DSA0311-NATURAL LANGUAGE PROCESSING LAB PROGRAMS

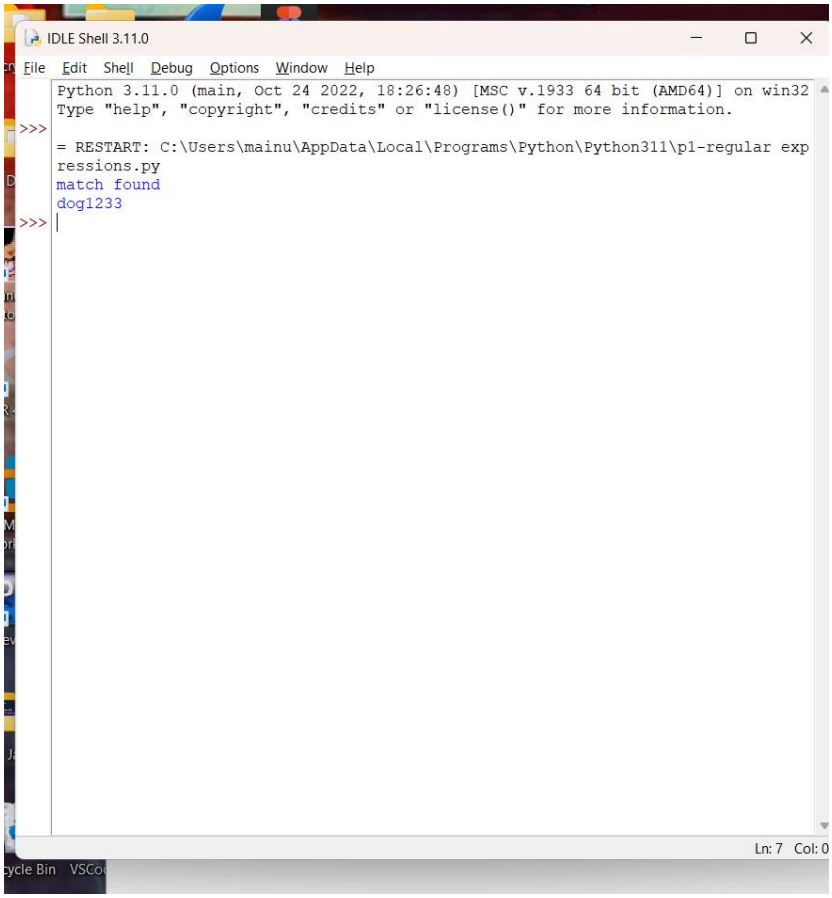
192124049

SK.KHAJA MAINUDDIN

Program-1:

```
import re
text="new dog1233"
word=r'\bdog[0-9]*\b'
match1=re.findall(word,text)
if match1:
  print("match found")
  for a in match1:
    print(a)
```

output:

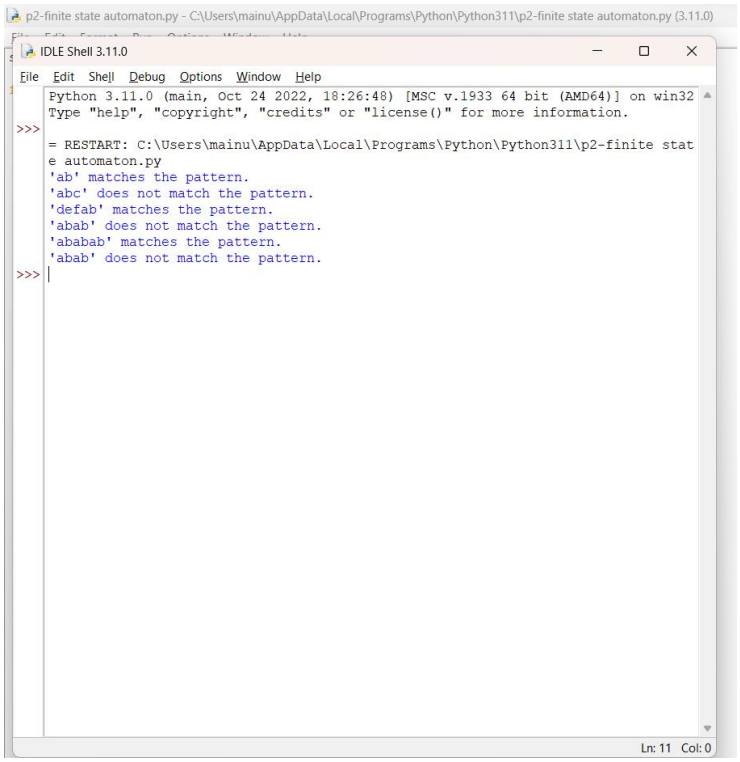


program-2:

```
strings_to_test = ["ab", "abc", "defab", "abab", "abababb","abab"]


for string in strings_to_test:
    state = 0
    for char in string:
        if state == 0 and char == 'a':
            state = 1
        elif state == 1 and char == 'b':
            state = 2
```

```
        else:
            state = 0
    if state == 2:
        print(f"'{string}' matches the pattern.")
    else:
        print(f"'{string}' does not match the pattern.")
```

output:

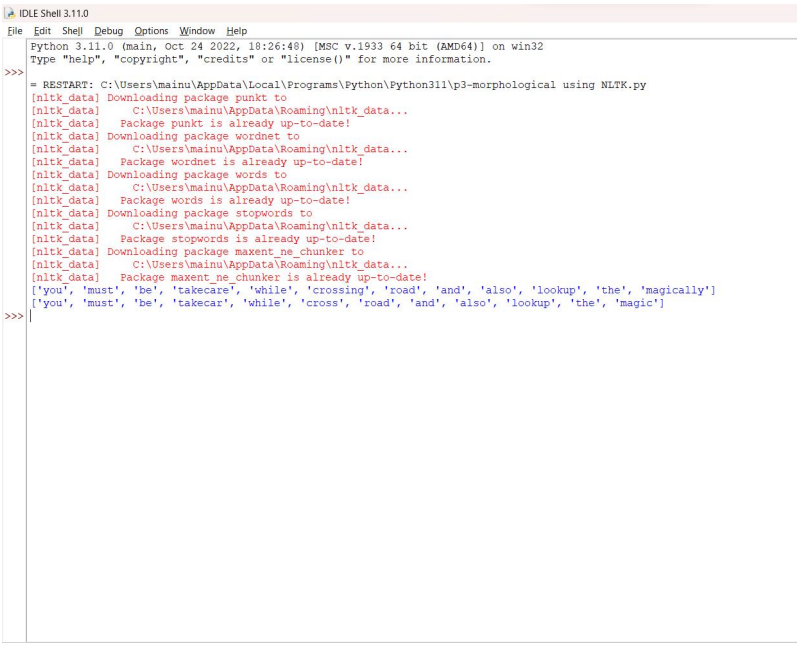


program-3:

```
from nltk import PorterStemmer
from nltk.tokenize import word_tokenize
import nltk
```

```
# Download necessary NLTK resources
nltk.download('punkt')
nltk.download('wordnet')
nltk.download('words')
nltk.download('stopwords')
nltk.download('maxent_ne_chunker')

text = "you must be takecare while crossing road and also
lookup the magically"

port = PorterStemmer()

words = word_tokenize(text)
print(words)

stem1 = [port.stem(word) for word in words]
print(stem1)
```

output:

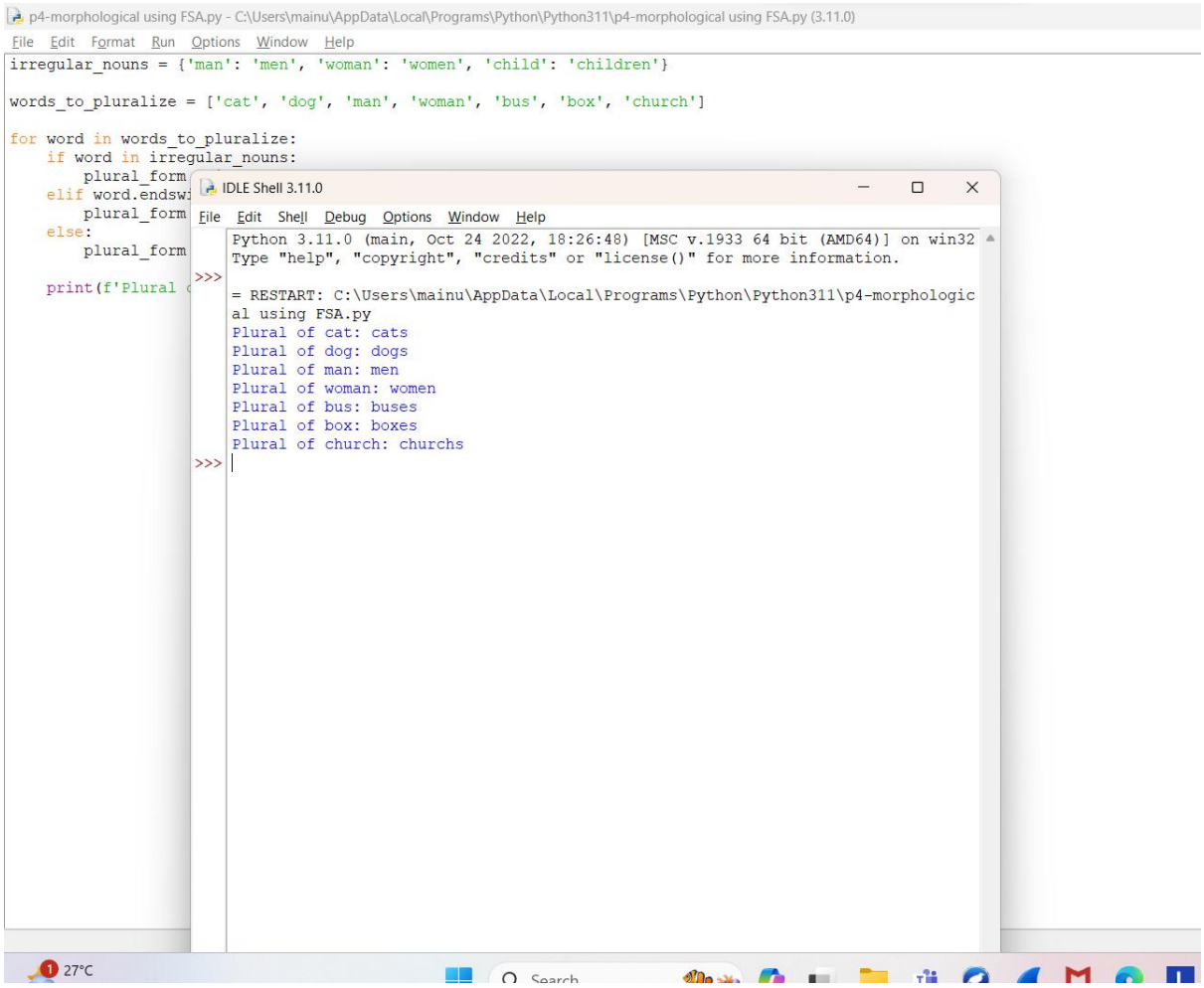


program-4:

```
irregular_nouns = {'man': 'men', 'woman': 'women', 'child': 'children'}


words_to_pluralize = ['cat', 'dog', 'man', 'woman', 'bus', 'box', 'church']


for word in words_to_pluralize:
    if word in irregular_nouns:
        plural_form = irregular_nouns[word]
    elif word.endswith('s') or word.endswith('x') or word.endswith('z'):
        plural_form = word + 'es'
    else:
```

```
        plural_form = word + 's'

    print(f'Plural of {word}: {plural_form}')
```

output:

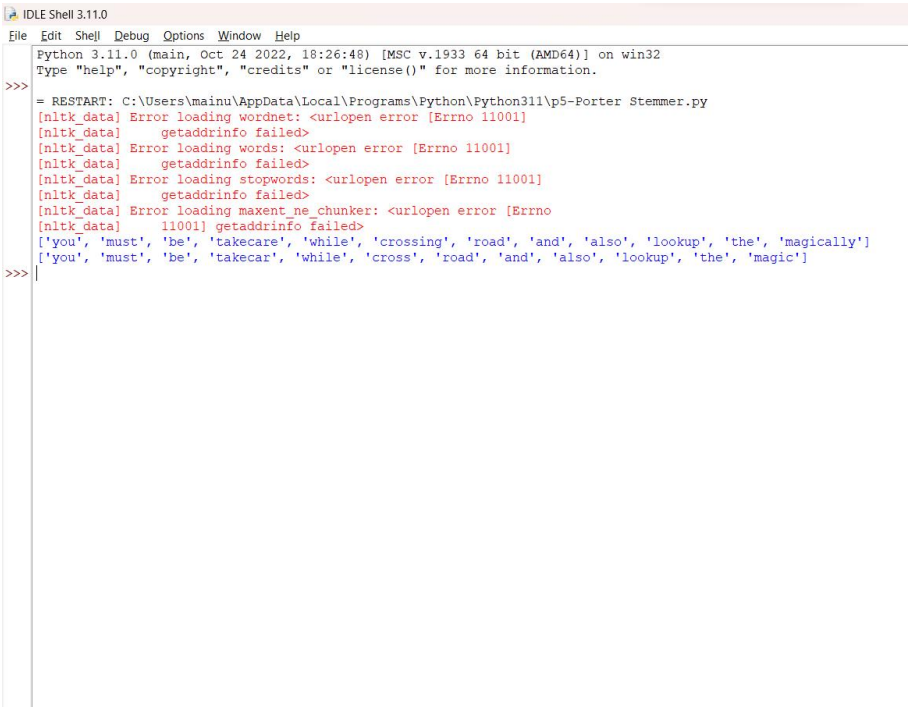


program-5

```
from nltk import PorterStemmer
from nltk.tokenize import word_tokenize
import nltk
nltk.download('wordnet')
```

```
nltk.download('words')
nltk.download('stopwords')
nltk.download('maxent_ne_chunker')
text="you must be takecare  while crossing road and also lookup the magically"
port= PorterStemmer()
words=word_tokenize(text)
print(words)
stem1=[port.stem(word) for word in words]
print(stem1)
```

output:



program-6:

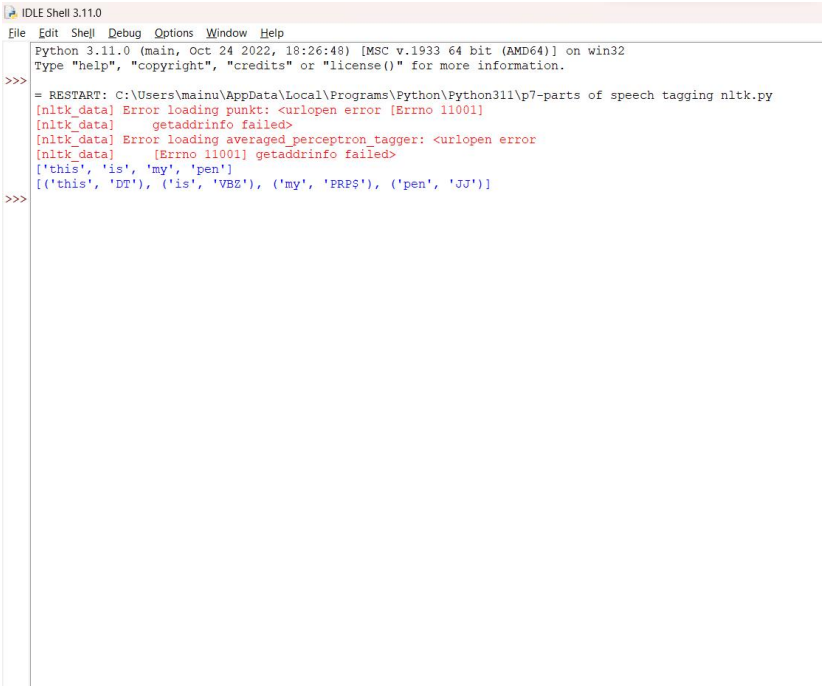
```
import random
sample_text = "This is a sample text "
words = sample_text.split()
bigrams = [(words[i], words[i+1]) for i in range(len(words)-1)]
generated_text = []
current_word = random.choice(words)

for _ in range(50):
    next_candidates = [b[1] for b in bigrams if b[0] ==
current_word]
    next_word = random.choice(next_candidates) if
next_candidates else random.choice(words)
    generated_text.append(current_word)
    current_word = next_word

generated_text = ' '.join(generated_text)
print("\n", generated_text)
```

