Importing Packages

In [1]:
```
import pandas as pd
import numpy as np
from keras.models import Sequential
from keras.layers import LSTM, Dense, Bidirectional, Dropout
from sklearn.preprocessing import MinMaxScaler
from keras.optimizers import Adam
import matplotlib.pyplot as plt
```

Data Preprocessing

In [2]:
```
df = pd.read_excel('input copy full 2 (copy).xlsx')
```

In [3]:
```
df.head()
```

Out[3]:

	Unnamed: 0	Unnamed: 1	Unnamed: 2
0	2023-02-28	NaN	04 06 10 26 30
1	2022-02-27	NaN	01 03 18 26 27
2	2022-02-26	NaN	13 17 18 50 60
3	2022-02-25	NaN	09 12 35 35 56
4	2022-02-24	NaN	15 21 39 45 49

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1773 entries, 0 to 1772
Data columns (total 3 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   Unnamed: 0  1773 non-null   datetime64[ns]
 1   Unnamed: 1  0 non-null      float64
 2   Unnamed: 2  1773 non-null   object
dtypes: datetime64[ns](1), float64(1), object(1)
memory usage: 41.7+ KB
```

In [5]:
```
# split the numbers column into separate columns
numbers_df = df['Unnamed: 2'].str.split(expand=True)
```

In [6]:
```
numbers_df = numbers_df.astype(int)
```

In [7]:
```
numbers_df.describe()
```

Out[7]:

	0	1	2	3	4
count	1773.000000	1773.000000	1773.000000	1773.000000	1773.000000
mean	10.238579	20.166385	30.358150	40.503666	50.687535
std	8.142567	10.339112	11.019518	10.644396	8.242819
min	1.000000	2.000000	4.000000	6.000000	14.000000
25%	4.000000	12.000000	22.000000	34.000000	46.000000
50%	8.000000	19.000000	30.000000	42.000000	53.000000
75%	15.000000	27.000000	39.000000	49.000000	57.000000
max	46.000000	56.000000	58.000000	59.000000	60.000000

In [8]:
```
# normalize the data
scaler = MinMaxScaler(feature_range=(0, 1))
numbers_df = scaler.fit_transform(numbers_df)
```

In [9]:
```
# split the data into training and testing sets
train_size = int(len(numbers_df) * 0.7)
train_data = numbers_df[:train_size, :]
test_data = numbers_df[train_size:, :]
```

In [10]:
```
def create_dataset(dataset, look_back=1):
    dataX, dataY = [], []
    for i in range(len(dataset) - look_back):
        a = dataset[i:(i + look_back), :]
        dataX.append(a)
        dataY.append(dataset[i + look_back, :])
    return np.array(dataX), np.array(dataY)
```

In [11]:
```
# create the training and testing datasets
look_back = 5
trainX, trainY = create_dataset(train_data, look_back)
testX, testY = create_dataset(test_data, look_back)
```

Model Training and Testing

In [12]:
```
# define the model architecture
model = Sequential()
model.add(LSTM(units=50, return_sequences=True, input_shape=(5, 5)))
model.add(LSTM(units=50))
# Adding a first Dropout layer
model.add(Dropout(0.2))
# Adding the first output layer
model.add(Dense(59))
model.add(Dropout(0.2))
model.add(Dense(units=5))

# compile the model
model.compile(optimizer=Adam(learning_rate= 0.00001 ), loss ='mse', metrics=['
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 lstm (LSTM)                 (None, 5, 50)             11200     
                                                                 
