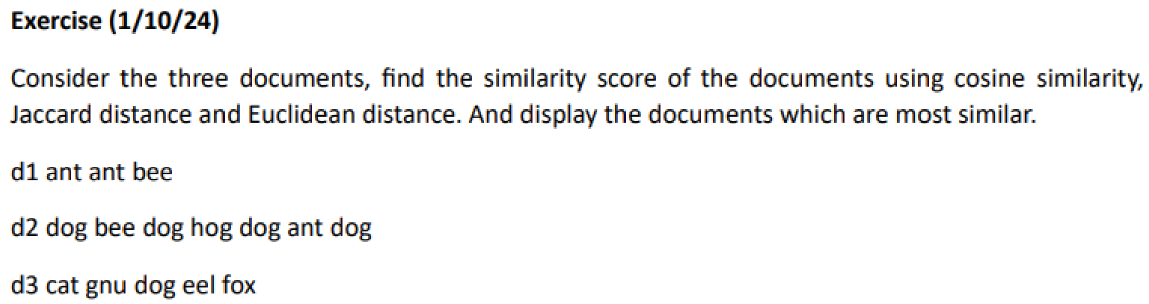
Name: Varun Sudhir

Reg No: 21BDS0040

Data Mining Lab Digital Assignment – V



Exercise (1/10/24)

Consider the three documents, find the similarity score of the documents using cosine similarity, Jaccard distance and Euclidean distance. And display the documents which are most similar.