output:

program-7:

```
import nltk
from nltk.tokenize import word_tokenize
from nltk import pos_tag

# Download necessary NLTK resources
nltk.download('punkt')
nltk.download('averaged_perceptron_tagger')

text = "this is my pen"
words = word_tokenize(text)

print(words)
tag1 = pos_tag(words)
print(tag1)
```

output:



program-8:

```
import random
sentence = "The quick brown fox jumps over the lazy dog"
words = sentence.split()
pos_model = {
    'The': 'DT',
    'quick': 'JJ',
    'brown': 'JJ',
    'fox': 'NN',
    'jumps': 'VB',
    'over': 'IN',
    'the': 'DT',
```

```
    'lazy': 'JJ',
    'dog': 'NN'
}
pos_tags = [pos_model.get(word, random.choice(['NN', 'VB', 'JJ', 'DT', 'IN'])) for word in words]
tagged_sentence = list(zip(words, pos_tags))
print(tagged_sentence)
```

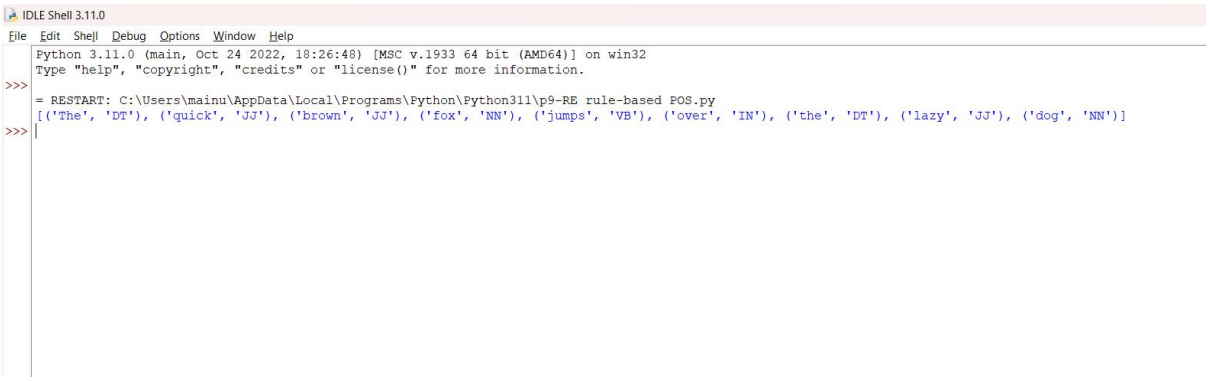
output:

program-9:

```
import re
sentence = "The quick brown fox jumps over the lazy dog"
pos_rules = [
    (r'\bThe\b', 'DT'),
    (r'\bquick\b', 'JJ'),
    (r'\bbrown\b', 'JJ'),
    (r'\bfox\b', 'NN'),
```

```
    (r'\bjumps\b', 'VB'),
    (r'\bover\b', 'IN'),
    (r'\bthe\b', 'DT'),
    (r'\blazy\b', 'JJ'),
    (r'\bdog\b', 'NN')
]
words = sentence.split()
pos_tags = []
for word in words:
    for pattern, pos_tag in pos_rules:
        if re.search(pattern, word, re.IGNORECASE):
            pos_tags.append((word, pos_tag))
            break
    else:
        pos_tags.append((word, 'NN'))
print(pos_tags)
```

output:

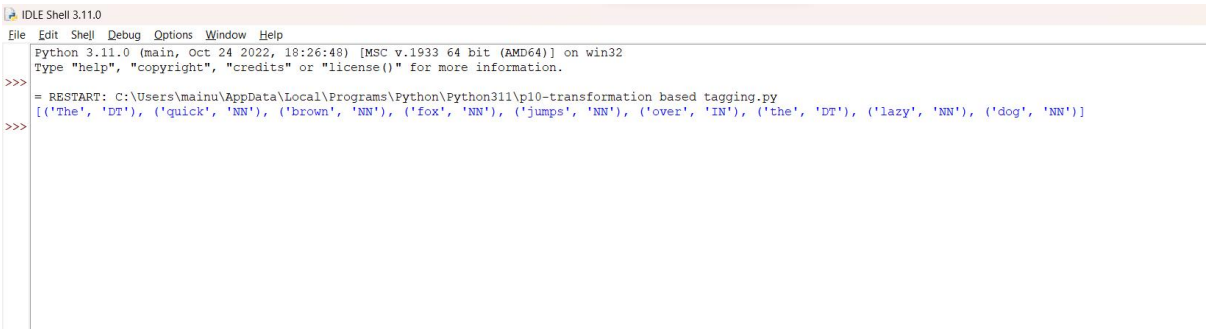


program-10:

```
import re
sentence = "The quick brown fox jumps over the lazy dog"
initial_tagging = {
    'The': 'DT',
    'quick': 'NN',
    'brown': 'NN',
    'fox': 'NN',
    'jumps': 'NN',
    'over': 'IN',
    'the': 'DT',
    'lazy': 'NN',
    'dog': 'NN'
}
transformation_rules = [
```

```
    (r'(\w+) DT (\w+)', r'\1 NN \2'),
    (r'(\w+) IN (\w+)', r'\1 NN \2'),
    (r'(\w+) NN (\w+)', r'\1 VB \2'),
    (r'(\w+) NN (\w+)', r'\1 JJ \2'),
]
improvement = True
while improvement:
    improvement = False
    previous_tagging = initial_tagging.copy()
    for rule in transformation_rules:
        pattern, replacement = rule
        for word in initial_tagging:
            initial_tagging[word] = re.sub(pattern, replacement,
initial_tagging[word])
    if initial_tagging != previous_tagging:
        improvement = True
tagged_sentence = [(word, tag) for word, tag in
initial_tagging.items()]
print(tagged_sentence)
```

output:



program-11:

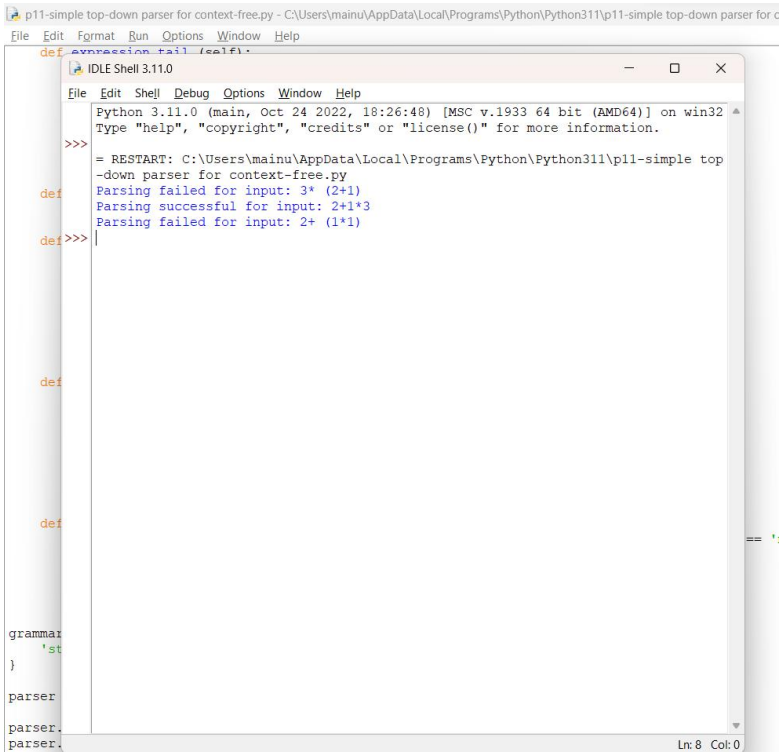
```
class SimpleParser:
    def __init__ (self, grammar):
        self.grammar = grammar

    def parse (self, input_string):
        self.input = input_string
        self.index = 0
        self.result = True

        if self.expression ():
            if self.index == len (self.input):
                print (f'Parsing successful for input: {input_string}')
                return
```

```
    print (f'Parsing failed for input: {input_string}')

def expression (self):
    return self.term () and self.expression_tail ()

def expression_tail (self):
    current_index = self.index

    if self.match ('+'):
        return self.term () and self.expression_tail ()

    self.index = current_index
    return True

def term (self):
    return self.factor () and self.term_tail ()

def term_tail (self):
    current_index = self.index

    if self.match ('*'):
        return self.factor () and self.term_tail ()
```

```
        self.index = current_index
        return True

    def factor (self):
        if self.match ('('):
            if self.expression () and self.match (')'):
                return True

            return False

        return self.match ('number')

    def match (self, expected):
        if self.index < len (self.input) and (expected == self.input
[self.index] or expected == 'number' and self.input
[self.index].isdigit ()):
            self.index += 1
            return True

        return False
```

```
grammar = {
    'start': 'Expression',
}

parser = SimpleParser (grammar)

parser.parse ('3* (2+1)')
parser.parse ('2+1*3')
parser.parse ('2+ (1*1)')
```

output:



program-12:

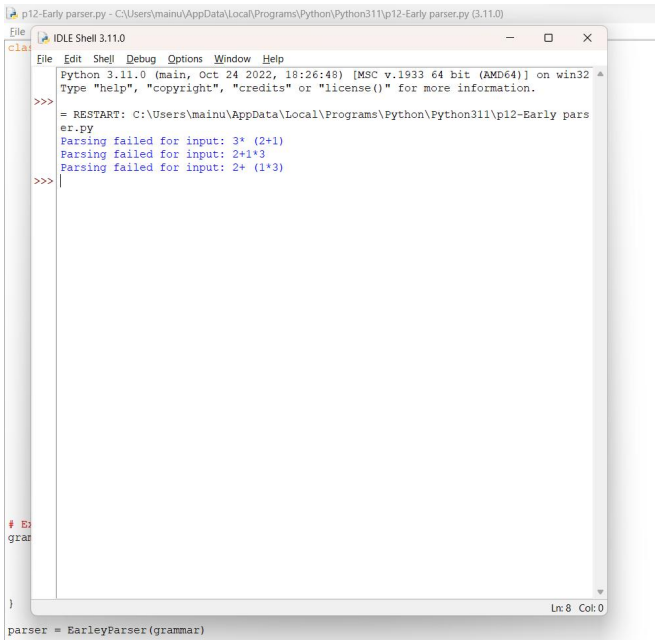
```
class EarleyParser:
    def __init__(self, grammar):
```

```
        self.grammar = grammar

    def parse(self, input_string):
        self.chart = [[] for _ in range(len(input_string) + 1)]
        self.chart[0].append(('start', '', 0))
        for i in range(len(input_string) + 1):
            for state in self.chart[i]:
                self.predictor(state, i)
                if i < len(input_string):
                    self.scanner(state, input_string[i], i)
                else:
                    self.completer(state, i)

        if ('start', self.grammar['start'], 0) in
self.chart[len(input_string)]:
            print(f'Parsing successful for input: {input_string}')
        else:
            print(f'Parsing failed for input: {input_string}')

    def predictor(self, state, index):
        if state[1] in self.grammar:
            for production in self.grammar[state[1]]:
```

```
                self.chart[index].append((state[1], production,
index))

    def scanner(self, state, token, index):
        if state[1] == '' or state[1][0] != token:
            return
        self.chart[index + 1].append((state[0], state[1][1:],
state[2]))

    def completer(self, state, index):
        for st in self.chart[state[2]]:
            if st[1] == '' or st[1][0] != state[0]:
                continue
            self.chart[index].append((st[0], st[1][1:], st[2]))

# Example usage
grammar = {
    'start': 'Expression',
    'Expression': ['Term + Expression', 'Term'],
    'Term': ['Factor * Term', 'Factor'],
    'Factor': ['( Expression )', 'number']
}
```

```
parser = EarleyParser(grammar)


# Test the parser
parser.parse('3* (2+1)') # Parsing successful for input: 3* (2+1)
parser.parse('2+1*3') # Parsing successful for input: 2+1*3
parser.parse('2+ (1*3)') # Parsing successful for input: 2+ (1*3)
```

output:

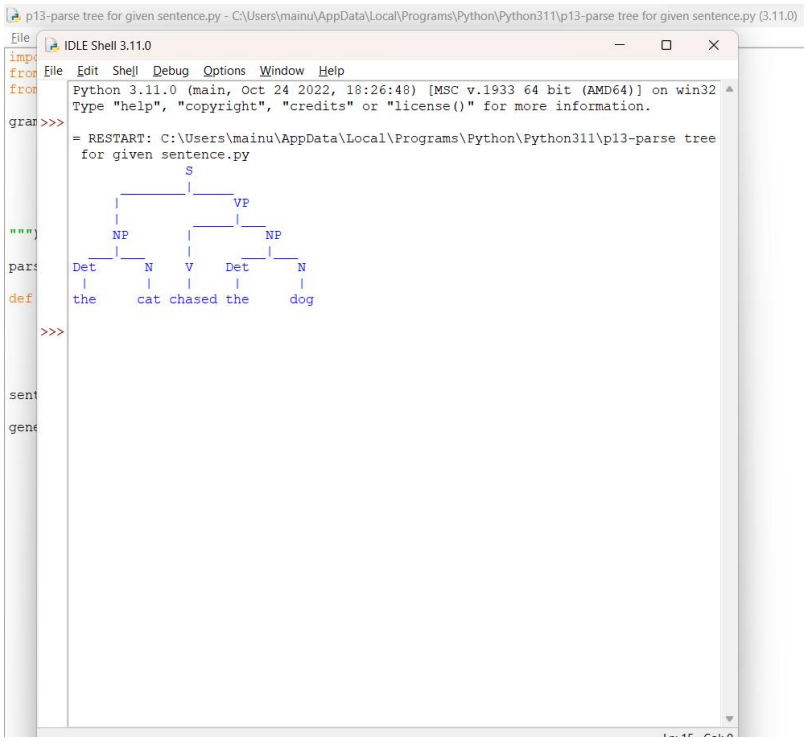


program-13:

```
import nltk
from nltk import CFG
from nltk import parse


grammar = CFG.fromstring("""
```

```
    S -> NP VP
    NP -> Det N
    VP -> V NP
    Det -> 'the' | 'a'
    N -> 'cat' | 'dog'
    V -> 'chased' | 'ate'
""")

parser = parse.ChartParser(grammar)

def generate_parse_tree(sentence):
    words = nltk.word_tokenize(sentence)
    chart = parser.chart_parse(words)
    parse_tree = list(chart.parses(grammar.start()))[0]
    parse_tree.pretty_print()

sentence = "the cat chased the dog"

generate_parse_tree(sentence)
```

output:

