Pratical no: 01

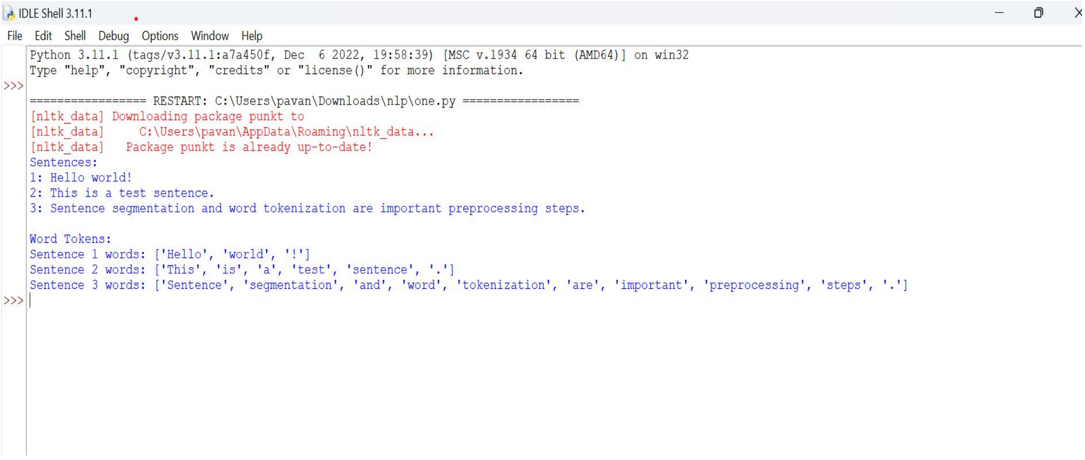
1. Write a program to implement sentence segmentation and word tokenization.

Input:

```
import nltk
from nltk.tokenize import sent_tokenize, word_tokenize

# Download the necessary resources
nltk.download('punkt')

def segment_sentences(text):
    """
    Segment the input text into sentences.

    :param text: A string containing the text to be segmented.
    :return: A list of sentences.
    """
    sentences = sent_tokenize(text)
    return sentences

def tokenize_words(sentences):
    """
    Tokenize the input sentences into words.

    :param sentences: A list of sentences.
    :return: A list of lists, where each inner list contains the words of the corresponding
sentence.
    """
    word_tokens = [word_tokenize(sentence) for sentence in sentences]
    return word_tokens

if __name__ == "__main__":
    text = "Hello world! This is a test sentence. Sentence segmentation and word
tokenization are important preprocessing steps."

    # Segment the text into sentences
    sentences = segment_sentences(text)
    print("Sentences:")
    for i, sentence in enumerate(sentences):
        print(f"{i+1}: {sentence}")

    # Tokenize each sentence into words
    word_tokens = tokenize_words(sentences)
    print("\nWord Tokens:")
```

```
for i, words in enumerate(word_tokens):
    print(f"Sentence {i+1} words: {words}")
```

Output:



```
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================= RESTART: C:\Users\pavan\Downloads\nlp\one.py =================
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\pavan\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
Sentences:
1: Hello world!
2: This is a test sentence.
3: Sentence segmentation and word tokenization are important preprocessing steps.

Word Tokens:
Sentence 1 words: ['Hello', 'world', '!']
Sentence 2 words: ['This', 'is', 'a', 'test', 'sentence', '.']
Sentence 3 words: ['Sentence', 'segmentation', 'and', 'word', 'tokenization', 'are', 'important', 'preprocessing', 'steps', '.']
>>>
```

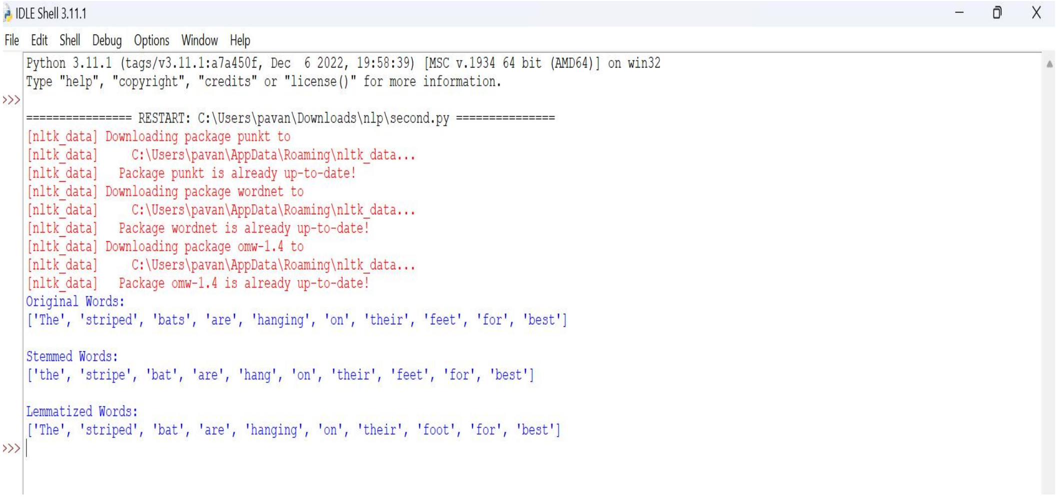
Pratical no: 02

2. Write a program to implement stemming and lemmatization.

Input:

```
import nltk
from nltk.stem import PorterStemmer, WordNetLemmatizer
from nltk.tokenize import word_tokenize

# Download the necessary resources
nltk.download('punkt')
nltk.download('wordnet')
nltk.download('omw-1.4')

def perform_stemming(words):
    """
    Perform stemming on the input words.

    :param words: A list of words to be stemmed.
    :return: A list of stemmed words.
    """
    stemmer = PorterStemmer()
    stemmed_words = [stemmer.stem(word) for word in words]
    return stemmed_words

def perform_lemmatization(words):
    """
    Perform lemmatization on the input words.

    :param words: A list of words to be lemmatized.
    :return: A list of lemmatized words.
    """
    lemmatizer = WordNetLemmatizer()
    lemmatized_words = [lemmatizer.lemmatize(word) for word in words]
    return lemmatized_words

if __name__ == "__main__":
    text = "The striped bats are hanging on their feet for best"

    # Tokenize the text into words
    words = word_tokenize(text)
    print("Original Words:")
    print(words)

    # Perform stemming
    stemmed_words = perform_stemming(words)
    print("\nStemmed Words:")
print(stemmed_words)

# Perform lemmatization
lemmatized_words = perform_lemmatization(words)
print("\nLemmatized Words:")
print(lemmatized_words)
```

Output:



```
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================ RESTART: C:\Users\pavan\Downloads\nlp\second.py ===============
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\pavan\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data]     C:\Users\pavan\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
[nltk_data] Downloading package omw-1.4 to
[nltk_data]     C:\Users\pavan\AppData\Roaming\nltk_data...
[nltk_data]   Package omw-1.4 is already up-to-date!
Original Words:
['The', 'striped', 'bats', 'are', 'hanging', 'on', 'their', 'feet', 'for', 'best']

Stemmed Words:
['the', 'stripe', 'bat', 'are', 'hang', 'on', 'their', 'feet', 'for', 'best']

Lemmatized Words:
['The', 'striped', 'bat', 'are', 'hanging', 'on', 'their', 'foot', 'for', 'best']
>>>
```

Practical no:03

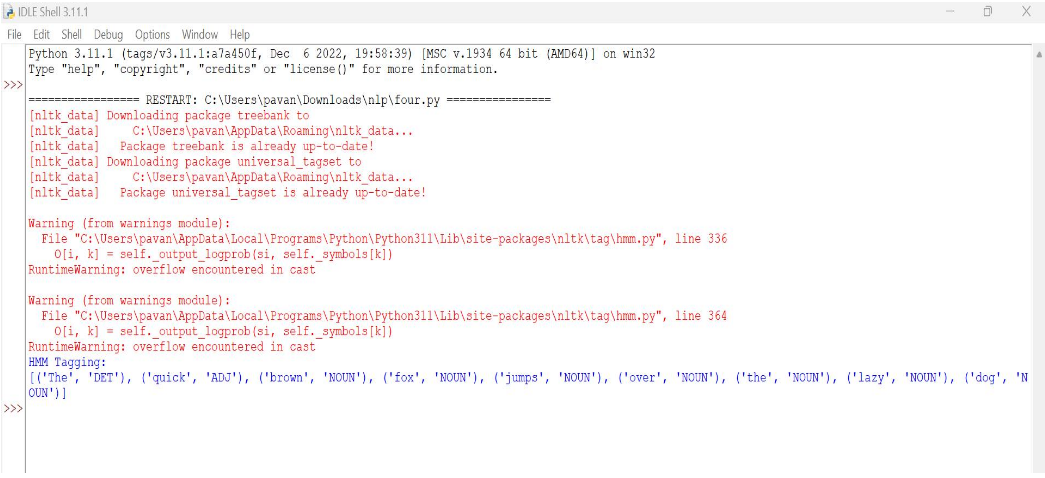
3. Write a program to implement Pos tagging using HMM and Neural Model.

Input:

a) PoS Tagging using HMM with NLTK

```
import nltk
from nltk.tag import hmm
from nltk.corpus import treebank

# Download necessary resources
nltk.download('treebank')
nltk.download('universal_tagset')

# Prepare the training data
train_data = treebank.tagged_sents(tagset='universal')

# Train an HMM tagger
trainer = hmm.HiddenMarkovModelTrainer()
hmm_tagger = trainer.train(train_data)

# Test the HMM tagger
test_sentence = "The quick brown fox jumps over the lazy dog".split()
hmm_tags = hmm_tagger.tag(test_sentence)

print("HMM Tagging:")
print(hmm_tags)
```

Output:



```
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================= RESTART: C:\Users\pavan\Downloads\nlp\four.py ================
[nltk_data] Downloading package treebank to
[nltk_data]     C:\Users\pavan\AppData\Roaming\nltk_data...
[nltk_data]   Package treebank is already up-to-date!
[nltk_data] Downloading package universal_tagset to
[nltk_data]     C:\Users\pavan\AppData\Roaming\nltk_data...
[nltk_data]   Package universal_tagset is already up-to-date!

Warning (from warnings module):
  File "C:\Users\pavan\AppData\Local\Programs\Python\Python311\Lib\site-packages\nltk\tag\hmm.py", line 336
    O[i, k] = self._output_logprob(si, self._symbols[k])
RuntimeWarning: overflow encountered in cast

Warning (from warnings module):
  File "C:\Users\pavan\AppData\Local\Programs\Python\Python311\Lib\site-packages\nltk\tag\hmm.py", line 364
    O[i, k] = self._output_logprob(si, self._symbols[k])
RuntimeWarning: overflow encountered in cast
HMM Tagging:
[('The', 'DET'), ('quick', 'ADJ'), ('brown', 'NOUN'), ('fox', 'NOUN'), ('jumps', 'NOUN'), ('over', 'NOUN'), ('the', 'NOUN'), ('lazy', 'NOUN'), ('dog', 'N
OUN')]
>>>
```

B) PoS Tagging using a Neural Model with PyTorch

Input:

```
import torch
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import DataLoader, Dataset
import nltk
from nltk.corpus import treebank
from nltk import word_tokenize

# Download necessary resources
nltk.download('treebank')
nltk.download('universal_tagset')

# Prepare the data
tagged_sentences = treebank.tagged_sents(tagset='universal')
vocab = set(word for sentence in treebank.sents() for word in sentence)
tags = set(tag for sentence in treebank.tagged_sents(tagset='universal') for word, tag
in sentence)

word_to_ix = {word: i for i, word in enumerate(vocab)}
tag_to_ix = {tag: i for i, tag in enumerate(tags)}

class POSTaggingDataset(Dataset):
    def __init__(self, tagged_sentences):
        self.sentences = [[word for word, tag in sentence] for sentence in
tagged_sentences]
        self.tags = [[tag for word, tag in sentence] for sentence in tagged_sentences]

    def __len__(self):
        return len(self.sentences)

    def __getitem__(self, idx):
        sentence = self.sentences[idx]
        tags = self.tags[idx]
        return torch.tensor([word_to_ix[word] for word in sentence], dtype=torch.long),
torch.tensor([tag_to_ix[tag] for tag in tags], dtype=torch.long)

dataset = POSTaggingDataset(tagged_sentences)
dataloader = DataLoader(dataset, batch_size=1, shuffle=True)

class LSTMTagger(nn.Module):
    def __init__(self, vocab_size, tagset_size, embedding_dim=64, hidden_dim=128):
        super(LSTMTagger, self).__init__()
        self.embedding = nn.Embedding(vocab_size, embedding_dim)
        self.lstm = nn.LSTM(embedding_dim, hidden_dim, batch_first=True)
        self.hidden2tag = nn.Linear(hidden_dim, tagset_size)
    def forward(self, sentence):
        embeds = self.embedding(sentence)
        lstm_out, _ = self.lstm(embeds)
        tag_space = self.hidden2tag(lstm_out)
        tag_scores = nn.functional.log_softmax(tag_space, dim=2)
        return tag_scores

model = LSTMTagger(len(vocab), len(tag_to_ix))
loss_function = nn.NLLLoss()
optimizer = optim.SGD(model.parameters(), lr=0.1)

# Training the model
for epoch in range(10):
    for sentence, tags in dataloader:
        model.zero_grad()
        tag_scores = model(sentence)
        loss = loss_function(tag_scores.view(-1, len(tag_to_ix)), tags.view(-1))
        loss.backward()
        optimizer.step()

# Testing the model
def predict(model, sentence):
    with torch.no_grad():
        inputs = torch.tensor([word_to_ix[word] for word in word_tokenize(sentence)],
dtype=torch.long).unsqueeze(0)
        tag_scores = model(inputs)
        _, predicted_tags = torch.max(tag_scores, dim=2)
        predicted_tags = predicted_tags.squeeze().tolist()
        return [(word, list(tag_to_ix.keys())[tag]) for word, tag in
zip(word_tokenize(sentence), predicted_tags)]

test_sentence = "The quick brown fox jumps over the lazy dog"
neural_tags = predict(model, test_sentence)

print("Neural Model Tagging:")
print(neural_tags)
```

Output:

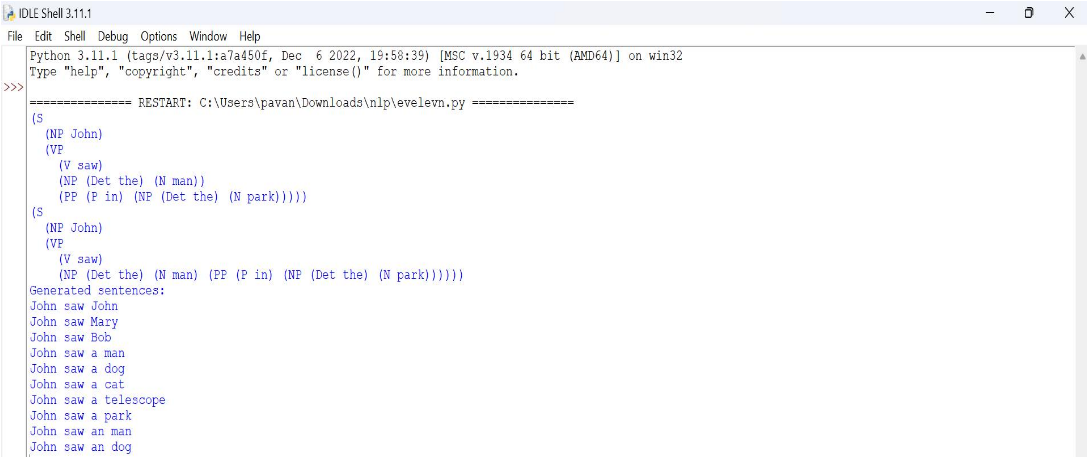
Pratical:04

4.Write a program to Implement syntactic parsing of a given text.

Input:

```
import nltk
from nltk import CFG
from nltk.parse.generate import generate

# Define a simple grammar
grammar = CFG.fromstring("""
    S -> NP VP
    VP -> V NP | V NP PP
    PP -> P NP
    V -> "saw" | "ate" | "walked"
    NP -> "John" | "Mary" | "Bob" | Det N | Det N PP
    Det -> "a" | "an" | "the" | "my"
    N -> "man" | "dog" | "cat" | "telescope" | "park"
    P -> "in" | "on" | "by" | "with"
""")

# Create a parser
parser = nltk.ChartParser(grammar)

# Define a test sentence
sentence = "John saw the man in the park".split()

# Parse the sentence
parses = list(parser.parse(sentence))

# Display the parse trees
for tree in parses:
    print(tree)
    tree.draw()

# If you want to generate all possible sentences according to the grammar
print("Generated sentences:")
for sentence in generate(grammar, n=10):
    print(' '.join(sentence))
```

Output:



```
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
=============== RESTART: C:\Users\pavan\Downloads\nlp\evelevn.py ===============
(S
  (NP John)
  (VP
    (V saw)
    (NP (Det the) (N man))
    (PP (P in) (NP (Det the) (N park)))))
(S
  (NP John)
  (VP
    (V saw)
    (NP (Det the) (N man) (PP (P in) (NP (Det the) (N park))))))
Generated sentences:
John saw John
John saw Mary
John saw Bob
John saw a man
John saw a dog
John saw a cat
John saw a telescope
John saw a park
John saw an man
John saw an dog
```

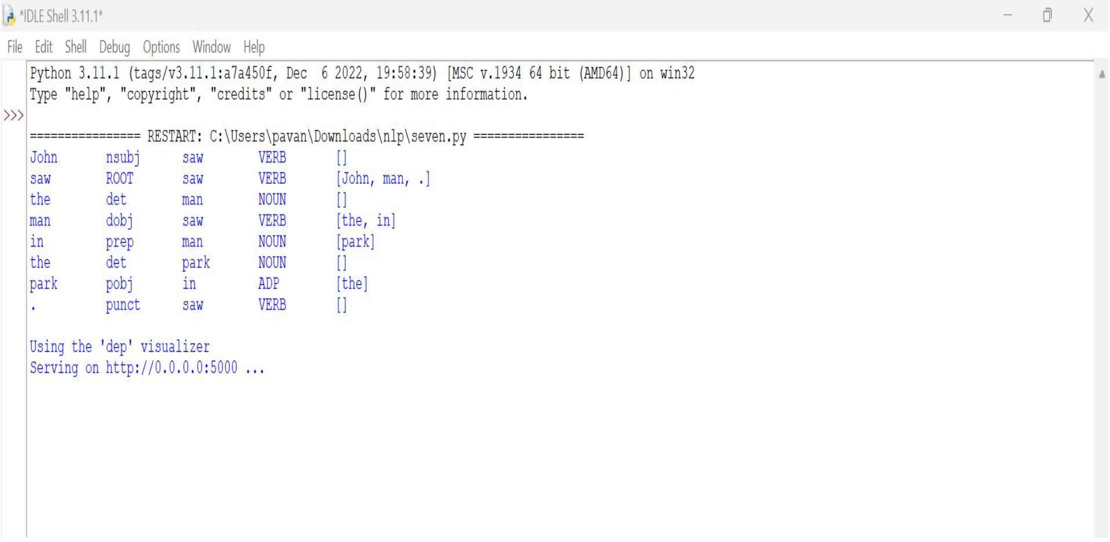
Pratical no:05

5.Write a program to Implement dependency parsing of a given text.

Input:

```
import spacy

# Load the pre-trained spaCy model
nlp = spacy.load("en_core_web_sm")

# Define a test sentence
sentence = "John saw the man in the park."

# Parse the sentence
doc = nlp(sentence)

# Display the syntactic structure
for token in doc:
    print(f"{token.text:10} {token.dep_:10} {token.head.text:10} {token.head.pos_:10}
{[child for child in token.children]}")

# Visualize the parse tree
spacy.displacy.serve(doc, style="dep")
```

Output:



```
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
================ RESTART: C:\Users\pavan\Downloads\nlp\seven.py ================
John       nsubj      saw        VERB       []
saw        ROOT       saw        VERB       [John, man, .]
the        det        man        NOUN       []
man        dobj       saw        VERB       [the, in]
in         prep       man        NOUN       [park]
the        det        park       NOUN       []
park       pobj       in         ADP        [the]
.          punct      saw        VERB       []

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

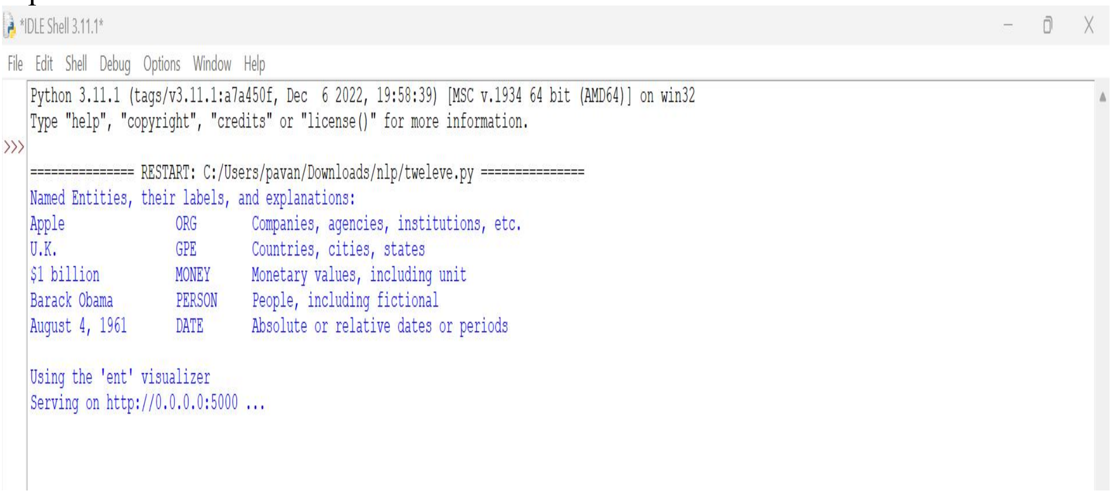
Practical:06

6. Write a program to Implement Named Entity Recognition (NER).

Input:

```
import spacy

# Load the pre-trained spaCy model
nlp = spacy.load("en_core_web_sm")

# Define a test sentence
text = "Apple is looking at buying U.K. startup for $1 billion. Barack Obama was
born on August 4, 1961."

# Process the text
doc = nlp(text)

# Display the named entities
print("Named Entities, their labels, and explanations:")
for ent in doc.ents:
    print(f"{ent.text:20} {ent.label_:10} {spacy.explain(ent.label_)}")

# Visualize the named entities
spacy.displacy.serve(doc, style="ent")
```

Input



```
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
============== RESTART: C:/Users/pavan/Downloads/nlp/tweleve.py ==============
Named Entities, their labels, and explanations:
Apple                ORG        Companies, agencies, institutions, etc.
U.K.                 GPE        Countries, cities, states
$1 billion           MONEY      Monetary values, including unit
Barack Obama         PERSON     People, including fictional
August 4, 1961       DATE       Absolute or relative dates or periods

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