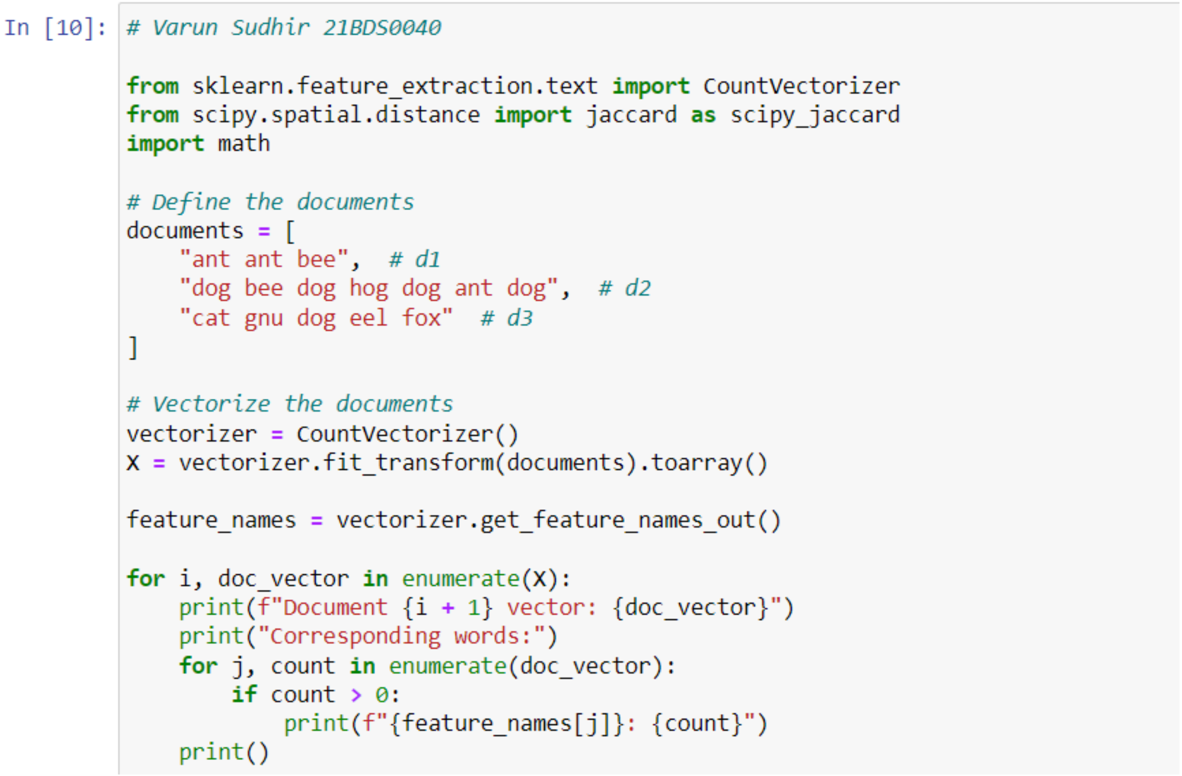
d1 ant ant bee

d2 dog bee dog hog dog ant dog

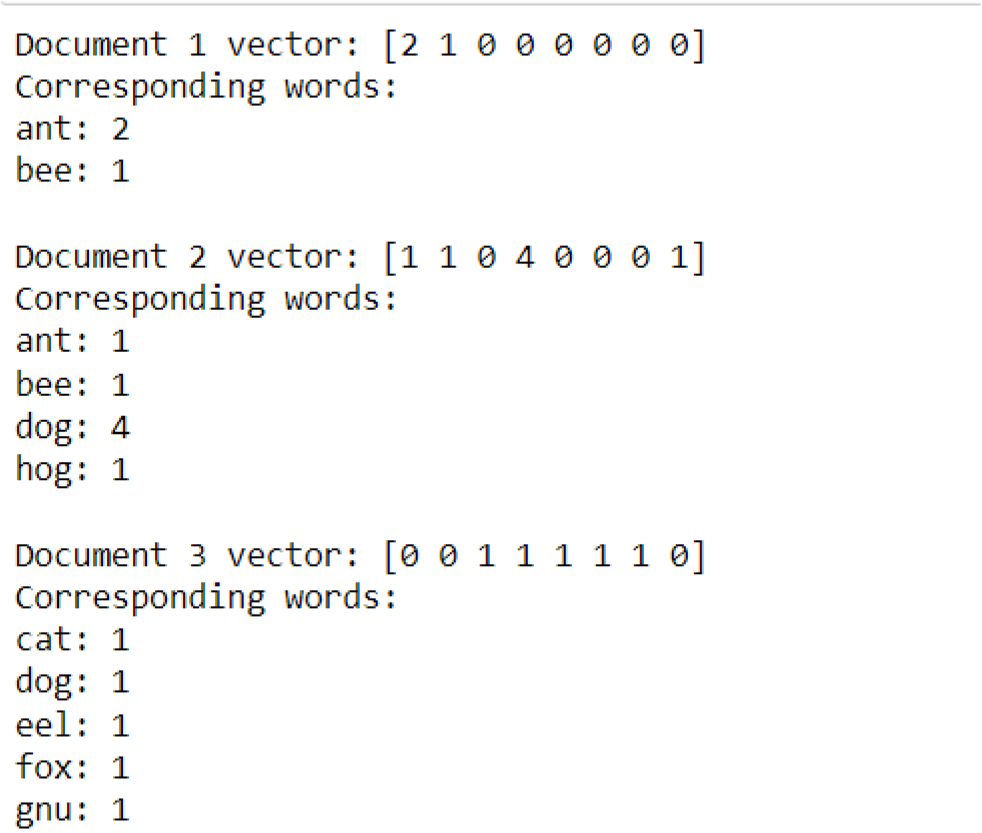
d3 cat gnu dog eel fox

Code and Output:

```
# Varun Sudhir 21BDS0040

from sklearn.feature_extraction.text import CountVectorizer
from scipy.spatial.distance import jaccard as scipy_jaccard
import math

# Define the documents
documents = [
    "ant ant bee",  # d1
    "dog bee dog hog dog ant dog",  # d2
    "cat gnu dog eel fox"  # d3
]

# Vectorize the documents
vectorizer = CountVectorizer()
X = vectorizer.fit_transform(documents).toarray()

feature_names = vectorizer.get_feature_names_out()

for i, doc_vector in enumerate(X):
    print(f"Document {i + 1} vector: {doc_vector}")
    print("Corresponding words:")
    for j, count in enumerate(doc_vector):
        if count > 0:
            print(f"{feature_names[j]}: {count}")
    print()
```

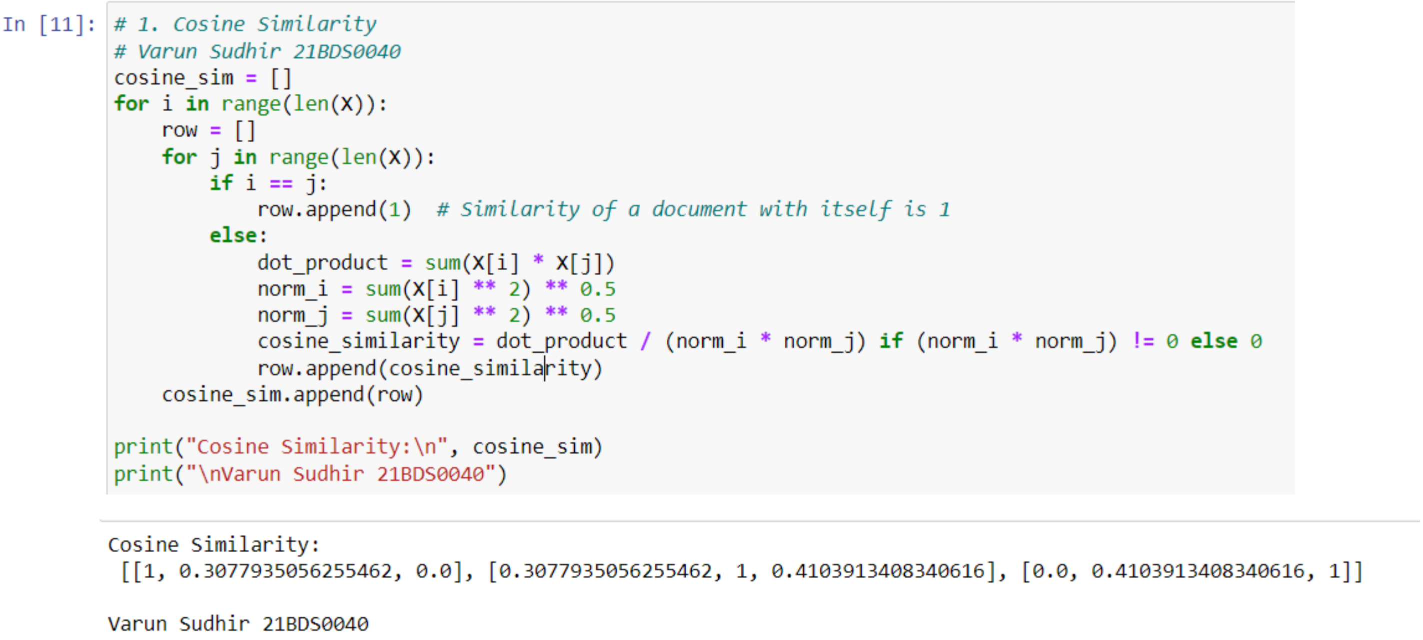


```
In [10]: # Varun Sudhir 21BDS0040

         from sklearn.feature_extraction.text import CountVectorizer
         from scipy.spatial.distance import jaccard as scipy_jaccard
         import math

         # Define the documents
         documents = [
             "ant ant bee",  # d1
             "dog bee dog hog dog ant dog",  # d2
             "cat gnu dog eel fox"  # d3
         ]

         # Vectorize the documents
         vectorizer = CountVectorizer()
         X = vectorizer.fit_transform(documents).toarray()

         feature_names = vectorizer.get_feature_names_out()

         for i, doc_vector in enumerate(X):
             print(f"Document {i + 1} vector: {doc_vector}")
             print("Corresponding words:")
             for j, count in enumerate(doc_vector):
                 if count > 0:
                     print(f"{feature_names[j]}: {count}")
             print()
```



```
Document 1 vector: [2 1 0 0 0 0 0 0]
Corresponding words:
ant: 2
bee: 1

Document 2 vector: [1 1 0 4 0 0 0 1]
Corresponding words:
ant: 1
bee: 1
dog: 4
hog: 1

Document 3 vector: [0 0 1 1 1 1 1 0]
Corresponding words:
cat: 1
dog: 1
eel: 1
fox: 1
gnu: 1
```

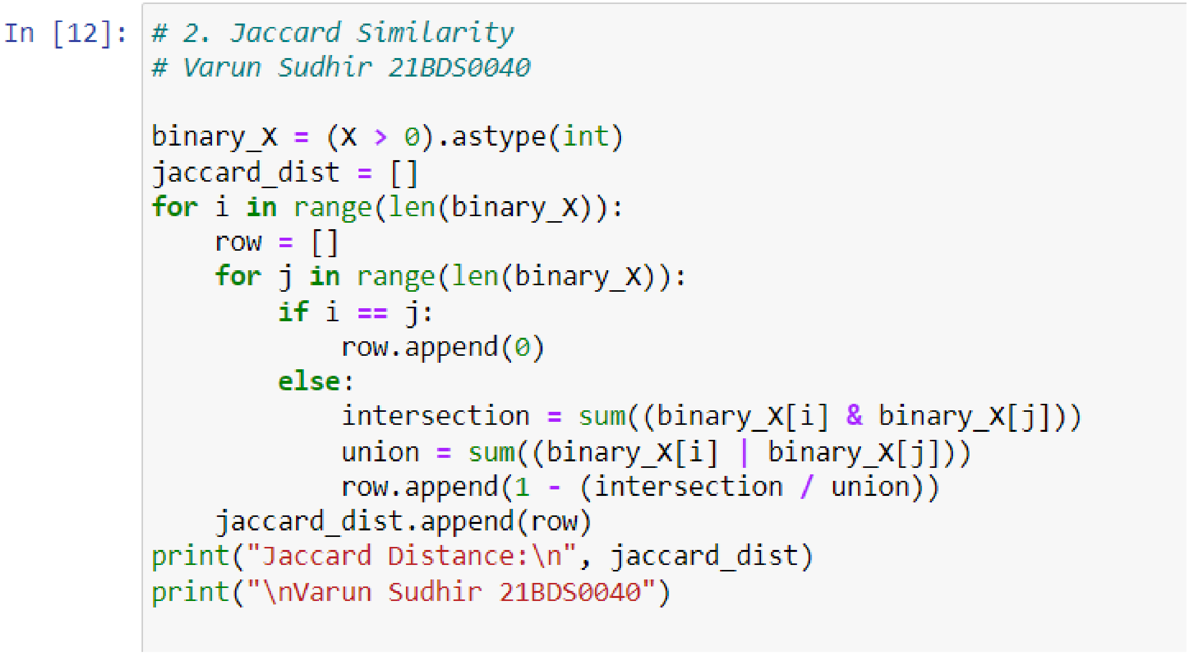
```
# 1. Cosine Similarity
# Varun Sudhir 21BDS0040
cosine_sim = []
for i in range(len(X)):
    row = []
    for j in range(len(X)):
        if i == j:
            row.append(1)  # Similarity of a document with itself is 1
        else:
            dot_product = sum(X[i] * X[j])
            norm_i = sum(X[i] ** 2) ** 0.5
            norm_j = sum(X[j] ** 2) ** 0.5
            cosine_similarity = dot_product / (norm_i * norm_j) if (norm_i *
norm_j) != 0 else 0
            row.append(cosine_similarity)
    cosine_sim.append(row)

print("Cosine Similarity:\n", cosine_sim)
print("\nVarun Sudhir 21BDS0040")
```



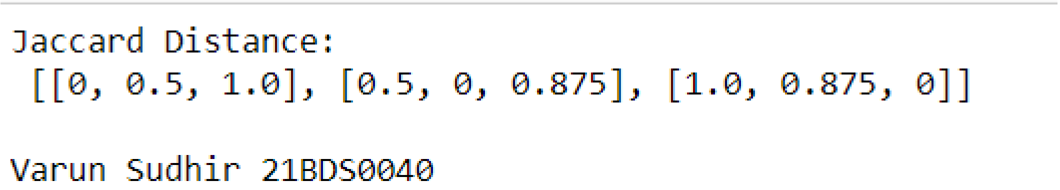
```
In [11]: # 1. Cosine Similarity
         # Varun Sudhir 21BDS0040
         cosine_sim = []
         for i in range(len(X)):
             row = []
             for j in range(len(X)):
                 if i == j:
                     row.append(1)  # Similarity of a document with itself is 1
                 else:
                     dot_product = sum(X[i] * X[j])
                     norm_i = sum(X[i] ** 2) ** 0.5
                     norm_j = sum(X[j] ** 2) ** 0.5
                     cosine_similarity = dot_product / (norm_i * norm_j) if (norm_i * norm_j) != 0 else 0
                     row.append(cosine_similarity)
             cosine_sim.append(row)

         print("Cosine Similarity:\n", cosine_sim)
         print("\nVarun Sudhir 21BDS0040")
```

```
Cosine Similarity:
 [[1, 0.3077935056255462, 0.0], [0.3077935056255462, 1, 0.4103913408340616], [0.0, 0.4103913408340616, 1]]

Varun Sudhir 21BDS0040
```

```
# 2. Jaccard Similarity
# Varun Sudhir 21BDS0040

binary_X = (X > 0).astype(int)
jaccard_dist = []
for i in range(len(binary_X)):
    row = []
    for j in range(len(binary_X)):
        if i == j:
            row.append(0)
        else:
            intersection = sum((binary_X[i] & binary_X[j]))
            union = sum((binary_X[i] | binary_X[j]))
            row.append(1 - (intersection / union))
    jaccard_dist.append(row)
print("Jaccard Distance:\n", jaccard_dist)
print("\nVarun Sudhir 21BDS0040")
```



```
In [12]: # 2. Jaccard Similarity
         # Varun Sudhir 21BDS0040

         binary_X = (X > 0).astype(int)
         jaccard_dist = []
         for i in range(len(binary_X)):
             row = []
             for j in range(len(binary_X)):
                 if i == j:
                     row.append(0)
                 else:
                     intersection = sum((binary_X[i] & binary_X[j]))
                     union = sum((binary_X[i] | binary_X[j]))
                     row.append(1 - (intersection / union))
             jaccard_dist.append(row)
         print("Jaccard Distance:\n", jaccard_dist)
         print("\nVarun Sudhir 21BDS0040")
```



```
Jaccard Distance:
 [[0, 0.5, 1.0], [0.5, 0, 0.875], [1.0, 0.875, 0]]

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```
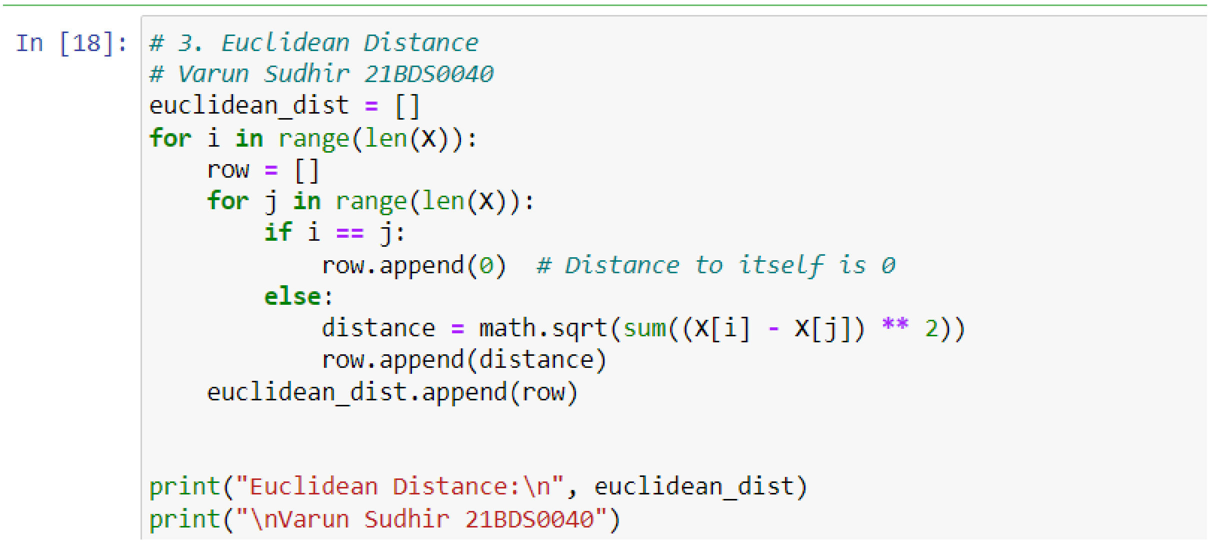
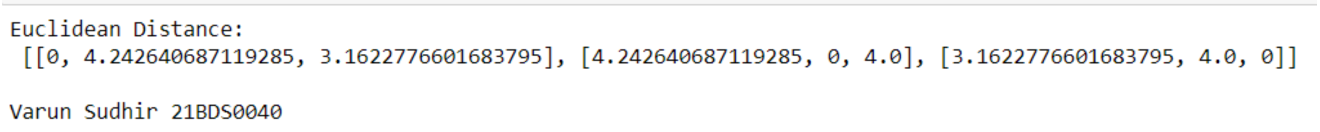

```
# 3. Euclidean Distance
# Varun Sudhir 21BDS0040
euclidean_dist = []
for i in range(len(X)):
    row = []
    for j in range(len(X)):
        if i == j:
            row.append(0)  # Distance to itself is 0
        else:
            distance = math.sqrt(sum((X[i] - X[j]) ** 2))
            row.append(distance)
    euclidean_dist.append(row)

print("Euclidean Distance:\n", euclidean_dist)
print("\nVarun Sudhir 21BDS0040")
```



```
In [18]: # 3. Euclidean Distance
         # Varun Sudhir 21BDS0040
         euclidean_dist = []
         for i in range(len(X)):
             row = []
             for j in range(len(X)):
                 if i == j:
                     row.append(0)  # Distance to itself is 0
                 else:
                     distance = math.sqrt(sum((X[i] - X[j]) ** 2))
                     row.append(distance)
             euclidean_dist.append(row)


         print("Euclidean Distance:\n", euclidean_dist)
         print("\nVarun Sudhir 21BDS0040")
```

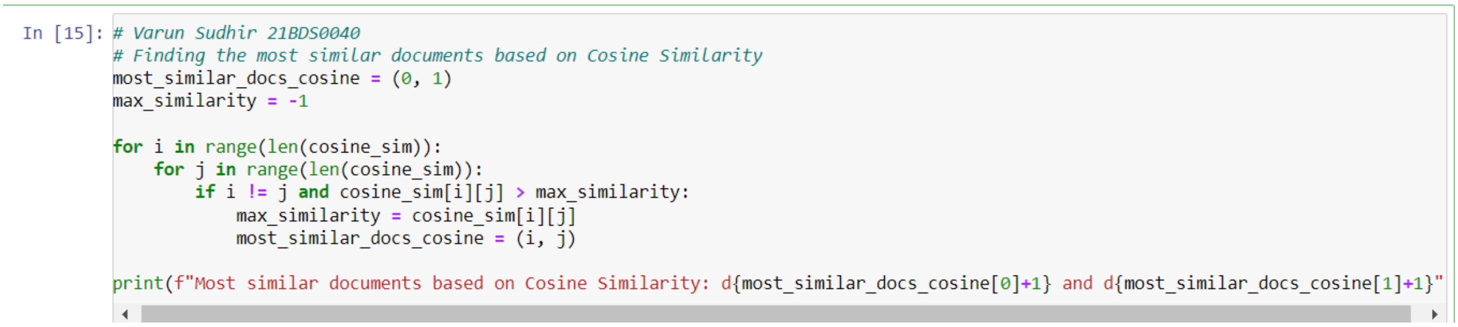


```
Euclidean Distance:
 [[0, 4.242640687119285, 3.1622776601683795], [4.242640687119285, 0, 4.0], [3.1622776601683795, 4.0, 0]]

Varun Sudhir 21BDS0040
```

Finding the most similar pair of documents based on each of these metrics

```
# Varun Sudhir 21BDS0040
# Finding the most similar documents based on Cosine Similarity
most_similar_docs_cosine = (0, 1)
max_similarity = -1
```

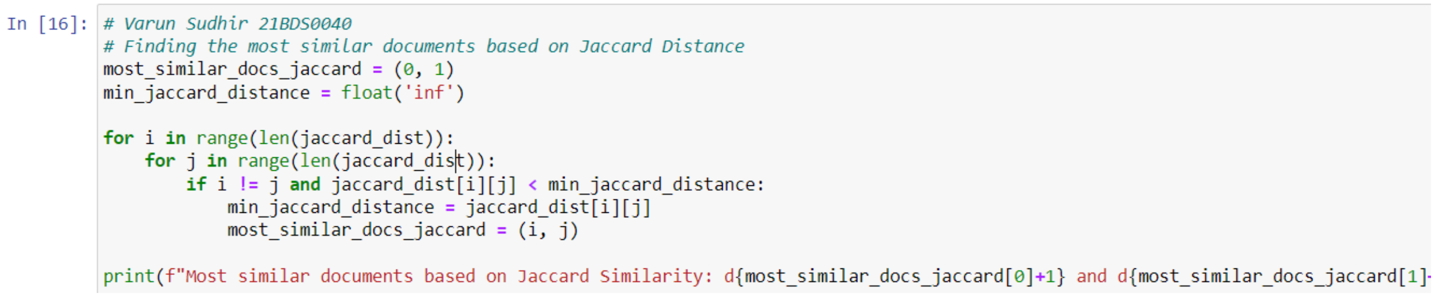
```
for i in range(len(cosine_sim)):
    for j in range(len(cosine_sim)):
        if i != j and cosine_sim[i][j] > max_similarity:
            max_similarity = cosine_sim[i][j]
            most_similar_docs_cosine = (i, j)

print(f"Most similar documents based on Cosine Similarity:
d{most_similar_docs_cosine[0]+1} and d{most_similar_docs_cosine[1]+1}")
```



```
In [15]: # Varun Sudhir 21BDS0040
         # Finding the most similar documents based on Cosine Similarity
         most_similar_docs_cosine = (0, 1)
         max_similarity = -1

         for i in range(len(cosine_sim)):
             for j in range(len(cosine_sim)):
                 if i != j and cosine_sim[i][j] > max_similarity:
                     max_similarity = cosine_sim[i][j]
                     most_similar_docs_cosine = (i, j)

         print(f"Most similar documents based on Cosine Similarity: d{most_similar_docs_cosine[0]+1} and d{most_similar_docs_cosine[1]+1}"
```

```
Most similar documents based on Cosine Similarity: d2 and d3
```

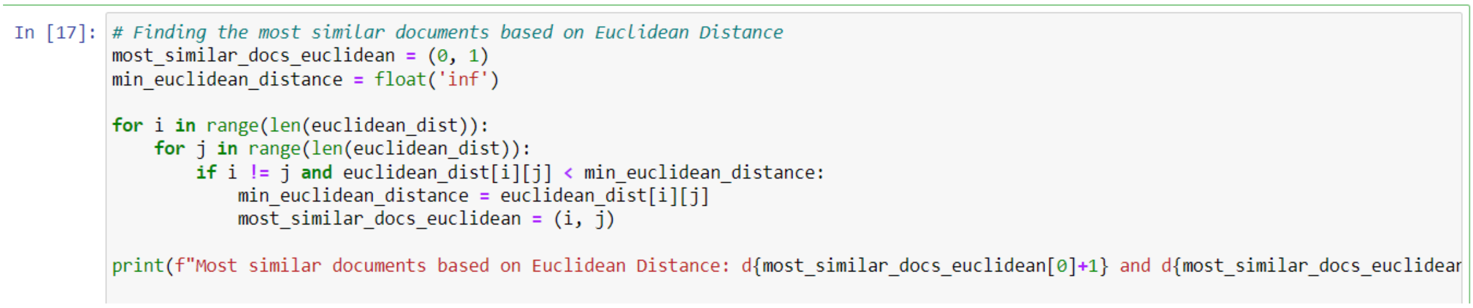
```
# Varun Sudhir 21BDS0040
# Finding the most similar documents based on Jaccard Distance
most_similar_docs_jaccard = (0, 1)
min_jaccard_distance = float('inf')

for i in range(len(jaccard_dist)):
    for j in range(len(jaccard_dist)):
        if i != j and jaccard_dist[i][j] < min_jaccard_distance:
            min_jaccard_distance = jaccard_dist[i][j]
            most_similar_docs_jaccard = (i, j)

print(f"Most similar documents based on Jaccard Similarity:
d{most_similar_docs_jaccard[0]+1} and d{most_similar_docs_jaccard[1]+1}")
```



```
In [16]: # Varun Sudhir 21BDS0040
         # Finding the most similar documents based on Jaccard Distance
         most_similar_docs_jaccard = (0, 1)
         min_jaccard_distance = float('inf')

         for i in range(len(jaccard_dist)):
             for j in range(len(jaccard_dist)):
                 if i != j and jaccard_dist[i][j] < min_jaccard_distance:
                     min_jaccard_distance = jaccard_dist[i][j]
                     most_similar_docs_jaccard = (i, j)

         print(f"Most similar documents based on Jaccard Similarity: d{most_similar_docs_jaccard[0]+1} and d{most_similar_docs_jaccard[1]+
```

```
Most similar documents based on Jaccard Similarity: d1 and d2
```

```
# Finding the most similar documents based on Euclidean Distance
most_similar_docs_euclidean = (0, 1)
min_euclidean_distance = float('inf')

for i in range(len(euclidean_dist)):
    for j in range(len(euclidean_dist)):
        if i != j and euclidean_dist[i][j] < min_euclidean_distance:
            min_euclidean_distance = euclidean_dist[i][j]
            most_similar_docs_euclidean = (i, j)

print(f"Most similar documents based on Euclidean Distance:
d{most_similar_docs_euclidean[0]+1} and d{most_similar_docs_euclidean[1]+1}")
```



```
In [17]: # Finding the most similar documents based on Euclidean Distance
         most_similar_docs_euclidean = (0, 1)
         min_euclidean_distance = float('inf')

         for i in range(len(euclidean_dist)):
             for j in range(len(euclidean_dist)):
                 if i != j and euclidean_dist[i][j] < min_euclidean_distance:
                     min_euclidean_distance = euclidean_dist[i][j]
                     most_similar_docs_euclidean = (i, j)

         print(f"Most similar documents based on Euclidean Distance: d{most_similar_docs_euclidean[0]+1} and d{most_similar_docs_euclidear
```

```
Most similar documents based on Euclidean Distance: d1 and d3
```