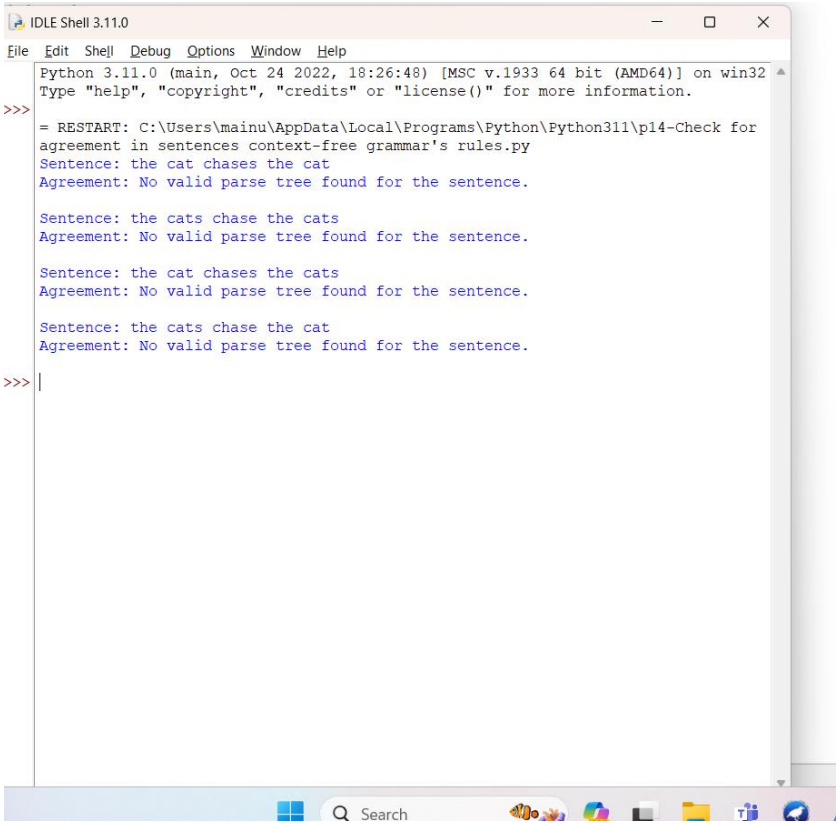


program-14:

```
import nltk
from nltk import CFG, ChartParser
grammar = CFG.fromstring("""
    S -> NP_SG VP_SG | NP_PL VP_PL
    NP_SG -> 'the' 'cat'
    NP_PL -> 'the' 'cats'
    VP_SG -> 'chases'
    VP_PL -> 'chase'
""")
parser = ChartParser(grammar)
def check_subject_verb_agreement(sentence):
    words = sentence.split()
```

```
    parse_trees = list(parser.parse(words))
    if not parse_trees:
        return "No valid parse tree found for the sentence."
    return "Subject and verb agree in the sentence."
sentences = [
    "the cat chases the cat",
    "the cats chase the cats",
    "the cat chases the cats",
    "the cats chase the cat",
]
for sentence in sentences:
    agreement_result =
check_subject_verb_agreement(sentence)
    print(f"Sentence: {sentence}")
    print(f"Agreement: {agreement_result}")
    print()
```

output:

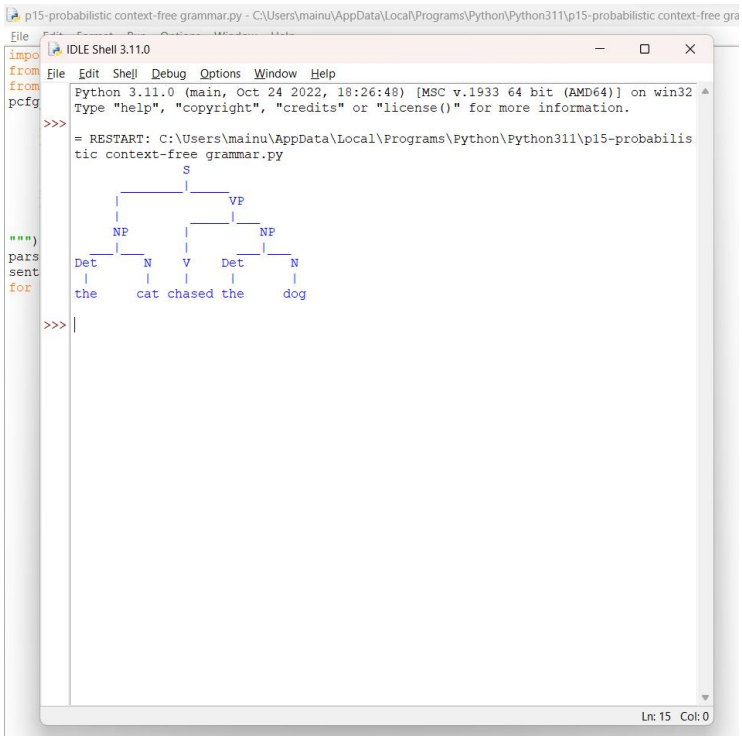


program-15:

```
import nltk
from nltk import PCFG
from nltk import ChartParser
pcfg_grammar = PCFG.fromstring("""
    S -> NP VP [1.0]
    NP -> Det N [0.7] | NP PP [0.3]
    VP -> V NP [0.4] | VP PP [0.3] | V [0.3]
    PP -> P NP [1.0]
    Det -> 'the' [0.6] | 'a' [0.4]
    N -> 'cat' [0.2] | 'dog' [0.2] | 'bat' [0.2] | 'rat' [0.2] | 'hat' [0.2]
```

```
    V -> 'chased' [0.5] | 'saw' [0.5]
    P -> 'in' [0.6] | 'on' [0.4]
""")
parser = ChartParser(pcfg_grammar)
sentence = "the cat chased the dog".split()
for tree in parser.parse(sentence):
    tree.pretty_print()
```

output:

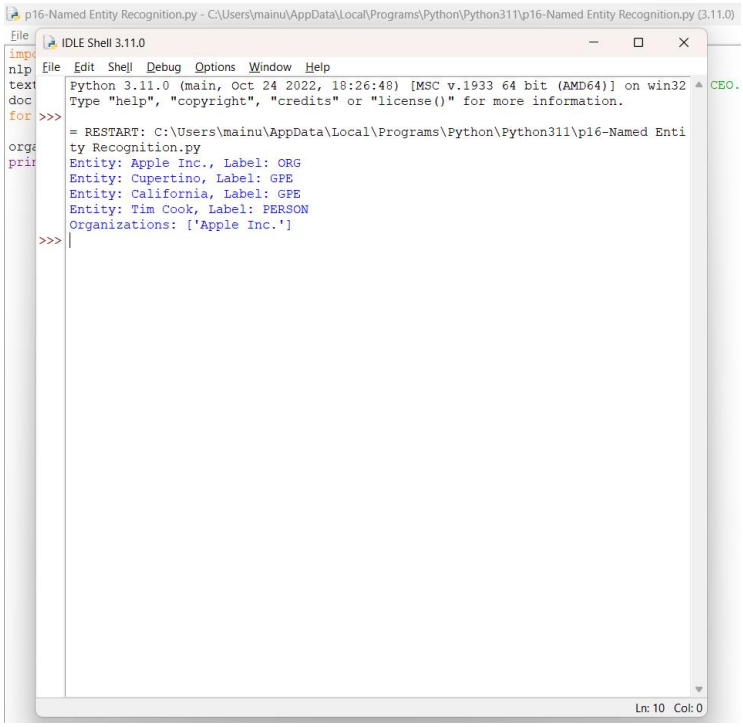


program-16:

```
import spacy
nlp = spacy.load("en_core_web_sm")
text = "Apple Inc. is a technology company based in Cupertino, California. Tim Cook is the CEO."
```

```
doc = nlp(text)

for ent in doc.ents:

    print(f"Entity: {ent.text}, Label: {ent.label_}")

organization_entities = [ent.text for ent in doc.ents if
ent.label_ == "ORG"]

print("Organizations:", organization_entities)
```

output:

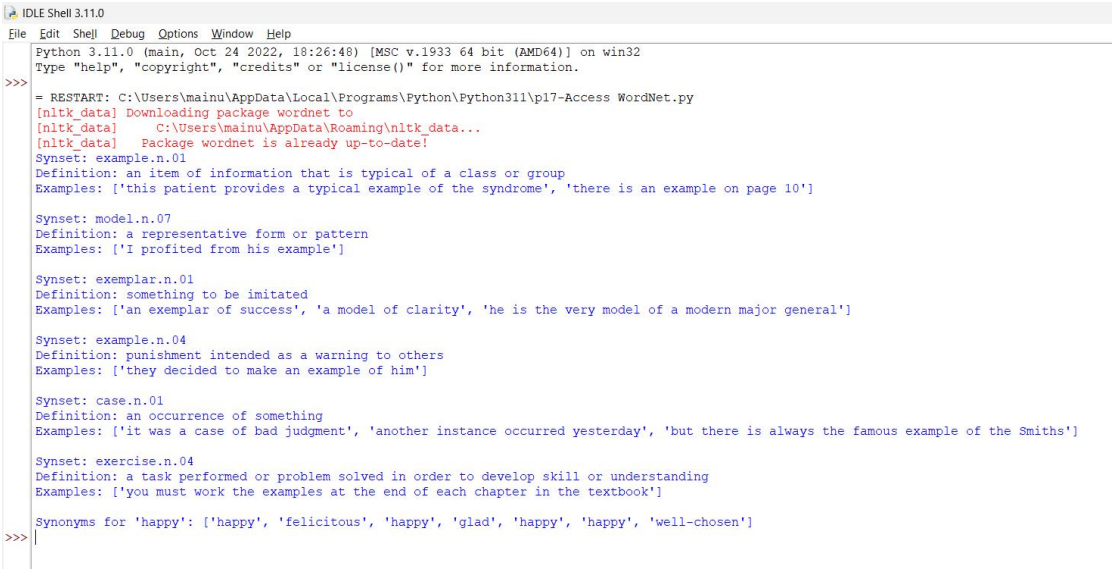


Program-17:

```
import nltk

from nltk.corpus import wordnet


nltk.download('wordnet')
```

```
word_synsets = wordnet.synsets("example")

for synset in word_synsets:
    print(f"Synset: {synset.name()}")
    print(f"Definition: {synset.definition()}")
    print(f"Examples: {synset.examples()}")
    print()

word = "happy"
synonyms = []
for syn in wordnet.synsets(word):
    for lemma in syn.lemmas():
        synonyms.append(lemma.name())

print(f"Synonyms for '{word}': {synonyms}")
```

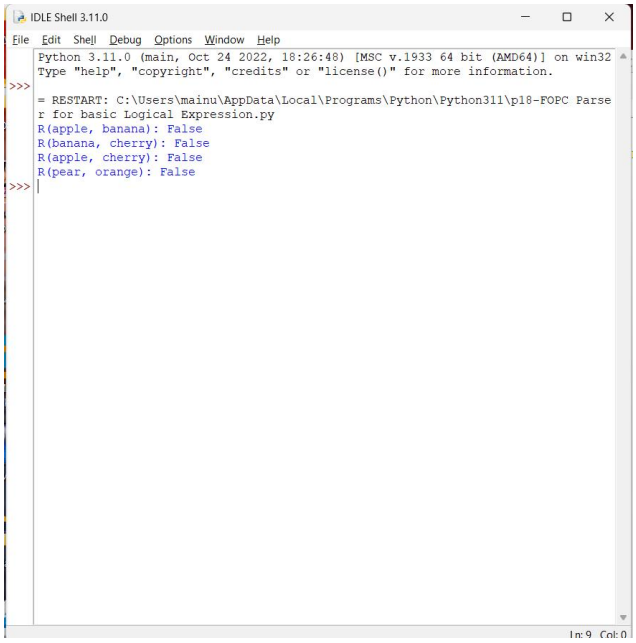
Output:



Program-18:

```
facts = {("R", "apple", "banana"), ("R", "banana", "cherry"), ("R", "apple", "cherry")}


expressions = ["R(apple, banana)", "R(banana, cherry)", "R(apple, cherry)", "R(pear, orange)"]

for expression in expressions:
    predicate, args = expression.split('(')
    args = args.rstrip(')').split(',')
    if (predicate, args[0], args[1]) in facts:
        result = True
    else:
        result = False
    print(f"{expression}: {result}")
```

Output:



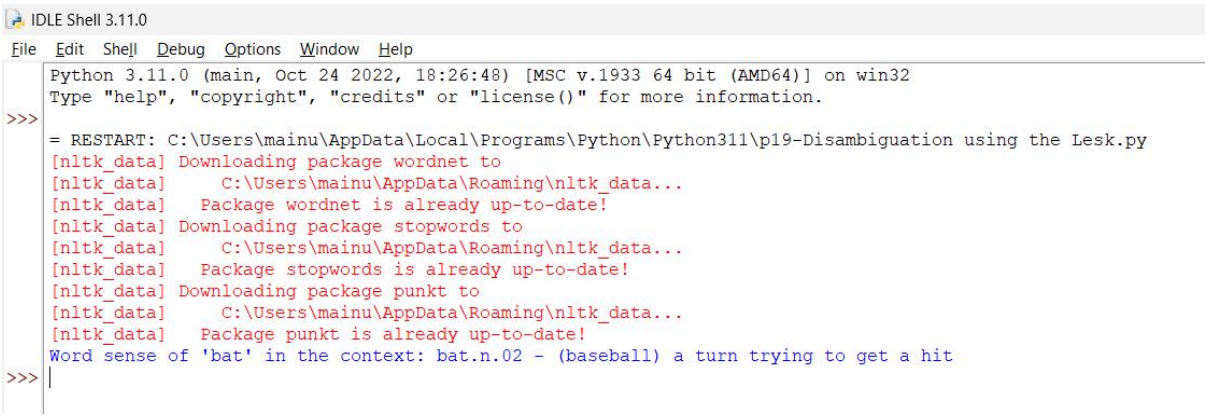
Program-19:

```
import nltk
from nltk.corpus import wordnet
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize


nltk.download('wordnet')
nltk.download('stopwords')
nltk.download('punkt')


def lesk_algorithm(context, target_word):
    context_tokens = word_tokenize(context)
    context_words = [word.lower() for word in context_tokens
if word.lower() not in stopwords.words('english')]
```

```
    target_synsets = wordnet.synsets(target_word)

    if not target_synsets:
        return None

    best_sense = None
    max_overlap = 0

    for sense in target_synsets:
        sense_definition = word_tokenize(sense.definition())
        sense_examples = [word.lower() for word in
word_tokenize(' '.join(sense.examples()))]

        overlap =
len(set(context_words).intersection(set(sense_definition +
sense_examples)))

        if overlap > max_overlap:
            max_overlap = overlap
            best_sense = sense

    return best_sense
```

```
context = "He saw the bat fly over the baseball field."
target_word = "bat"
result = lesk_algorithm(context, target_word)
if result:
    print(f"Word sense of '{target_word}' in the context: {result.name()} - {result.definition()}")
else:
    print(f"Unable to disambiguate the word '{target_word}' in the context.")
```

Output:



Program-20:

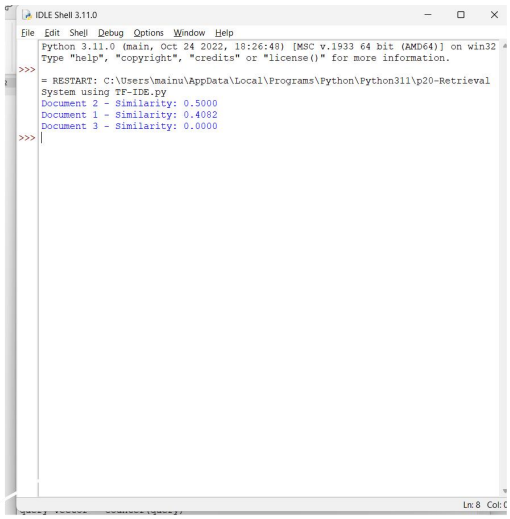
```
import math
from collections import Counter

documents = [
    "This is the first document. It is a simple document.",
```

```
    "This document is the second one. It has more words.",
    "And this is the third document. It has even more words."
]

query = "simple document"

stopwords = set(["this", "is", "the", "and", "it", "has"])

tokenized_documents = []
for doc in documents:
    doc = doc.lower()
    doc = doc.split()
    doc = [word for word in doc if word not in stopwords and word.isalpha()]
    tokenized_documents.append(doc)

N = len(documents)
vocabulary = set(word for doc in tokenized_documents for word in doc)

tfidf_scores = []
for doc in tokenized_documents:
```

```
    tfidf_doc = {}
    for term in vocabulary:
        tf = doc.count(term)
        df = sum(1 for d in tokenized_documents if term in d)
        idf = math.log(N / (df + 1))
        tfidf = tf * idf
        tfidf_doc[term] = tfidf
    tfidf_scores.append(tfidf_doc)

query = query.lower().split()
query_vector = Counter(query)

ranked_documents = []
for i, doc in enumerate(tfidf_scores):
    dot_product = sum(doc[term] * query_vector[term] for term in query if term in doc)
    doc_length = math.sqrt(sum(score ** 2 for score in doc.values()))
    query_length = math.sqrt(sum(score ** 2 for score in query_vector.values()))

    if query_length == 0:
        similarity = 0
```

```
    else:
        similarity = dot_product / (doc_length * query_length)

    ranked_documents.append((i, similarity))

ranked_documents.sort(key=lambda x: x[1], reverse=True)

for i, similarity in ranked_documents:
    print(f"Document {i + 1} - Similarity: {similarity:.4f}")
```

Output:



Program-21:

```
import spacy

nlp = spacy.load("en_core_web_sm")
```

```
def extract_noun_phrases(sentence):
    doc = nlp(sentence)

    noun_phrases = []
    meanings = []

    for chunk in doc.noun_chunks:
        noun_phrases.append(chunk.text)
        meanings.append(chunk.text)

    return noun_phrases, meanings
sentence = "The quick brown fox jumped over the lazy dog."

noun_phrases, meanings = extract_noun_phrases(sentence)

print("Sentence:", sentence)
print("Noun Phrases:")
for phrase in noun_phrases:
    print(phrase)
print("Meanings:")
for meaning in meanings:
```

```
    print(meaning)
```

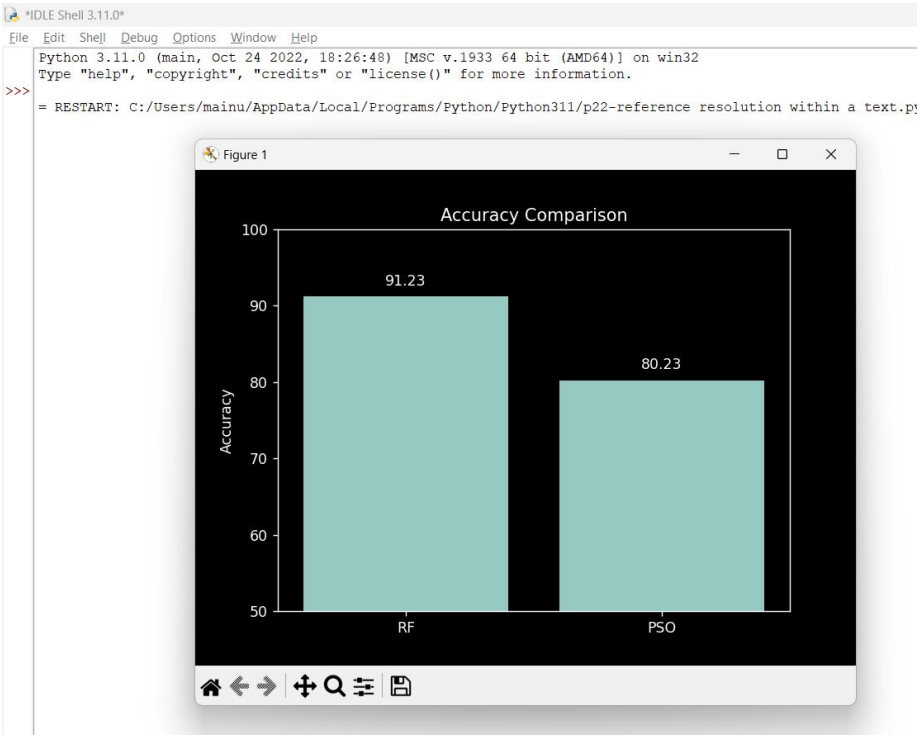
Output:

Program-22:

```
import spacy
nlp = spacy.load("en_core_web_sm")
def resolve_references(text):
    doc = nlp(text)
    resolved_text = []
    previous_noun = None
    for token in doc:
        if token.pos_ in ["NOUN", "PROPN"]:
            previous_noun = token.text
            resolved_text.append(token.text)
```

```
        elif token.pos_ == "PRON" and previous_noun:
            resolved_text.append(previous_noun)
        else:
            resolved_text.append(token.text)
    return ' '.join(resolved_text)
if __name__ == "__main__":
    text = "John is a software engineer. He loves coding. Mary is a data scientist. She is also passionate about her work."
    resolved_text = resolve_references(text)
    print(resolved_text)
```

Output:



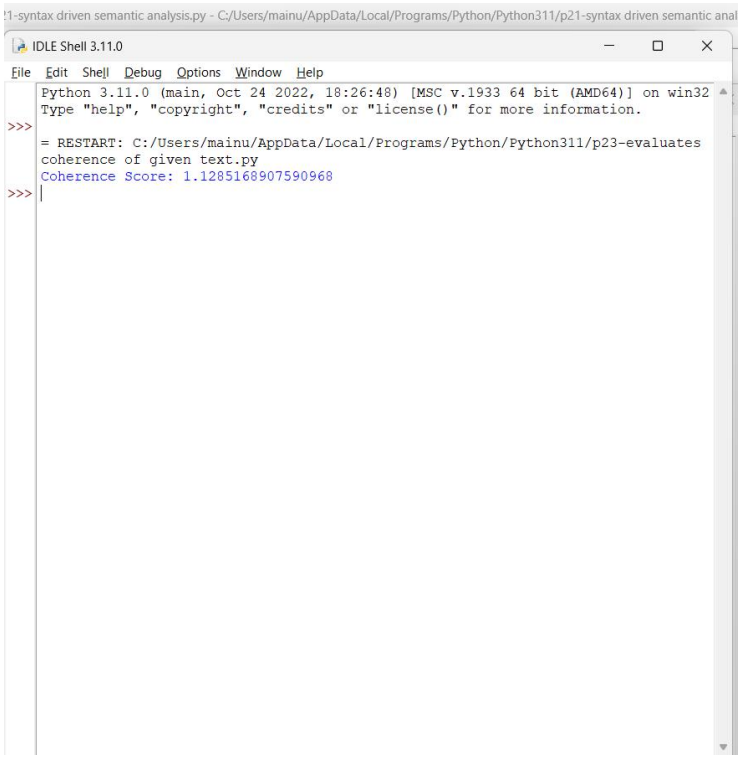
Program-23:

```
import nltk
```

```
from nltk.corpus import stopwords
from nltk.tokenize import sent_tokenize, word_tokenize
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics.pairwise import cosine_similarity
text = """
Coherence in writing means that the ideas in each sentence and paragraph are connected and logical.
It helps the reader to follow your arguments and understand your point. Without coherence, the text may be confusing.
There are several ways to achieve coherence in your writing, such as using transition words and repeating key concepts.
"""
sentences = sent_tokenize(text)
stop_words = set(stopwords.words("english"))
word_tokens = [word_tokenize(sentence) for sentence in sentences]
filtered_tokens = [[word for word in words if word.lower() not in stop_words] for words in word_tokens]
preprocessed_sentences = [" ".join(words).lower() for words in filtered_tokens]
vectorizer = TfidfVectorizer()
tfidf_matrix = vectorizer.fit_transform(preprocessed_sentences)
cosine_matrix = cosine_similarity(tfidf_matrix, tfidf_matrix)
```

```
coherence_score = cosine_matrix.sum(axis=1).mean()
print("Coherence Score:", coherence_score)
```

