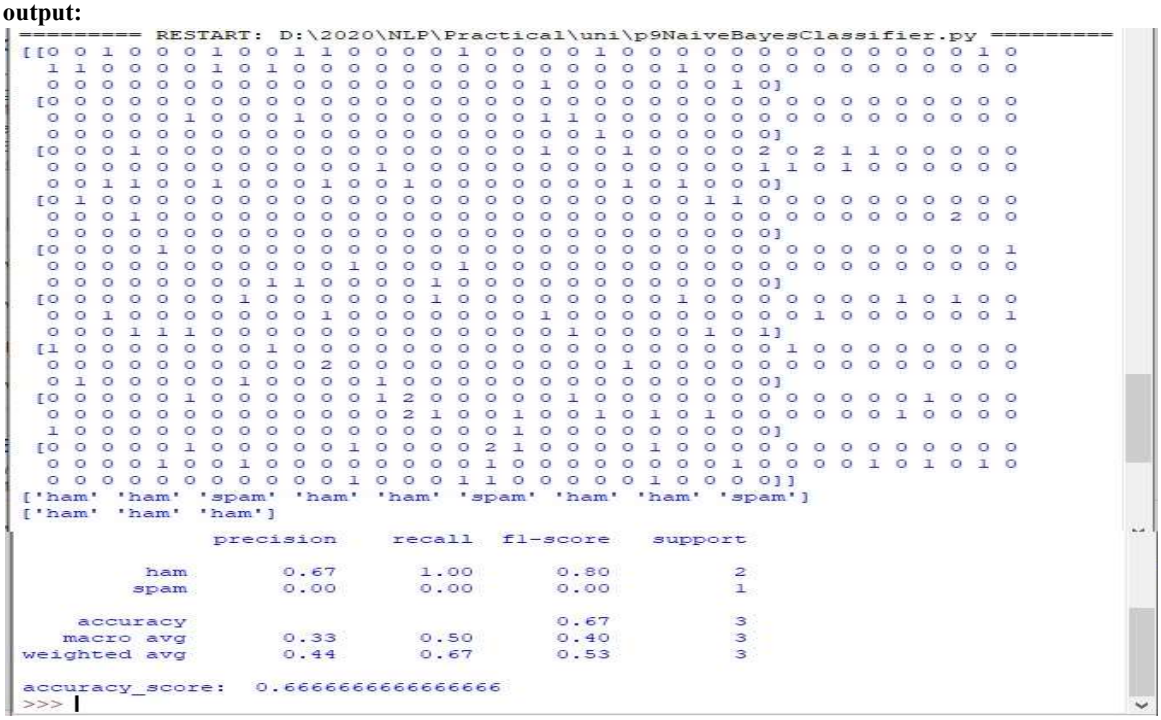
Code:

#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 0 1 0 0 0 0 0 1 0 0 0 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 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 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 0 0 0 0 0 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 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 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 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 0 0 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 0
  0 0 1 1 0 0 1 0 0 0 1 0 0 1 0 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 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 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 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 1
  0 0 0 0 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 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 0 0 1 0 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 0 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 1 1 1 0 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 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 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 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 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 1 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 1 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 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 1 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 2 1 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 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 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
>>>
```

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:
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:

```
================== 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          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 ...
```

```
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:

#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)
```

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]
```

```
================== 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
>>>
```

```
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)
```

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

```
================== 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)
>>>
```

Kapadia\AppData\Local\Programs\Python\Python39 folder and should be extracted in the same folder.

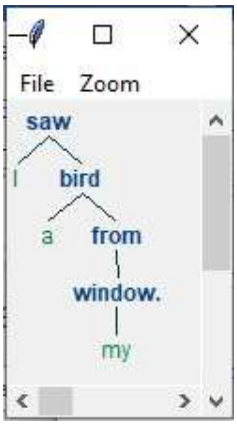
3) engmalt.linear-1.7.mco file should be copied to C:\Users\Beena Kapadia\AppData\Local\Programs\Python\Python39 folder **Source code:**

```
# 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 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/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
#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')>
>>>
```