 lstm_1 (LSTM)               (None, 50)                20200     
                                                                 
 dropout (Dropout)           (None, 50)                0         
                                                                 
 dense (Dense)               (None, 59)                3009      
                                                                 
 dropout_1 (Dropout)         (None, 59)                0         
                                                                 
 dense_1 (Dense)             (None, 5)                 300       
                                                                 
=================================================================
Total params: 34,709
Trainable params: 34,709
Non-trainable params: 0
_________________________________________________________________
```

In [13]:
```
# train the model
history = model.fit(trainX, trainY, validation_data =(testX, testY), epochs=50
```

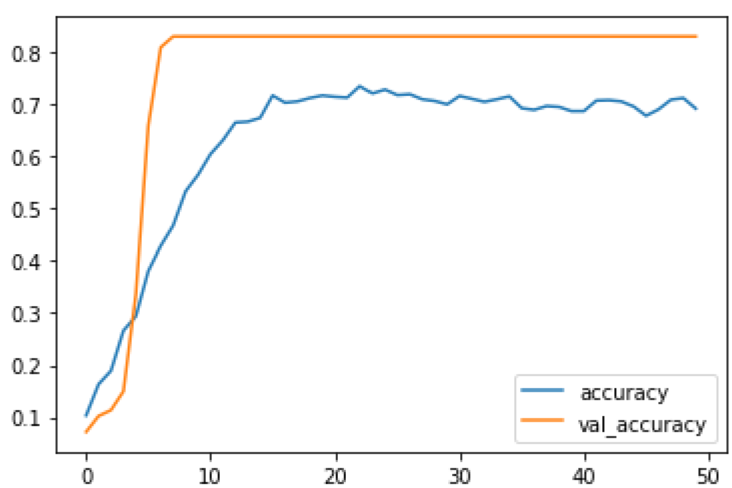
```
Epoch 1/50
39/39 [==============================] - 8s 61ms/step - loss: 0.3312 - acc
uracy: 0.1036 - val_loss: 0.3204 - val_accuracy: 0.0721
Epoch 2/50
39/39 [==============================] - 1s 13ms/step - loss: 0.3189 - acc
uracy: 0.1634 - val_loss: 0.3084 - val_accuracy: 0.1025
Epoch 3/50
39/39 [==============================] - 1s 19ms/step - loss: 0.3073 - acc
uracy: 0.1893 - val_loss: 0.2965 - val_accuracy: 0.1139
Epoch 4/50
39/39 [==============================] - 1s 17ms/step - loss: 0.2953 - acc
uracy: 0.2662 - val_loss: 0.2848 - val_accuracy: 0.1499
Epoch 5/50
39/39 [==============================] - 1s 21ms/step - loss: 0.2837 - acc
uracy: 0.2937 - val_loss: 0.2731 - val_accuracy: 0.3359
Epoch 6/50
39/39 [==============================] - 1s 16ms/step - loss: 0.2712 - acc
uracy: 0.3803 - val_loss: 0.2611 - val_accuracy: 0.6584
Epoch 7/50
```

In [18]:
```
test_loss, test_acc = model.evaluate(testX, testY)
print('Test accuracy:', test_acc)
```

```
17/17 [==============================] - 0s 4ms/step - loss: 0.0389 - accurac
y: 0.8292
Test accuracy: 0.8292220234870911
```

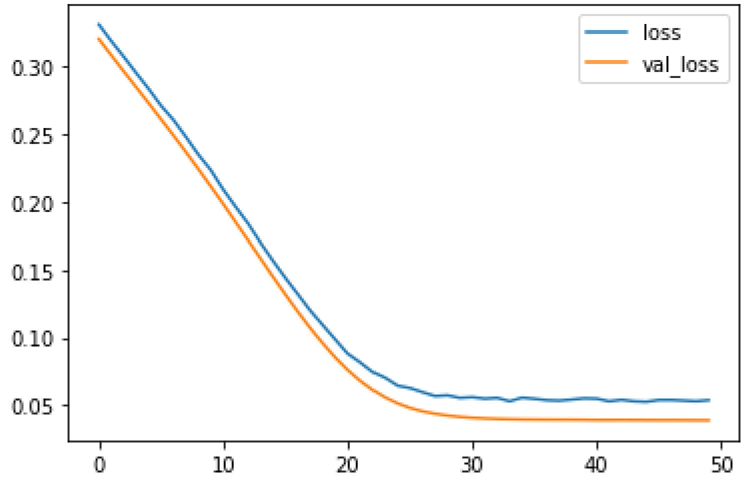
In [19]:
```
history_df = pd.DataFrame(history.history)
history_df[['accuracy', 'val_accuracy']].plot()
```

Out[19]: <AxesSubplot:>



In [20]:
```
history_df = pd.DataFrame(history.history)
history_df[['loss', 'val_loss']].plot()
```

Out[20]: <AxesSubplot:>



Prediction for Next Sequence

In [21]:
```
# use the model to predict the sequence of numbers
last_numbers = numbers_df[-5:]
last_numbers = np.reshape(last_numbers, (1, 5, 5))
predicted_numbers = model.predict(last_numbers)
predicted_numbers = scaler.inverse_transform(predicted_numbers)
predicted_numbers = [int(i) for i in predicted_numbers[0]]

print('Predicted next Sequence:', predicted_numbers)
```

```
1/1 [==============================] - 0s 22ms/step
Predicted next Sequence: [9, 19, 28, 37, 47]
```