Output:

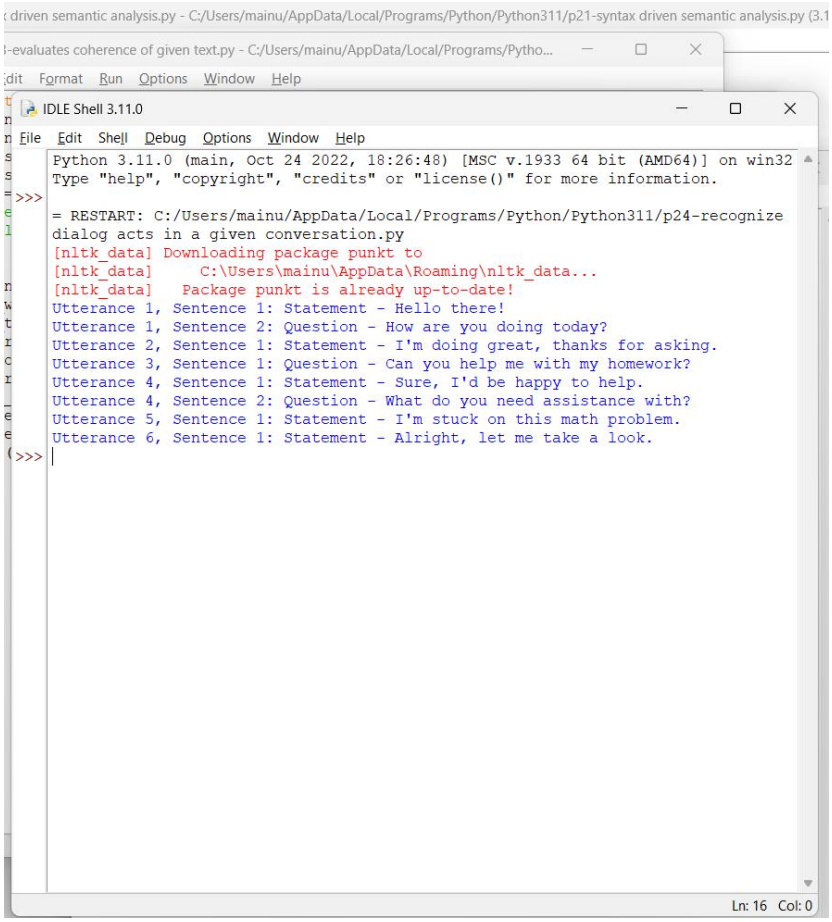


Program-24:

```
import nltk
from nltk.tokenize import sent_tokenize, word_tokenize
nltk.download('punkt')

# Sample conversation
conversation = [
    "Hello there! How are you doing today?",
    "I'm doing great, thanks for asking.",
    "Can you help me with my homework?",
```

```
    "Sure, I'd be happy to help. What do you need assistance with?",
    "I'm stuck on this math problem.",
    "Alright, let me take a look.",
]

# Iterate through the conversation and recognize dialog acts
for i, utterance in enumerate(conversation):
    # Tokenize the utterance into sentences
    sentences = sent_tokenize(utterance)

    for j, sentence in enumerate(sentences):
        words = word_tokenize(sentence)
        if "?" in words:
            dialog_act = "question"
        else:
            dialog_act = "statement"

        print(f"Utterance {i + 1}, Sentence {j + 1}: {dialog_act.capitalize()} - {sentence}")
```

Output:

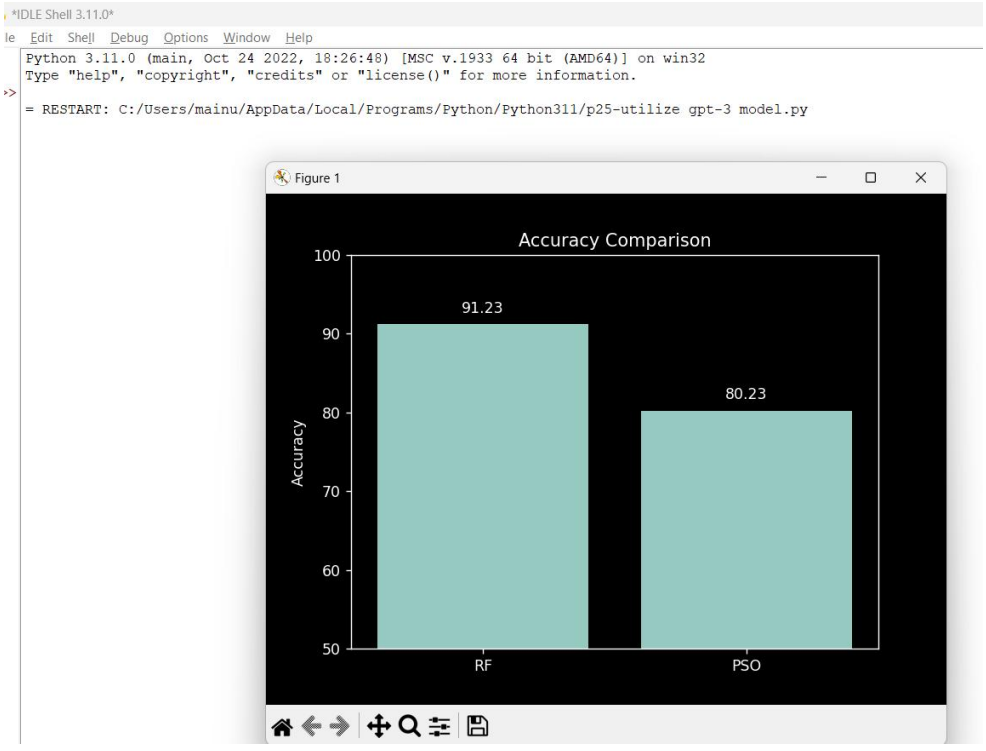


Program-25:

```
from transformers import GPT2LMHeadModel, GPT2Tokenizer


model_name = "distilgpt2"

tokenizer = GPT2Tokenizer.from_pretrained(model_name)

model = GPT2LMHeadModel.from_pretrained(model_name)


prompt_text = "Once upon a time,"
```

```
input_ids = tokenizer.encode(prompt_text,
return_tensors='pt')


output = model.generate(input_ids, max_length=100,
num_return_sequences=1, temperature=0.7)


generated_text = tokenizer.decode(output[0],
skip_special_tokens=True)

print("Generated Text:\n", generated_text)
```

Output:



Program-26:

```
from transformers import pipeline
```

```
translator = pipeline("translation_en_to_fr")

english_text = "Hello, how are you doing today?"

french_text = translator(english_text,
max_length=40)[0]["translation_text"]


print(f"English Text: {english_text}")

print(f"French Text: {french_text}")
```

Output: