Assignment-4

Assignment Date	17 October 2022
Student Name	A.Sivalakshmi
Student Roll Number	962719106032
Maximum Marks	2Marks

Question 1:

Download the dataset

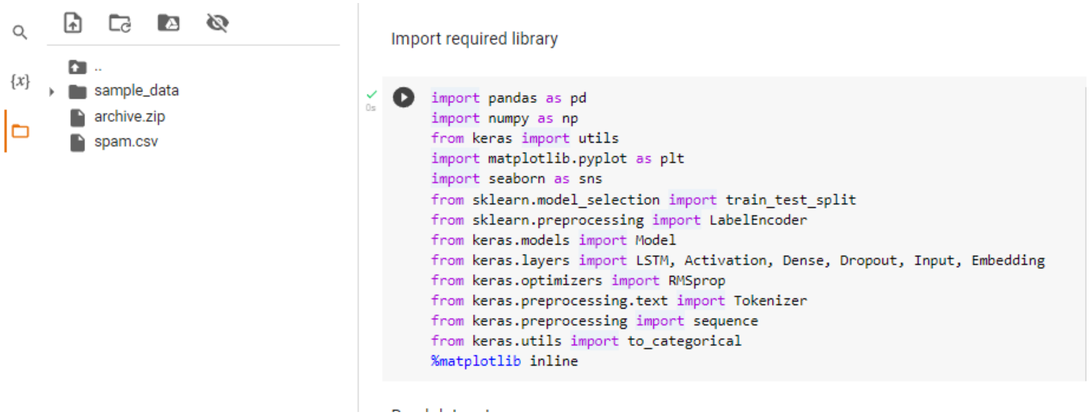
Link: https://drive.google.com/file/d/1Sjqx5H5R86tRp2YZKzzd4_iEfjChZ3ob/view?usp=sharing

Question 2:

Import required library

Solution:

```
import pandas as pd
import numpy as np
from keras import utils
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from keras.models import Model
from keras.layers import LSTM, Activation, Dense, Dropout, Input, Embedding
from keras.optimizers import RMSprop
from keras.preprocessing.text import Tokenizer
from keras.preprocessing import sequence
from keras.utils import to_categorical
```



Import required library

```
import pandas as pd
import numpy as np
from keras import utils
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from keras.models import Model
from keras.layers import LSTM, Activation, Dense, Dropout, Input, Embedding
from keras.optimizers import RMSprop
from keras.preprocessing.text import Tokenizer
from keras.preprocessing import sequence
from keras.utils import to_categorical
%matplotlib inline
```

Question 3:

Read dataset and do pre-processing

Solution:

Read dataset

```
!unzip "/content/archive.zip"

df = pd.read_csv('spam.csv',delimiter=',',encoding='latin-1')
df
```

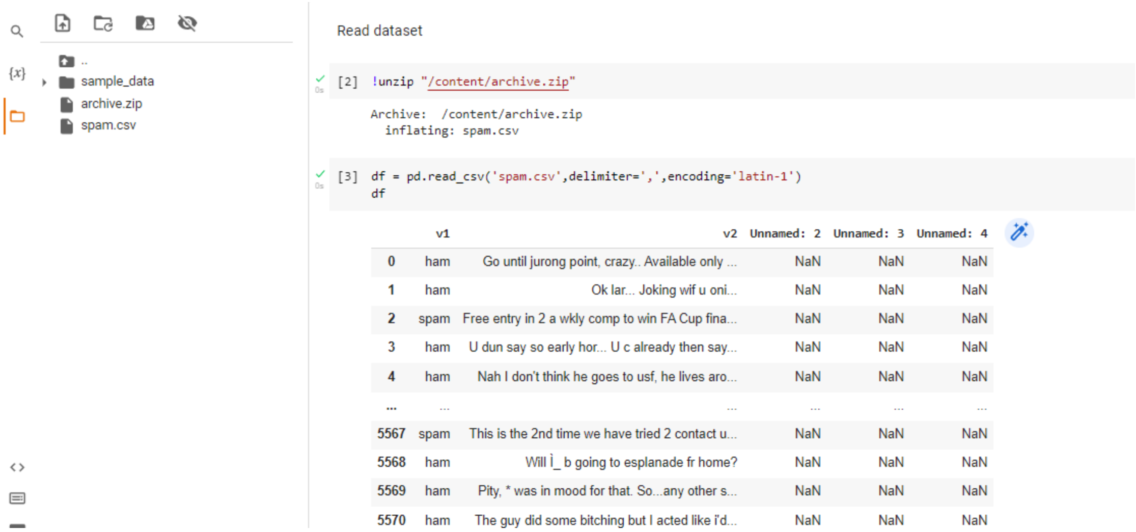
Pre processing

```
df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
df

sns.countplot(df.v1,palette='Set3')
plt.xlabel('Label')
plt.title('Number of ham and spam messages')

X = df.v2
Y = df.v1
le = LabelEncoder()
Y = le.fit_transform(Y)
Y = Y.reshape(-1,1)

X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15)

max_words = 1000
max_len = 150
tok = Tokenizer(num_words=max_words)
tok.fit_on_texts(X_train)
sequences = tok.texts_to_sequences(X_train)
sequences_matrix = utils.pad_sequences(sequences,maxlen=max_len)
```

sequences_matrix.shape

sequences_matrix.ndim

sequences_matrix = np.reshape(sequences_matrix,(4736,150,1))
sequences_matrix.ndim

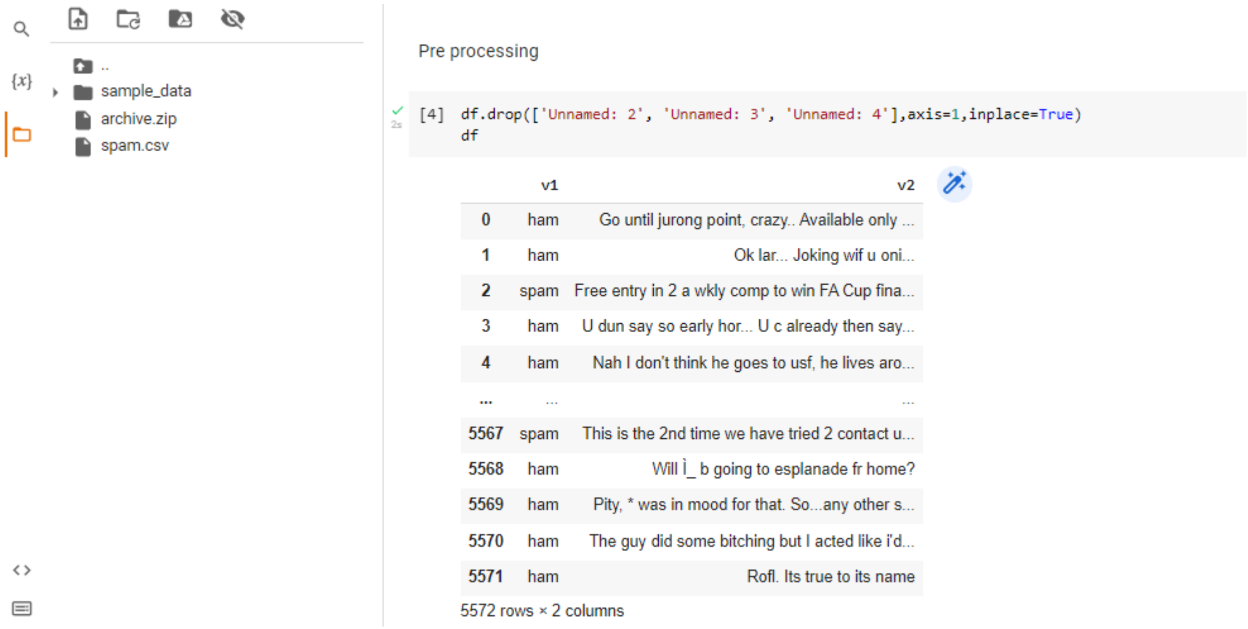


Read dataset

```
[2] !unzip "/content/archive.zip"

Archive:  /content/archive.zip
  inflating: spam.csv
```

```
[3] df = pd.read_csv('spam.csv',delimiter=',',encoding='latin-1')
    df
```

	v1	v2	Unnamed: 2	Unnamed: 3	Unnamed: 4
0	ham	Go until jurong point, crazy.. Available only ...	NaN	NaN	NaN
1	ham	Ok lar... Joking wif u oni...	NaN	NaN	NaN
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	NaN	NaN	NaN
3	ham	U dun say so early hor... U c already then say...	NaN	NaN	NaN
4	ham	Nah I don't think he goes to usf, he lives aro...	NaN	NaN	NaN
...	...	...	...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...	NaN	NaN	NaN
5568	ham	Will Ì_ b going to esplanade fr home?	NaN	NaN	NaN
5569	ham	Pity, * was in mood for that. So...any other s...	NaN	NaN	NaN
5570	ham	The guy did some bitching but I acted like i'd...	NaN	NaN	NaN

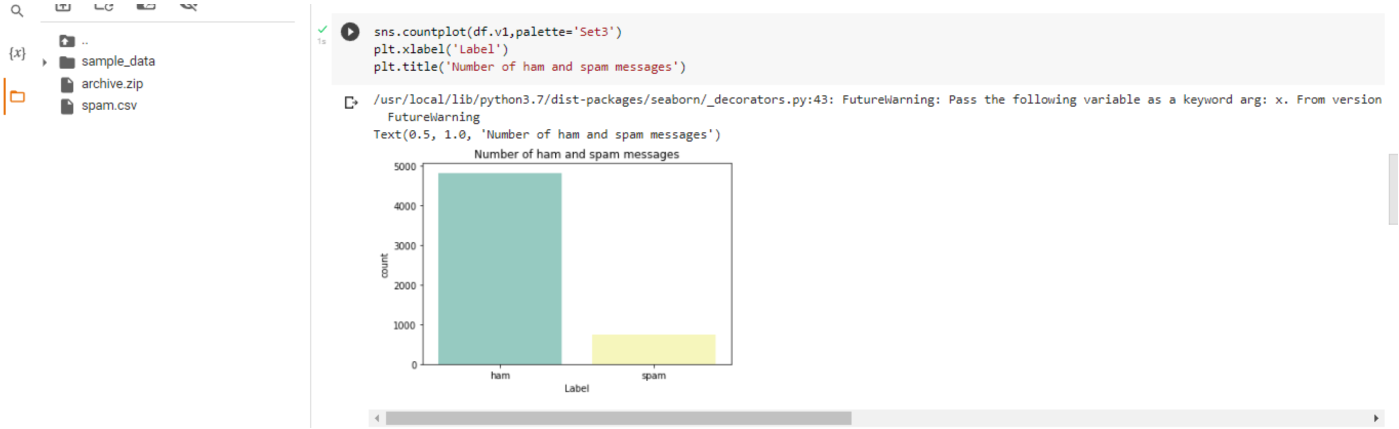


Pre processing

```
[4] df.drop(['Unnamed: 2', 'Unnamed: 3', 'Unnamed: 4'],axis=1,inplace=True)
    df
```

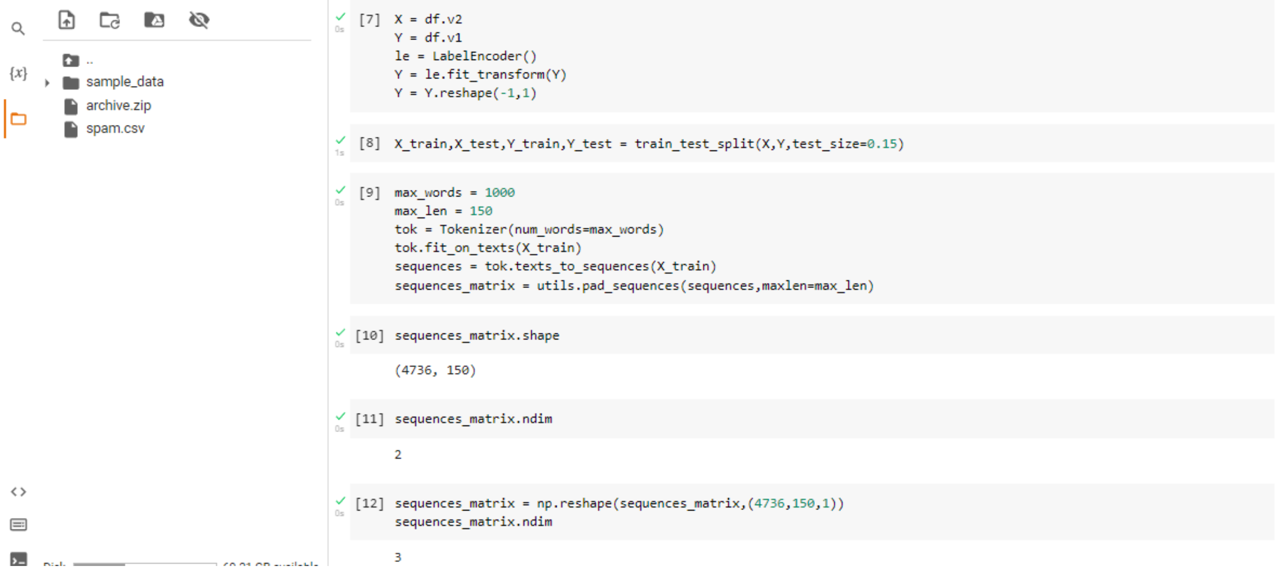
	v1	v2
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...
4	ham	Nah I don't think he goes to usf, he lives aro...
...	...	...
5567	spam	This is the 2nd time we have tried 2 contact u...
5568	ham	Will Ì_ b going to esplanade fr home?
5569	ham	Pity, * was in mood for that. So...any other s...
5570	ham	The guy did some bitching but I acted like i'd...
5571	ham	Rofl. Its true to its name

5572 rows × 2 columns



```
sns.countplot(df.v1,palette='Set3')
plt.xlabel('Label')
plt.title('Number of ham and spam messages')
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version
  FutureWarning
Text(0.5, 1.0, 'Number of ham and spam messages')
```



```
[7]  X = df.v2
     Y = df.v1
     le = LabelEncoder()
     Y = le.fit_transform(Y)
     Y = Y.reshape(-1,1)
```

```
[8]  X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.15)
```

```
[9]  max_words = 1000
     max_len = 150
     tok = Tokenizer(num_words=max_words)
     tok.fit_on_texts(X_train)
     sequences = tok.texts_to_sequences(X_train)
     sequences_matrix = utils.pad_sequences(sequences,maxlen=max_len)
```

```
[10] sequences_matrix.shape

     (4736, 150)
```

```
[11] sequences_matrix.ndim

     2
```

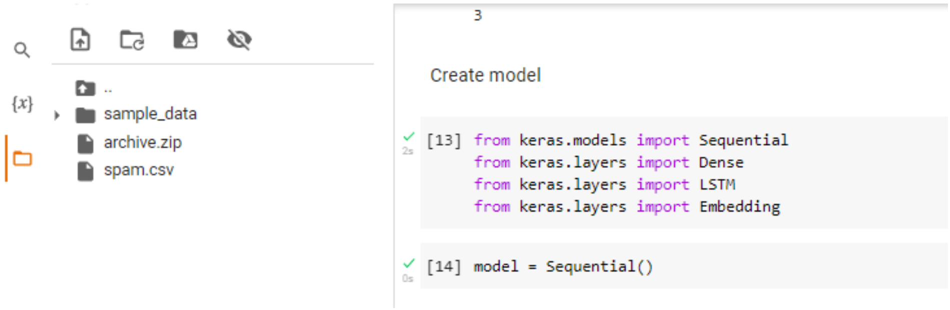
```
[12] sequences_matrix = np.reshape(sequences_matrix,(4736,150,1))
     sequences_matrix.ndim

     3
```

Question 4:

Create model

Solution:

```
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Embedding

model = Sequential()
```



```
3
```

Create model

```
[13] from keras.models import Sequential
     from keras.layers import Dense
     from keras.layers import LSTM
     from keras.layers import Embedding
```

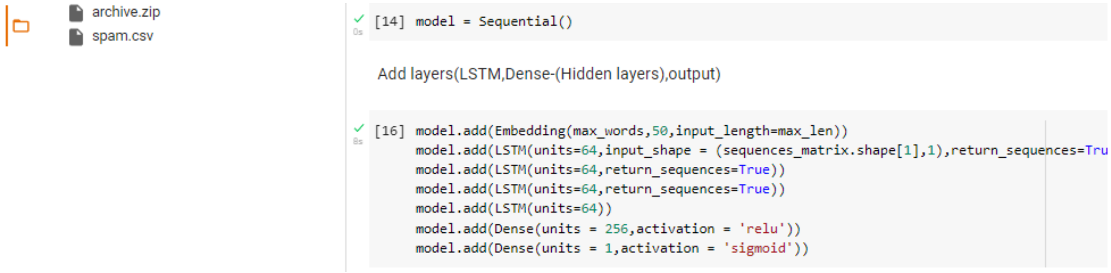
```
[14] model = Sequential()
```

Question 5:

Add layers(LSTM,Dense-(Hidden layers),output)

Solution:

```
model.add(Embedding(max_words,50,input_length=max_len))
model.add(LSTM(units=64,input_shape = (sequences_matrix.shape[1],1),return_sequences=True))
model.add(LSTM(units=64,return_sequences=True))
model.add(LSTM(units=64,return_sequences=True))
model.add(LSTM(units=64))
model.add(Dense(units = 256,activation = 'relu'))
model.add(Dense(units = 1,activation = 'sigmoid'))
```



```
[14] model = Sequential()
```

Add layers(LSTM,Dense-(Hidden layers),output)

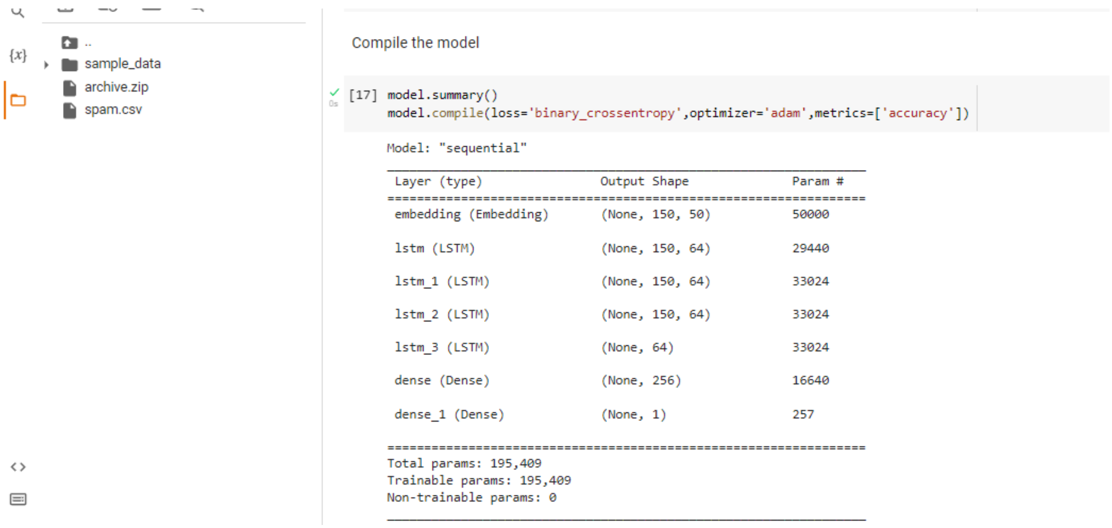
```
[16] model.add(Embedding(max_words,50,input_length=max_len))
     model.add(LSTM(units=64,input_shape = (sequences_matrix.shape[1],1),return_sequences=Tru
     model.add(LSTM(units=64,return_sequences=True))
     model.add(LSTM(units=64,return_sequences=True))
     model.add(LSTM(units=64))
     model.add(Dense(units = 256,activation = 'relu'))
     model.add(Dense(units = 1,activation = 'sigmoid'))
```

Question 6:

Compile the model

Solution:

```
model.summary()
model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])
```



Compile the model

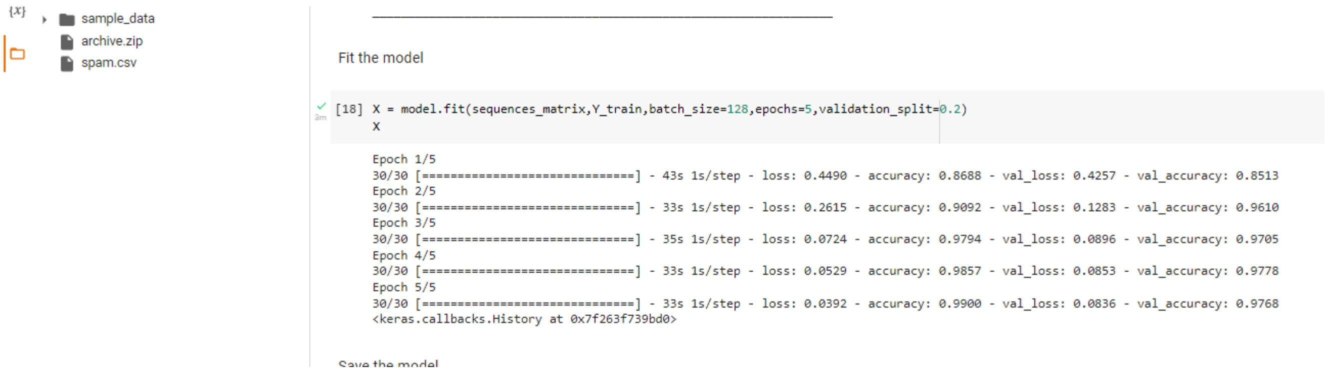
```
[17] model.summary()
     model.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])

Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding (Embedding)       (None, 150, 50)           50000

 lstm (LSTM)                 (None, 150, 64)           29440

 lstm_1 (LSTM)               (None, 150, 64)           33024

 lstm_2 (LSTM)               (None, 150, 64)           33024

 lstm_3 (LSTM)               (None, 64)                33024

 dense (Dense)               (None, 256)               16640

 dense_1 (Dense)             (None, 1)                 257

=================================================================
Total params: 195,409
Trainable params: 195,409
Non-trainable params: 0
_________________________________________________________________
```

Question 7:

Fit the model

Solution:

```
X = model.fit(sequences_matrix,Y_train,batch_size=128,epochs=5,validation_split=0.2)
X
```



Fit the model

```
[18] X = model.fit(sequences_matrix,Y_train,batch_size=128,epochs=5,validation_split=0.2)
     X

Epoch 1/5
30/30 [==============================] - 43s 1s/step - loss: 0.4490 - accuracy: 0.8688 - val_loss: 0.4257 - val_accuracy: 0.8513
Epoch 2/5
30/30 [==============================] - 33s 1s/step - loss: 0.2615 - accuracy: 0.9092 - val_loss: 0.1283 - val_accuracy: 0.9610
Epoch 3/5
30/30 [==============================] - 35s 1s/step - loss: 0.0724 - accuracy: 0.9794 - val_loss: 0.0896 - val_accuracy: 0.9705
Epoch 4/5
30/30 [==============================] - 33s 1s/step - loss: 0.0529 - accuracy: 0.9857 - val_loss: 0.0853 - val_accuracy: 0.9778
Epoch 5/5
30/30 [==============================] - 33s 1s/step - loss: 0.0392 - accuracy: 0.9900 - val_loss: 0.0836 - val_accuracy: 0.9768
<keras.callbacks.History at 0x7f263f739bd0>
```

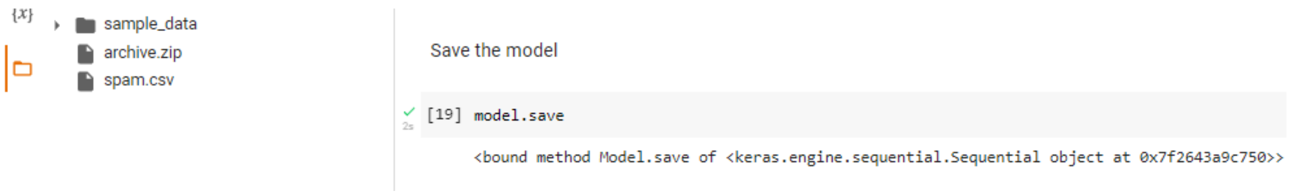
Save the model

Question 8:

Save the model

Solution:

```
model.save
```



Save the model

```
[19] model.save
```

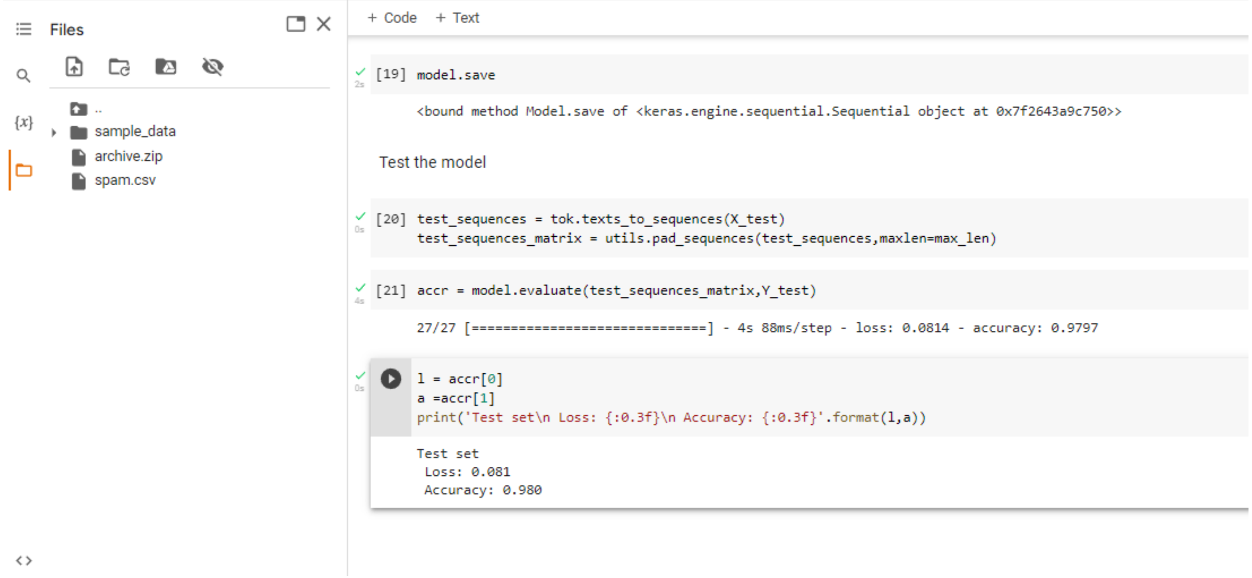
```
<bound method Model.save of <keras.engine.sequential.Sequential object at 0x7f2643a9c750>>
```

Question 9:

Test the model

Solution:

```
test_sequences = tok.texts_to_sequences(X_test)
test_sequences_matrix = utils.pad_sequences(test_sequences,maxlen=max_len)

accr = model.evaluate(test_sequences_matrix,Y_test)

l = accr[0]
a =accr[1]
print('Test set\n Loss: {:0.3f}\n Accuracy: {:0.3f}'.format(l,a))
```



```
[19] model.save
```

```
<bound method Model.save of <keras.engine.sequential.Sequential object at 0x7f2643a9c750>>
```

Test the model

```
[20] test_sequences = tok.texts_to_sequences(X_test)
     test_sequences_matrix = utils.pad_sequences(test_sequences,maxlen=max_len)
```

```
[21] accr = model.evaluate(test_sequences_matrix,Y_test)
```

```
27/27 [==============================] - 4s 88ms/step - loss: 0.0814 - accuracy: 0.9797
```

```
l = accr[0]
a =accr[1]
print('Test set\n Loss: {:0.3f}\n Accuracy: {:0.3f}'.format(l,a))
```

```
Test set
 Loss: 0.081
 Accuracy: 0.980
```