```python
# Import NLTK for tokenization and stemming
import nltk
from nltk.tokenize import sent_tokenize, word_tokenize
from nltk.stem import PorterStemmer

# Import spaCy for advanced NLP tasks
import spacy
```

```python
# Medical text corpus for NLP processing
medical_text = """
The patient was diagnosed with diabetes and hypertension.
Doctors prescribed medications to manage blood sugar levels.
Early diagnosis helps in preventing severe complications.
Patients are advised to monitor glucose regularly.
"""
```

```python
nltk.download('punkt')# Download tokenizer models for NLTK
nltk.download('punkt')

nltk.download('punkt_tab')
# Tokenize text into sentences using NLTK
nltk_sentences = sent_tokenize(medical_text)

# Display NLTK sentence tokens
nltk_sentences
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package punkt_tab to /root/nltk_data...
[nltk_data]   Package punkt_tab is already up-to-date!
['\nThe patient was diagnosed with diabetes and hypertension.',
 'Doctors prescribed medications to manage blood sugar levels.',
 'Early diagnosis helps in preventing severe complications.',
 'Patients are advised to monitor glucose regularly.']
```

```python
import spacy
nlp = spacy.load('en_core_web_sm') # Load the English language model

# Process text using spaCy
doc = nlp(medical_text)

# Extract sentences using spaCy
spacy_sentences = [sent.text for sent in doc.sents]

# Display spaCy sentence tokens
spacy_sentences
```

```
['\nThe patient was diagnosed with diabetes and hypertension.\n',
 'Doctors prescribed medications to manage blood sugar levels.\n',
 'Early diagnosis helps in preventing severe complications.\n',
 'Patients are advised to monitor glucose regularly.\n']
```

```python
# Tokenize text into words using NLTK
nltk_words = word_tokenize(medical_text)

# Display word tokens
nltk_words
```

```
['The',
 'patient',
 'was',
 'diagnosed',
 'with',
 'diabetes',
 'and',
 'hypertension',
 '.',
 'Doctors',
 'prescribed',
 'medications',
 'to',
 'manage',
 'blood',
 'sugar',
 'levels',
 '.',
 'Early',
 'diagnosis',
 'helps',
 'in',
 'preventing',
 'severe',
 'complications',
 '.',
 'Patients',
 'are',
 'advised',
 'to',
 'monitor',
 'glucose',
 'regularly',
 '.']
```

```python
# Tokenize text into words using spaCy
spacy_words = [token.text for token in doc]

# Display spaCy word tokens
spacy_words
```

```
['\n',
 'The',
 'patient',
```

```
'was',
'diagnosed',
'with',
'diabetes',
'and',
'hypertension',
'.',
'\n',
'Doctors',
'prescribed',
'medications',
'to',
'manage',
'blood',
'sugar',
'levels',
'.',
'\n',
'Early',
'diagnosis',
'helps',
'in',
'preventing',
'severe',
'complications',
'.',
'\n',
'Patients',
'are',
'advised',
'to',
'monitor',
'glucose',
'regularly',
'.',
'\n']
```

```python
# Initialize Porter Stemmer
stemmer = PorterStemmer()

# Apply stemming to alphabetic words only
stemmed_words = [stemmer.stem(word) for word in nltk_words if word.isalpha()

# Display stemmed words
stemmed_words
```

```
['the',
 'patient',
 'wa',
 'diagnos',
 'with',
 'diabet',
 'and',
 'hypertens',
 'doctor',
 'prescrib',
 'medic',
```

```
        'to',
        'manag',
        'blood',
        'sugar',
        'level',
        'earli',
        'diagnosi',
        'help',
        'in',
        'prevent',
        'sever',
        'complic',
        'patient',
        'are',
        'advis',
        'to',
        'monitor',
        'glucos',
        'regularli']
```

```python
# Apply lemmatization using spaCy
lemmatized_words = [token.lemma_ for token in doc if token.is_alpha]

# Display lemmatized words
lemmatized_words
```

```
['the',
 'patient',
 'be',
 'diagnose',
 'with',
 'diabete',
 'and',
 'hypertension',
 'doctor',
 'prescribe',
 'medication',
 'to',
 'manage',
 'blood',
 'sugar',
 'level',
 'early',
 'diagnosis',
 'help',
 'in',
 'prevent',
 'severe',
 'complication',
 'patient',
 'be',
 'advise',
 'to',
 'monitor',
 'glucose',
 'regularly']
```

```
# Compare first few stemmed and lemmatized words
comparison = list(zip(stemmed_words[:30], lemmatized_words[:30]))

# Display comparison
comparison
```

```
[('the', 'the'),
 ('patient', 'patient'),
 ('wa', 'be'),
 ('diagnos', 'diagnose'),
 ('with', 'with'),
 ('diabet', 'diabete'),
 ('and', 'and'),
 ('hypertens', 'hypertension'),
 ('doctor', 'doctor'),
 ('prescrib', 'prescribe'),
 ('medic', 'medication'),
 ('to', 'to'),
 ('manag', 'manage'),
 ('blood', 'blood'),
 ('sugar', 'sugar'),
 ('level', 'level'),
 ('earli', 'early'),
 ('diagnosi', 'diagnosis'),
 ('help', 'help'),
 ('in', 'in'),
 ('prevent', 'prevent'),
 ('sever', 'severe'),
 ('complic', 'complication'),
 ('patient', 'patient'),
 ('are', 'be'),
 ('advis', 'advise'),
 ('to', 'to'),
 ('monitor', 'monitor'),
 ('glucos', 'glucose'),
 ('regularli', 'regularly')]
```

DISCUSSION:Why Lemmatization is Critical in Healthcare NLP?

Stemming removes word endings mechanically and may produce incomplete or non-meaningful roots such as "diagnos" instead of "diagnosis". Lemmatization, on the other hand, converts words into their base dictionary form while preserving meaning.

In healthcare NLP:

*Medical terms must remain accurate

*Incorrect word forms can lead to wrong interpretation

*Lemmatization supports clinical text understanding and decision-making

Hence, lemmatization is preferred over stemming in healthcare-related NLP applications.