

```
In [1]: #Import libraries
import pandas as pd
from sklearn.preprocessing import LabelBinarizer
import numpy as np
```

```
In [2]: # Read in the data from the excel file
data = pd.read_excel("/Users/alanoudalturki/Desktop/D483-Symptoms.xlsx")
```

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

```
Out[3]:
```

	TestResult	pub	WhytestedOther	Flu	Fatigue	RespiratorySymptoms	SoreT
0	Yes, and I tested negative	I came into contact with someone who has the c...	NaN	No, I have not been tested	None	None	
1	Yes, and I tested negative	I came into contact with someone who has the c...	NaN	Yes, and I tested negative	None	None	
2	Yes, and I tested positive	I came into contact with someone who has the c...	NaN	No, I have not been tested	Fatigue (more than normal)	Sore throat	Sore T

3 rows x 104 columns

```
In [4]: data.columns
```

```
Out[4]: Index(['TestResult', 'pub', 'WhytestedOther', 'Flu', 'Fatigue',
'RespiratorySymptoms', 'SoreThroat', 'RunnyNose', 'Cough', 'ChestP
ain',
...,
'explasttime4=publictrans', 'explasttime5=airplane',
'explasttime6=cruise', 'explasttime7=barcaferest',
'explasttime8=grocery', 'explasttime9=retail', 'explasttime10=visi
t',
'explasttime11=gym_team', 'explasttime12=rlgssvc', 'explasttime13=
hcp'],
dtype='object', length=104)
```

```
In [5]: # Extract the relevant columns from the data
columns = ['age', 'gender', 'TestResult', 'Fatigue', 'SoreThroat', 'RunnyNo',
           'Cough', 'ChestPain', 'ShortBreath', 'DifficultyBreathing', 'Whee',
           'AbdominalPain', 'LossOfAppetite', 'NauseaVomiting', 'Headache',
           'LossSmell', 'LossBalance', 'LossTaste', 'TinglingNumbness', 'Exce',
           'RedRashAnywhere', 'JointPain', 'First Symp',]
data = data[columns]
```

In [6]: data

Out[6]:

	age	gender	TestResult	Fatigue	SoreThroat	RunnyNose	Cough	ChestPa
0	20	Female	Yes, and I tested negative	None	NaN	NaN	NaN	NaN
1	18	Female	Yes, and I tested negative	None	NaN	NaN	NaN	NaN
2	19	Female	Yes, and I tested positive	Fatigue (more than normal)	Sore Throat	NaN	NaN	NaN
3	18	Female	Yes, and I tested negative	NaN	Sore Throat	Runny Nose	NaN	NaN
4	19	Male	Yes, and I tested negative	None	Sore Throat	NaN	NaN	NaN
...
478	19	Female	Yes, and I tested positive	None or I did not get tested	NaN	Runny Nose	Cough	NaN
479	19	Female	Yes, and I tested negative	NaN	Sore Throat	NaN	Cough	NaN
480	19	Female	Yes, and I tested negative	Fever or feeling feverish,Fatigue (more than n...	NaN	NaN	NaN	Chest Pa
481	19	Female	Yes, and I tested negative	Fever or feeling feverish	Sore Throat	Runny Nose	Cough	NaN
482	19	Male	Yes, and I tested negative	Muscle aches (not due to exercise),Fatigue (mo...	Sore Throat	Runny Nose	Cough	Chest Pa

483 rows x 28 columns

```
In [7]: # replace NaN values with 0
data = data.fillna(0)
```

```
In [8]: data = data.fillna(0).replace('None', 0)
data
```

Out[8]:

	age	gender	TestResult	Fatigue	SoreThroat	RunnyNose	Cough	ChestPa
0	20	Female	Yes, and I tested negative	0	0	0	0	
1	18	Female	Yes, and I tested negative	0	0	0	0	
2	19	Female	Yes, and I tested positive	Fatigue (more than normal)	Sore Throat	0	0	
3	18	Female	Yes, and I tested negative	0	Sore Throat	Runny Nose	0	
4	19	Male	Yes, and I tested negative	0	Sore Throat	0	0	
...
478	19	Female	Yes, and I tested positive	None or I did not get tested	0	Runny Nose	Cough	
479	19	Female	Yes, and I tested negative	0	Sore Throat	0	Cough	
480	19	Female	Yes, and I tested negative	Fever or feeling feverish,Fatigue (more than n...	0	0	0	Chest Pa
481	19	Female	Yes, and I tested negative	Fever or feeling feverish	Sore Throat	Runny Nose	Cough	
482	19	Male	Yes, and I tested negative	Muscle aches (not due to exercise),Fatigue (mo...	Sore Throat	Runny Nose	Cough	Chest Pa

483 rows x 28 columns

```
In [9]: ##Fatigue  
# Create a new dataframe with just the "Fatigue" column  
fatigue_data = data[["Fatigue"]]  
  
# Split the "Fatigue" column into a new dataframe with one column for each  
fatigue_dummies = fatigue_data["Fatigue"].str.get_dummies(",")  
  
# Add the new columns to the original dataframe  
data = pd.concat([data, fatigue_dummies], axis=1)  
  
# Drop the original "Fatigue" column from the dataframe  
data = data.drop("Fatigue", axis=1)
```

```
In [10]: data
```

Out[10]:

	age	gender	TestResult	SoreThroat	RunnyNose	Cough	ChestPain	ShortBreath
0	20	Female	Yes, and I tested negative	0	0	0	0	0
1	18	Female	Yes, and I tested negative	0	0	0	0	0
2	19	Female	Yes, and I tested positive	Sore Throat	0	0	0	0
3	18	Female	Yes, and I tested negative	Sore Throat	Runny Nose	0	0	0
4	19	Male	Yes, and I tested negative	Sore Throat	0	0	0	0
...
478	19	Female	Yes, and I tested positive	0	Runny Nose	Cough	0	0
479	19	Female	Yes, and I tested negative	Sore Throat	0	Cough	0	0
480	19	Female	Yes, and I tested negative	0	0	0	Chest Pain	0
481	19	Female	Yes, and I tested negative	Sore Throat	Runny Nose	Cough	0	0
482	19	Male	Yes, and I tested negative	Sore Throat	Runny Nose	Cough	Chest Pain	Shortness of Breath

483 rows x 34 columns

```
In [11]: ##Fatigue column re-name
new_names = {'Fatigue (more than normal)': 'Fatigue',
             'Fever or feeling feverish': 'Fever',
             'Muscle aches (not due to exercise)': 'Muscle aches',
             'Pinkeye or Conjunctivitis': 'Pinkeye',

             }

data_renamed = data.rename(columns=new_names)
data_renamed.columns = data_renamed.columns.str.strip() # remove any lead
```

```
In [12]: data_renamed
```

Out[12]:

	age	gender	TestResult	SoreThroat	RunnyNose	Cough	ChestPain	ShortBreath
0	20	Female	Yes, and I tested negative	0	0	0	0	0
1	18	Female	Yes, and I tested negative	0	0	0	0	0
2	19	Female	Yes, and I tested positive	Sore Throat	0	0	0	0
3	18	Female	Yes, and I tested negative	Sore Throat	Runny Nose	0	0	0
4	19	Male	Yes, and I tested negative	Sore Throat	0	0	0	0
...
478	19	Female	Yes, and I tested positive	0	Runny Nose	Cough	0	0
479	19	Female	Yes, and I tested negative	Sore Throat	0	Cough	0	0
480	19	Female	Yes, and I tested negative	0	0	0	Chest Pain	0
481	19	Female	Yes, and I tested negative	Sore Throat	Runny Nose	Cough	0	0
482	19	Male	Yes, and I tested negative	Sore Throat	Runny Nose	Cough	Chest Pain	Shortness of Breath

483 rows x 34 columns

```
In [13]: data2 = data_renamed.drop(columns=['None or I did not get tested', '0'])
```

```
In [14]: data2
```

Out[14]:

	age	gender	TestResult	SoreThroat	RunnyNose	Cough	ChestPain	ShortBreath
0	20	Female	Yes, and I tested negative	0	0	0	0	0
1	18	Female	Yes, and I tested negative	0	0	0	0	0
2	19	Female	Yes, and I tested positive	Sore Throat	0	0	0	0
3	18	Female	Yes, and I tested negative	Sore Throat	Runny Nose	0	0	0
4	19	Male	Yes, and I tested negative	Sore Throat	0	0	0	0
...
478	19	Female	Yes, and I tested positive	0	Runny Nose	Cough	0	0
479	19	Female	Yes, and I tested negative	Sore Throat	0	Cough	0	0
480	19	Female	Yes, and I tested negative	0	0	0	Chest Pain	0
481	19	Female	Yes, and I tested negative	Sore Throat	Runny Nose	Cough	0	0
482	19	Male	Yes, and I tested negative	Sore Throat	Runny Nose	Cough	Chest Pain	Shortness of Breath

483 rows x 32 columns

In [15]:

```
print(data2.columns)
```

```
Index(['age', 'gender', 'TestResult', 'SoreThroat', 'RunnyNose', 'Cough',
      'ChestPain', 'ShortBreath', 'DifficultyBreathing', 'Wheezing',
      'BluishLip', 'Diarrhea', 'AbdominalPain', 'LossOfAppetite',
      'NauseaVomiting', 'Headache', 'SlurredSpeech', 'ShakingShivering',
      'LossSmell', 'LossBalance', 'LossTaste', 'TinglingNumbness',
      'ExcessiveSweat', 'RedRashToe', 'RedRashAnywhere', 'JointPain',
      'First Symp', 'Chills', 'Fatigue', 'Fever', 'Muscle aches', 'Pinke
      ye'],
      dtype='object')
```



```
In [16]: # Define a list of the columns you want to binarize
binarize_cols = ['SoreThroat', 'RunnyNose', 'Cough', 'ChestPain', 'ShortB
                'DifficultyBreathing', 'Wheezing', 'BluishLip', 'Diarrhe
                'AbdominalPain', 'LossOfAppetite', 'NauseaVomiting', 'He
                'SlurredSpeech', 'ShakingShivering', 'LossSmell', 'LossB
                'LossTaste', 'TinglingNumbness', 'ExcessiveSweat', 'RedR
                'RedRashAnywhere', 'JointPain',]

# Loop over each column and binarize the values
for col in binarize_cols:
    data2[col] = data2[col].apply(lambda x: 1 if x else 0)
```

```
In [17]: data2
```

Out[17]:

	age	gender	TestResult	SoreThroat	RunnyNose	Cough	ChestPain	ShortBreath
0	20	Female	Yes, and I tested negative	0	0	0	0	0
1	18	Female	Yes, and I tested negative	0	0	0	0	0
2	19	Female	Yes, and I tested positive	1	0	0	0	0
3	18	Female	Yes, and I tested negative	1	1	0	0	0
4	19	Male	Yes, and I tested negative	1	0	0	0	0
...
478	19	Female	Yes, and I tested positive	0	1	1	0	0
479	19	Female	Yes, and I tested negative	1	0	1	0	0
480	19	Female	Yes, and I tested negative	0	0	0	1	0
481	19	Female	Yes, and I tested negative	1	1	1	0	0
482	19	Male	Yes, and I tested negative	1	1	1	1	1

483 rows x 32 columns

In [18]:

```

##TestResult
# Create a new dataframe with just the "Fatigue" column
TestResult_data = data[["TestResult"]]

# Split the "Fatigue" column into a new dataframe with one column for each
TestResult_dummies = TestResult_data["TestResult"].str.get_dummies(",")

# Add the new columns to the original dataframe
data2 = pd.concat([data2, TestResult_dummies], axis=1)

# Drop the original "TestResult" column from the dataframe
data2 = data2.drop("TestResult", axis=1)

```

```
In [19]: ##gender
# Create a new dataframe with just the "Fatigue" column
gender_data = data2[["gender"]]

# Split the "Fatigue" column into a new dataframe with one column for each
gender_dummies = gender_data["gender"].str.get_dummies(",")

# Add the new columns to the original dataframe
data2 = pd.concat([data2, gender_dummies], axis=1)

# Drop the original "Fatigue" column from the dataframe
data2 = data2.drop("gender", axis=1)
```

```
In [20]: data2
```

```
Out[20]:
```

	age	SoreThroat	RunnyNose	Cough	ChestPain	ShortBreath	DifficultyBreathing
0	20	0	0	0	0	0	0
1	18	0	0	0	0	0	0
2	19	1	0	0	0	0	0
3	18	1	1	0	0	0	0
4	19	1	0	0	0	0	0
...
478	19	0	1	1	0	0	0
479	19	1	0	1	0	0	0
480	19	0	0	0	1	0	1
481	19	1	1	1	0	0	0
482	19	1	1	1	1	1	1

483 rows x 38 columns

```
In [21]: data2.columns
```

```
Out[21]: Index(['age', 'SoreThroat', 'RunnyNose', 'Cough', 'ChestPain', 'ShortBreath',
'DifficultyBreathing', 'Wheezing', 'BluishLip', 'Diarrhea',
'AbdominalPain', 'LossOfAppetite', 'NauseaVomiting', 'Headache',
'SlurredSpeech', 'ShakingShivering', 'LossSmell', 'LossBalance',
'LossTaste', 'TinglingNumbness', 'ExcessiveSweat', 'RedRashToe',
'RedRashAnywhere', 'JointPain', 'First Symp', 'Chills', 'Fatigue',
'Fever', 'Muscle aches', 'Pinkeye', ' and I tested negative',
' and I tested positive', ' and my results are still pending',
' and my results were inconclusive', 'Yes', 'Female', 'Male', 'Other'],
dtype='object')
```

```
In [22]: data2['First Symp']
```

```
Out[22]: 0          0
1          0
2      Diarrhea,Fatigue (more than normal),Headaches,...
3          Sore throat
4          Sore throat
...
478      Change in or loss of appetite,Runny nose
479          Cough,Sore throat
480      Fatigue (more than normal),Fever or feverish f...
481          Cough,Runny nose,Sore throat
482      Chest pain,Cough,Fatigue (more than normal),So...
Name: First Symp, Length: 483, dtype: object
```

```
In [23]: unique_values = data2['First Symp'].unique()
print(unique_values)
```

```
[0 'Diarrhea,Fatigue (more than normal),Headaches,Sore throat'
'Sore throat' 'Runny nose' 'Fever or feverish feeling'
'Cough,Fatigue (more than normal)'
'Fatigue (more than normal),Pinkeye or Conjunctivitis,Sore throat,Nausea
or vomiting'
'Fatigue (more than normal),Headaches,Runny nose'
'Fatigue (more than normal),Loss of taste,Sore throat'
'Excessive sweating,Headaches,Runny nose' 'Diarrhea' 'Chills'
'Headaches,Muscle aches (not due to exercise),Runny nose'
'Chills,Cough,Diarrhea,Fatigue (more than normal),Fever or feverish feel
ing,Headaches,Muscle aches (not due to exercise),Runny nose,Shortness of
breath'
'Cough' 'Fatigue (more than normal),Headaches' 'Shortness of breath'
'Chills,Excessive sweating,Fatigue (more than normal),Muscle aches (not
due to exercise),Unexplained rashes anywhere else'
'Unusual shivering or shaking' 'Nausea or vomiting'
'Any tingling/numbness/swelling in hands or feet,Chills,Fatigue (more th
an normal),Fever or feverish feeling,Headaches,Muscle aches (not due to e
xercise)'
'Headaches' 'Headaches,Muscle aches (not due to exercise)'
'Chills,Cough,Fatigue (more than normal),Headaches,Muscle aches (not due
to exercise)'
'Chills,Fever or feverish feeling,Headaches,Muscle aches (not due to exe
rcise)'
'Fever or feverish feeling,Headaches' 'Headaches,Runny nose'
'Chills,Fever or feverish feeling,Muscle aches (not due to exercise)'
'Difficulty breathing' 'Headaches,Sore throat'
'Fatigue (more than normal),Runny nose,Sore throat'
'Cough,Fever or feverish feeling' 'Fatigue (more than normal)'
'Cough,Excessive sweating,Runny nose,Sore throat'
'Chills,Cough,Diarrhea,Fatigue (more than normal),Fever or feverish feel
ing,Muscle aches (not due to exercise),Nausea or vomiting'
'Diarrhea,Headaches' 'Fatigue (more than normal),Loss of balance'
'Chills,Muscle aches (not due to exercise)'
'Diarrhea,Muscle aches (not due to exercise),Sore throat'
'Joint or any other unexplained pain,Loss of taste,Loss of smell'
'Any tingling/numbness/swelling in hands or feet,Change in or loss of ap
petite,Chills,Cough,Diarrhea,Excessive sweating,Fatigue (more than normal
),Fever or feverish feeling,Headaches,Muscle aches (not due to exercise),
```

Unexplained rashes anywhere else,Unusual shivering or shaking,Nausea or vomiting'

'Cough,Headaches,Runny nose,Sore throat'

'Chest pain,Chills,Difficulty breathing,Fatigue (more than normal),Fever or feverish feeling,Headaches,Loss of balance,Muscle aches (not due to exercise),Unusual shivering or shaking'

'Chills,Fatigue (more than normal),Fever or feverish feeling,Headaches,Joint or any other unexplained pain,Muscle aches (not due to exercise),Sore throat'

'Fatigue (more than normal),Fever or feverish feeling,Headaches,Sore throat'

'Fatigue (more than normal),Muscle aches (not due to exercise)'

'Change in or loss of appetite,Fatigue (more than normal)'

'Cough,Muscle aches (not due to exercise),Runny nose,Sore throat'

'Chest pain' 'Change in or loss of appetite'

'Chills,Fatigue (more than normal),Fever or feverish feeling,Muscle aches (not due to exercise)'

'Chills,Cough,Difficulty breathing,Fever or feverish feeling,Runny nose'

'Change in or loss of appetite,Headaches'

'Diarrhea,Fever or feverish feeling,Joint or any other unexplained pain,Loss of balance,Muscle aches (not due to exercise),Unexplained rashes anywhere else'

'Chills,Cough,Fatigue (more than normal),Fever or feverish feeling,Headaches,Joint or any other unexplained pain,Runny nose,Sore throat'

'Chills,Cough,Fatigue (more than normal),Fever or feverish feeling,Runny nose,Sore throat'

'Wheezing' 'Loss of taste,Runny nose'

'Fatigue (more than normal),Joint or any other unexplained pain,Loss of balance,New confusion,Red or purple rash or lesions on your toes'

'Chest pain,Chills,Cough,Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Cough,Difficulty breathing,Fever or feverish feeling,Loss of taste,Loss of smell,New confusion,Red or purple rash or lesions on your toes,Slurred speech,Stomach or abdominal pain'

'Diarrhea,Fatigue (more than normal),Fever or feverish feeling,Headaches,Muscle aches (not due to exercise),Sore throat,Nausea or vomiting'

'Chills,Cough,Diarrhea,Fatigue (more than normal),Fever or feverish feeling,Runny nose'

'Chills,Cough,Diarrhea,Fever or feverish feeling,Muscle aches (not due to exercise),Runny nose'

'Cough,Diarrhea,Fever or feverish feeling,Headaches,Runny nose'

'Chills,Cough,Fatigue (more than normal),Fever or feverish feeling,Sore throat'

'Fatigue (more than normal),Muscle aches (not due to exercise),Nausea or vomiting'

'Chest pain,Chills,Cough,Difficulty breathing,Fever or feverish feeling,Runny nose,Sore throat'

'Diarrhea,Shortness of breath'

'Chills,Cough,Fever or feverish feeling,Runny nose,Sore throat'

'Chills,Fatigue (more than normal),Headaches,Nausea or vomiting'

'Chills,Cough,Excessive sweating,Fever or feverish feeling,Runny nose'

'Change in or loss of appetite,Fever or feverish feeling'

'Chest pain,Fatigue (more than normal)'

'Fatigue (more than normal),Fever or feverish feeling,Muscle aches (not due to exercise)'

'Fever or feverish feeling,Pinkeye or Conjunctivitis,Runny nose'

'Change in or loss of appetite,Chest pain,Chills,Cough,Fever or feverish

feeling,Runny nose,Sore throat'

'Cough,Pinkeye or Conjunctivitis,Runny nose'

'Chills,Cough,Fever or feverish feeling'

'Fever or feverish feeling,Muscle aches (not due to exercise)'

'Chills,Cough,Diarrhea,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Fever or feverish feeling,Shortness of breath'

'Chills,Cough,Diarrhea,Difficulty breathing,Fatigue (more than normal),Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Chills,Cough,Fever or feverish feeling,Muscle aches (not due to exercise),Runny nose,Sore throat'

'Chills,Cough,Fatigue (more than normal),Fever or feverish feeling,Muscle aches (not due to exercise),Runny nose,Sore throat'

'Difficulty breathing,Loss of smell'

'Chest pain,Cough,Difficulty breathing,Fever or feverish feeling,Muscle aches (not due to exercise)'

'Chest pain,Chills,Cough,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose'

'Chest pain,Chills,Fever or feverish feeling,Runny nose,Sore throat'

'Chest pain,Chills,Cough,Fever or feverish feeling,Headaches,Runny nose'

'Difficulty breathing,Fatigue (more than normal),Muscle aches (not due to exercise)'

'Diarrhea,Fever or feverish feeling,Joint or any other unexplained pain, Loss of balance,Shortness of breath'

'Cough,Diarrhea,Fever or feverish feeling,Headaches,Sore throat,Stomach or abdominal pain'

'Cough,Diarrhea,Difficulty breathing,Fever or feverish feeling,Runny nose,Sore throat'

'Change in or loss of appetite,Sore throat'

'Change in or loss of appetite,Cough,Diarrhea,Difficulty breathing,Runny nose,Sore throat,Stomach or abdominal pain'

'Cough,Fever or feverish feeling,Runny nose,Sore throat'

'Muscle aches (not due to exercise)' 'Cough,Runny nose'

'Fever or feverish feeling,Runny nose' 'Headaches,Shortness of breath'

'Cough,Diarrhea,Fever or feverish feeling,Joint or any other unexplained pain,Sore throat,Stomach or abdominal pain'

'Excessive sweating,Fever or feverish feeling'

'Cough,Fever or feverish feeling,Headaches,Runny nose,Wheezing'

'Muscle aches (not due to exercise),Sore throat'

'Change in or loss of appetite,Cough,Fever or feverish feeling'

'Difficulty breathing,Fever or feverish feeling'

'Excessive sweating,Fever or feverish feeling,Headaches'

'Fatigue (more than normal),Fever or feverish feeling'

'Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Cough,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Runny nose,Wheezing' 'Runny nose,Sore throat'

'Cough,Difficulty breathing,Fatigue (more than normal),Fever or feverish feeling'

'Cough,Sore throat' 'Excessive sweating,Headaches'

'Headaches,Nausea or vomiting'

'Diarrhea,Difficulty breathing,Fever or feverish feeling'

'Cough,Excessive sweating' 'Excessive sweating,Shortness of breath'

'Cough,Diarrhea,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose'

'Cough,Fever or feverish feeling,Loss of smell' 'Cough,Loss of taste'

'Cough,Diarrhea,Difficulty breathing,Fever or feverish feeling,Sore throat'

at,Nausea or vomiting'

'Fever or feverish feeling,Runny nose,Sore throat'

'Cough,Diarrhea,Difficulty breathing,Fever or feverish feeling,Loss of balance,Runny nose,Unusual shivering or shaking'

'Cough,Diarrhea,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Cough,Fever or feverish feeling,Headaches,Runny nose'

'Cough,Diarrhea,Difficulty breathing,Sore throat'

'Cough,Diarrhea,Difficulty breathing,Excessive sweating,Sore throat,Stomach or abdominal pain'

'Cough,Fever or feverish feeling,Headaches,Sore throat'

'Cough,Runny nose,Sore throat'

'Chest pain,Cough,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose'

'Cough,Difficulty breathing,Fever or feverish feeling,Headaches,Pinkeye or Conjunctivitis,Runny nose'

'Chills,Cough,Runny nose' 'Cough,Fever or feverish feeling,Sore throat'

'Cough,Difficulty breathing,Fever or feverish feeling'

'Cough,Diarrhea,Nausea or vomiting'

'Cough,Fever or feverish feeling,Runny nose'

'Fever or feverish feeling,Sore throat' 'Cough,Loss of smell'

'Cough,Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Cough,Diarrhea,Difficulty breathing,Runny nose,Slurred speech,Sore throat'

'Stomach or abdominal pain' 'Excessive sweating'

'Chills,Cough,Fever or feverish feeling,Runny nose'

'Cough,Difficulty breathing,Fever or feverish feeling,Runny nose'

'Chest pain,Difficulty breathing,Fatigue (more than normal),Fever or feverish feeling,Muscle aches (not due to exercise),Wheezing'

'Change in or loss of appetite,Chills,Fatigue (more than normal),Fever or feverish feeling'

'Chest pain,Chills,Fatigue (more than normal),Fever or feverish feeling,Runny nose'

'Difficulty breathing,Headaches,Loss of taste'

'Fatigue (more than normal),Muscle aches (not due to exercise),Sore throat'

'Chills,Cough,Fatigue (more than normal),Fever or feverish feeling,Headaches,Muscle aches (not due to exercise),Runny nose'

'Chills,Fatigue (more than normal),Fever or feverish feeling'

'Chills,Fever or feverish feeling,Muscle aches (not due to exercise),Sore throat'

'Cough,Fatigue (more than normal),Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Chills,Cough,Fever or feverish feeling,Headaches,Runny nose,Sore throat'

'Chills,Cough,Diarrhea,Fatigue (more than normal),Fever or feverish feeling,Runny nose,Sore throat'

'Cough,Joint or any other unexplained pain'

'Change in or loss of appetite,Cough,Fever or feverish feeling,Loss of taste,Loss of smell'

'Chest pain,Chills,Diarrhea,Difficulty breathing,Joint or any other unexplained pain,Muscle aches (not due to exercise),Shortness of breath,Stomach or abdominal pain'

'Change in or loss of appetite,Chest pain,Diarrhea,Excessive sweating,Fever or feverish feeling,Loss of taste,Muscle aches (not due to exercise),Red or purple rash or lesions on your toes,Slurred speech,Unusual shivering or shaking'

'Change in or loss of appetite,Chills,Difficulty breathing,Fever or feverish feeling,Headaches,Runny nose'

'Cough,Fatigue (more than normal),Fever or feverish feeling,Headaches,Muscle aches (not due to exercise)'

'Cough,Headaches,Runny nose'

'Change in or loss of appetite,Fever or feverish feeling,Runny nose'

'Change in or loss of appetite,Cough,Fatigue (more than normal),Fever or feverish feeling,Headaches'

'Diarrhea,Headaches,Muscle aches (not due to exercise)'

'Headaches,Joint or any other unexplained pain'

'Chills,Fatigue (more than normal),Headaches,Muscle aches (not due to exercise),New confusion'

'Chills,Runny nose' 'Fatigue (more than normal),Shortness of breath'

'Difficulty breathing,Fever or feverish feeling,Joint or any other unexplained pain,New confusion,Pinkeye or Conjunctivitis,Runny nose,Shortness of breath'

'Joint or any other unexplained pain' 'Cough,Difficulty breathing'

'Cough,Fever or feverish feeling,Headaches,Muscle aches (not due to exercise)'

'Cough,Diarrhea,Difficulty breathing,Runny nose'

'Change in or loss of appetite,Chest pain,Chills,Cough,Fatigue (more than normal),Fever or feverish feeling,Headaches,Loss of taste,Loss of smell,Runny nose,Slurred speech,Sore throat,Nausea or vomiting,Wheezing'

'Fatigue (more than normal),Fever or feverish feeling,Headaches'

'Chest pain,Cough,Diarrhea,Fatigue (more than normal),Headaches,New confusion,Runny nose,Sore throat,Nausea or vomiting'

'Headaches,Runny nose,Stomach or abdominal pain'

'Muscle aches (not due to exercise),Runny nose'

'Cough,Diarrhea,Headaches,Muscle aches (not due to exercise),Runny nose,Sore throat'

'Chest pain,Fever or feverish feeling'

'Chest pain,Stomach or abdominal pain'

'Chest pain,Fatigue (more than normal),Loss of balance,Stomach or abdominal pain'

'Diarrhea,Fatigue (more than normal)'

'Change in or loss of appetite,Chest pain,Diarrhea,Difficulty breathing,Joint or any other unexplained pain,Muscle aches (not due to exercise),Red or purple rash or lesions on your toes,Sore throat,Unexplained rashes anywhere else,Nausea or vomiting'

'Change in or loss of appetite,Muscle aches (not due to exercise),Shortness of breath'

'Change in or loss of appetite,Cough'

'Cough,Fever or feverish feeling,Headaches'

'Bluish lips or face,Change in or loss of appetite,Cough,Difficulty breathing,Excessive sweating,Fatigue (more than normal),Fever or feverish feeling,Headaches,Loss of taste,Muscle aches (not due to exercise),Sore throat,Stomach or abdominal pain,Nausea or vomiting'

'Cough,Headaches'

'Difficulty breathing,Excessive sweating,Fever or feverish feeling,Loss of balance,Loss of smell,Runny nose,Slurred speech,Sore throat,Unexplained rashes anywhere else,Nausea or vomiting'

'Cough,Diarrhea,Fever or feverish feeling,Headaches' 'Cough,Diarrhea'

'Diarrhea,Loss of taste'

'Fatigue (more than normal),Muscle aches (not due to exercise),Runny nose'

'Fatigue (more than normal),Headaches,Muscle aches (not due to exercise),Sore throat'


```
'Chills,Fatigue (more than normal),Fever or feverish feeling,Headaches,M
uscle aches (not due to exercise)'
'New confusion'
'Chills,Fatigue (more than normal),Fever or feverish feeling,Headaches,S
ore throat,Unusual shivering or shaking'
'Fatigue (more than normal),Headaches,Muscle aches (not due to exercise)
,Runny nose'
'Stomach or abdominal pain,Unexplained rashes anywhere else'
'Chills,Headaches' 'Change in or loss of appetite,Runny nose'
'Chest pain,Cough,Fatigue (more than normal),Sore throat,Wheezing']
```

```
In [24]: # create a new dataframe with binary columns for each unique symptom in '
symptom_dummies = pd.get_dummies(data2['First Symp'].str.split(', ', expan

# add '_first' to the column names
symptom_dummies.columns = [col + '_first' for col in symptom_dummies.colu

# concatenate the original dataframe with the new binary columns
data2 = pd.concat([data2, symptom_dummies], axis=1)
```

```
/var/folders/cz/h8q7ysq15_b618tft_42rgmh0000gn/T/ipykernel_36803/40781915
93.py:2: FutureWarning: Using the level keyword in DataFrame and Series a
ggregations is deprecated and will be removed in a future version. Use gr
oupby instead. df.sum(level=1) should use df.groupby(level=1).sum().
    symptom_dummies = pd.get_dummies(data2['First Symp'].str.split(', ', exp
and=True).stack(), prefix='_').sum(level=0)
```

```
In [25]: data2.columns
```

```

Out[25]: Index(['age', 'SoreThroat', 'RunnyNose', 'Cough', 'ChestPain', 'ShortBrea
th',
              'DifficultyBreathing', 'Wheezing', 'BluishLip', 'Diarrhea',
              'AbdominalPain', 'LossOfAppetite', 'NauseaVomiting', 'Headache',
              'SlurredSpeach', 'ShakingShivering', 'LossSmell', 'LossBalance',
              'LossTaste', 'TinglingNumbness', 'ExcessiveSweat', 'RedRashToe',
              'RedRashAnywhere', 'JointPain', 'First Symp', 'Chills', 'Fatigue',
              'Fever', 'Muscle aches', 'Pinkeye', ' and I tested negative',
              ' and I tested positive', ' and my results are still pending',
              ' and my results were inconclusive', 'Yes', 'Female', 'Male', 'Oth
er',
              '__Any tingling/numbness/swelling in hands or feet_first',
              '__Bluish lips or face_first', '__Change in or loss of appetite_fi
rst',
              '__Chest pain_first', '__Chills_first', '__Cough_first',
              '__Diarrhea_first', '__Difficulty breathing_first',
              '__Excessive sweating_first', '__Fatigue (more than normal)_first'
              ,
              '__Fever or feverish feeling_first', '__Headaches_first',
              '__Joint or any other unexplained pain_first',
              '__Loss of balance_first', '__Loss of smell_first',
              '__Loss of taste_first', '__Muscle aches (not due to exercise)_fir
st',
              '__Nausea or vomiting_first', '__New confusion_first',
              '__Pinkeye or Conjunctivitis_first',
              '__Red or purple rash or lesions on your toes_first',
              '__Runny nose_first', '__Shortness of breath_first',
              '__Slurred speech_first', '__Sore throat_first',
              '__Stomach or abdominal pain_first',
              '__Unexplained rashes anywhere else_first',
              '__Unusual shivering or shaking_first', '__Wheezing_first'],
          dtype='object')

```

```

In [26]: #rename columns
data2 = data2.rename(columns={
    'age': 'Age',
    'SoreThroat': 'Sorethroat',
    'RunnyNose': 'Runnynose',
    'Cough': 'Cough',
    'ChestPain': 'Chestpain',
    'ShortBreath': 'Shortnessofbreath',
    'DifficultyBreathing': 'Difficultybreathing',
    'Wheezing': 'Wheezing',
    'BluishLip': 'Bluish',
    'Diarrhea': 'Diarrhea',
    'AbdominalPain': 'AbdominalPain',
    'LossOfAppetite': 'LossAppetite',
    'NauseaVomiting': 'Vomiting',
    'Headache': 'Headaches',
    'SlurredSpeach': 'SlurredSpeech',
    'ShakingShivering': 'Shivering',
    'LossSmell': 'LossSmell',
    'LossBalance': 'LossBalance',
    'LossTaste': 'LossTaste',
    'TinglingNumbness': 'Numbness',
    'ExcessiveSweat': 'ExcessSweat',
    'RedRashToe': 'RedRash',

```

```

'RedRashAnywhere': 'UnexplainedRash',
'JointPain': 'JointPain',
'Chills': 'Chills',
'Fatigue': 'Fatigue',
'Fever': 'Fever',
'Muscle aches': 'MuscleAches',
'Pinkeye': 'Pinkeye',
' and I tested negative': 'TestNegative',
' and I tested positive': 'TestPositive',
' and my results are still pending': 'TestPending',
' and my results were inconclusive': 'TestFalsePositive',
'Yes': 'Yes',
'Female': 'GenderFemale',
'Male': 'GenderMale',
'Other': 'GenderUnknown',
'__Any tingling/numbness/swelling in hands or feet_first': 'Numbness_f
'__Bluish lips or face_first': 'Bluish_first',
'__Change in or loss of appetite_first': 'LossAppetite_first',
'__Chest pain_first': 'Chestpain_first',
'__Chills_first': 'Chills_first',
'__Cough_first': 'Cough_first',
'__Diarrhea_first': 'Diarrhea_first',
'__Difficulty breathing_first': 'Difficultybreathing_first',
'__Excessive sweating_first': 'ExcessSweat_first',
'__Fatigue (more than normal)_first': 'Fatigue_first',
'__Fever or feverish feeling_first': 'Fever_first',
'__Headaches_first': 'Headaches_first',
'__Joint or any other unexplained pain_first': 'JointPain_first',
'__Loss of balance_first': 'LossBalance_first',
'__Loss of smell_first': 'LossSmell_first',
'__Loss of taste_first': 'LossTaste_first',
'__Muscle aches (not due to exercise)_first': 'MuscleAches_first',
'__Nausea or vomiting_first': 'Vomiting_first',
'__New confusion_first': 'Confusion_first',
'__Pinkeye or Conjunctivitis_first': 'Pinkeye_first',
'__Red or purple rash or lesions on your toes_first': 'RedRash_first',
'__Runny nose_first': 'Runnynose_first',
'__Shortness of breath_first': 'Shortnessofbreath_first',
'__Slurred speech_first': 'SlurredSpeech_first',
'__Sore throat_first': 'Sorethroat_first',
'__Stomach or abdominal pain_first': 'AbdominalPain_first',
'__Unexplained rashes anywhere else_first': 'UnexplainedRash_first',
'__Unusual shivering or shaking_first': 'Shivering_first',
'__Wheezing_first': 'Wheezing_first',
})

```

In [27]: data2

```
Out[27]:
```

	Age	Sorethroat	Runnynose	Cough	Chestpain	Shortnessofbreath	Difficultybreath
0	20	0	0	0	0	0	0
1	18	0	0	0	0	0	0
2	19	1	0	0	0	0	0
3	18	1	1	0	0	0	0
4	19	1	0	0	0	0	0
...
478	19	0	1	1	0	0	0
479	19	1	0	1	0	0	0
480	19	0	0	0	1	0	0
481	19	1	1	1	0	0	0
482	19	1	1	1	1	1	1

483 rows × 67 columns

```
In [28]: data2.columns
```

```
Out[28]: Index(['Age', 'Sorethroat', 'Runnynose', 'Cough', 'Chestpain',
              'Shortnessofbreath', 'Difficultybreathing', 'Wheezing', 'Bluish',
              'Diarrhea', 'AbdominalPain', 'LossAppetite', 'Vomiting', 'Headache
s',
              'SlurredSpeech', 'Shivering', 'LossSmell', 'LossBalance', 'LossTas
te',
              'Numbness', 'ExcessSweat', 'RedRash', 'UnexplainedRash', 'JointPai
n',
              'First Symp', 'Chills', 'Fatigue', 'Fever', 'MuscleAches', 'Pinkey
e',
              'TestNegative', 'TestPositive', 'TestPending', 'TestFalsePositive'
,
              'Yes', 'GenderFemale', 'GenderMale', 'GenderUnknown', 'Numbness_fi
rst',
              'Bluish_first', 'LossAppetite_first', 'Chestpain_first', 'Chills_f
irst',
              'Cough_first', 'Diarrhea_first', 'Difficultybreathing_first',
              'ExcessSweat_first', 'Fatigue_first', 'Fever_first', 'Headaches_fi
rst',
              'JointPain_first', 'LossBalance_first', 'LossSmell_first',
              'LossTaste_first', 'MuscleAches_first', 'Vomiting_first',
              'Confusion_first', 'Pinkeye_first', 'RedRash_first', 'Runnynose_fi
rst',
              'Shortnessofbreath_first', 'SlurredSpeech_first', 'Sorethroat_firs
t',
              'AbdominalPain_first', 'UnexplainedRash_first', 'Shivering_first',
              'Wheezing_first'],
              dtype='object')
```

```
In [29]: # replace NaN values with 0
data2 = data2.fillna(0)
```

```
In [30]: data2 = data2.drop(columns=['First Symp'])
```

```
In [31]: data2.columns
```

```
Out[31]: Index(['Age', 'Sorethroat', 'Runnynose', 'Cough', 'Chestpain',
      'Shortnessofbreath', 'Difficultybreathing', 'Wheezing', 'Bluish',
      'Diarrhea', 'AbdominalPain', 'LossAppetite', 'Vomiting', 'Headache
      s',
      'SlurredSpeech', 'Shivering', 'LossSmell', 'LossBalance', 'LossTas
      te',
      'Numbness', 'ExcessSweat', 'RedRash', 'UnexplainedRash', 'JointPai
      n',
      'Chills', 'Fatigue', 'Fever', 'MuscleAches', 'Pinkeye', 'TestNegat
      ive',
      'TestPositive', 'TestPending', 'TestFalsePositive', 'Yes',
      'GenderFemale', 'GenderMale', 'GenderUnknown', 'Numbness_first',
      'Bluish_first', 'LossAppetite_first', 'Chestpain_first', 'Chills_f
      irst',
      'Cough_first', 'Diarrhea_first', 'Difficultybreathing_first',
      'ExcessSweat_first', 'Fatigue_first', 'Fever_first', 'Headaches_fi
      rst',
      'JointPain_first', 'LossBalance_first', 'LossSmell_first',
      'LossTaste_first', 'MuscleAches_first', 'Vomiting_first',
      'Confusion_first', 'Pinkeye_first', 'RedRash_first', 'Runnynose_fi
      rst',
      'Shortnessofbreath_first', 'SlurredSpeech_first', 'Sorethroat_firs
      t',
      'AbdominalPain_first', 'UnexplainedRash_first', 'Shivering_first',
      'Wheezing_first'],
      dtype='object')
```

```
In [33]: #Save the Dataframe
data=data2.to_csv('/Users/alanoudalturki/Desktop/CleanDataQ1.csv', index=
```

```
In [34]: ##Start working on Question-1 part 1 We will Extract columns for symptoms
```

```
In [35]: # Extract the relevant columns from the data
columns = ['LossSmell', 'Fatigue', 'Difficultybreathing', 'SlurredSpeech', 'Di
      'LossAppetite', 'Bluish', 'MuscleAches', 'Pinkeye', 'UnexplainedRas
      'Shortnessofbreath', 'JointPain', 'Sorethroat', 'Shivering', 'Abdom
      'ExcessSweat', 'LossBalance', 'RedRash', 'Numbness', 'Headaches',
      'Cough', 'Chills', 'LossTaste', 'Wheezing', 'Fever', 'Vomiting', 'Run
      'GenderFemale', 'Age', 'LossSmell_first', 'Fatigue_first', 'Difficu
      'SlurredSpeech_first', 'Diarrhea_first', 'LossAppetite_first', 'Bl
      'MuscleAches_first', 'Confusion_first', 'Pinkeye_first', 'Unexplai
      'Shortnessofbreath_first', 'JointPain_first', 'Sorethroat_first',
      'AbdominalPain_first', 'ExcessSweat_first', 'LossBalance_first', '
      'Numbness_first', 'Headaches_first', 'Cough_first', 'Chills_first'
      'Wheezing_first', 'Fever_first', 'Vomiting_first', 'Runnynose_firs

      Cleandataq1 = data2[columns]
```

In [36]: Cleandataq1

Out[36]:	LossSmell	Fatigue	Difficultybreathing	SlurredSpeech	Diarrhea	LossAppetite	Blu
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0
2	0	1	0	0	0	1	0
3	0	0	0	0	0	1	0
4	0	0	0	0	0	0	0
...
478	1	0	0	0	0	0	1
479	0	0	0	0	0	0	1
480	0	1	1	0	0	0	0
481	0	0	0	0	0	0	0
482	0	1	1	0	0	0	0

483 rows x 59 columns

```
In [37]: #Creat a new DataFrame for COVID Symptoms
Symptoms_data =pd.DataFrame({'Symptoms': ['LossSmell', 'Fatigue', 'Diffic
'Diarrhea', 'LossAppetite', 'B
'UnexplainedRash', 'Shortnessofb
'Shivering', 'AbdominalPain', 'E
'RedRash', 'Numbness', 'Headach
'Chestpain']})
```

```
In [38]: new_data =Symptoms_data.to_csv('/Users/alanoudalturki/Desktop/COVIDsympto
```

```
In [39]: Symptoms_data
```

Out [39]:

	Symptoms
0	LossSmell
1	Fatigue
2	Difficultybreathing
3	SlurredSpeech
4	Diarrhea
5	LossAppetite
6	Bluish
7	MuscleAches
8	Pinkeye
9	UnexplainedRash
10	Shortnessofbreath
11	JointPain
12	Sorethroat
13	Shivering
14	AbdominalPain
15	ExcessSweat
16	LossBalance
17	RedRash
18	Numbness
19	Headaches
20	Cough
21	Chills
22	LossTaste
23	Wheezing
24	Fever
25	Vomiting
26	Runnynose
27	Chestpain

In [40]:

```
# Creat contain all the symptoms  
my_list = list(Symptoms_data['Symptoms'])
```

```
In [42]: #check the data ,, checks whether the value in the "Sorethroat_first" col
#of the DataFrame is equal to 1
(Cleandataq1['Sorethroat_first'] == 1)
```

```
Out[42]: 0      False
1      False
2       True
3       True
4       True
...
478    False
479     True
480    False
481     True
482     True
Name: Sorethroat_first, Length: 483, dtype: bool
```

```
In [43]: #Creat new dataframe
common_data = pd.DataFrame(columns=my_list,index=my_list)
```

```
In [46]: #Craet function to calculate how many times the two symptoms occur
#together

def symptomCross(symptom1,symptom2):

    common_data_func = Cleandataq1[(Cleandataq1[symptom1] == 1) & (Cleandat
my_shape = common_data_func.shape
    return my_shape[0]
```

```
In [47]: #check the function
symptomCross('Shortnessofbreath','Fatigue')
```

```
Out[47]: 64
```

```
In [48]: ##loop to add each pair of symptoms' frequency in the DataFrame
#to the common data DataFrame that was previously generated.
```

```
for items1 in my_list:
    for items2 in my_list:
        if items1 == items2:
            common_data.at[items1,items2] = 'NaN'
        else:
            common_data.at[items1,items2] = symptomCross(items1,items2)
```

```
In [49]: #save the dataframe
common_data.to_csv('/Users/alanoudalturki/Desktop/commonSymptoms.csv')
```

```
In [50]: common_data
```


Out[50]:

	LossSmell	Fatigue	Difficultybreathing	SlurredSpeech	Diarrhea	Los
LossSmell	NaN	17	16	11	21	
Fatigue	17	NaN	68	8	79	
Difficultybreathing	16	68	NaN	12	70	
SlurredSpeech	11	8	12	NaN	14	
Diarrhea	21	79	70	14	NaN	
LossAppetite	18	84	58	8	59	
Bluish	2	1	3	3	4	
MuscleAches	22	118	74	13	81	
Pinkeye	8	16	16	10	21	
UnexplainedRash	13	15	13	10	20	
Shortnessofbreath	10	64	51	4	55	
JointPain	16	60	59	16	70	
Sorethroat	25	96	73	14	84	
Shivering	7	41	36	9	40	
AbdominalPain	14	35	30	13	41	
ExcessSweat	16	14	10	4	17	
LossBalance	8	17	18	14	23	
RedRash	8	4	14	9	18	
Numbness	2	23	9	4	13	
Headaches	32	119	76	12	97	
Cough	32	124	82	15	102	
Chills	12	75	57	3	53	
LossTaste	32	56	40	9	48	
Wheezing	14	67	59	10	64	
Fever	33	120	97	16	108	
Vomiting	15	59	41	9	49	
Runnynose	33	115	86	16	100	
Chestpain	11	71	56	8	58	

28 rows x 28 columns

```
In [51]: # The purpose of this DataFrame is to store the difference between
#the number of times each pair of symptoms occur together in the
#Data dataset and the expected number of times they would occur
#together by chance.
```

```
difference_data = pd.DataFrame(columns=my_list,index=my_list)
```

```
In [52]: #Creat a function to function takes two symptoms as arguments
# and calculates the difference between the observed number of
#times those two symptoms occur together in the Data dataset
#and the expected number of times they would occur together by chance.
```

```
def symptomCrossDifference(symptom1,symptom2):
    symptom1_first = symptom1 + '_first'
    symptom2_first = symptom2 + '_first'

    difference_data_func = Cleandataq1[(Cleandataq1[symptom1_first] == 1)
                                       & (Cleandataq1[symptom2] == 1)
                                       & (Cleandataq1[symptom2_first]
                                       & (Cleandataq1[symptom2_first]

    my_shape = difference_data_func.shape
    return my_shape[0]
```

```
In [53]: symptomCrossDifference('Shortnessofbreath','Fatigue')
```

```
Out[53]: 4
```

```
In [54]: #Use(difference_data) dataframe created to count the difference
#between the observed and expected number of times each pair of
#symptoms occur together
```

```
for items1 in my_list:
    for items2 in my_list:
        if(items1 == items2):
            difference_data.at[items1,items2] = 'NaN'
        else:
            difference_data.at[items1,items2] = symptomCrossDifference(items1,i
```

```
In [55]: #save the file
difference_data.to_csv('/Users/alanoudalturki/Desktop/DifferenceSymptoms.
```

```
In [56]: difference_data
```

Out[56]:

	LossSmell	Fatigue	Difficultybreathing	SlurredSpeech	Diarrhea	Los
LossSmell	NaN	1	2	0	4	
Fatigue	5	NaN	26	3	23	
Difficultybreathing	8	13	NaN	7	10	
SlurredSpeech	2	0	1	NaN	2	
Diarrhea	8	14	8	10	NaN	
LossAppetite	4	8	3	2	7	
Bluish	0	0	0	0	1	
MuscleAches	8	26	14	3	15	
Pinkeye	1	2	0	1	2	
UnexplainedRash	3	2	0	3	1	
Shortnessofbreath	2	4	2	1	1	
JointPain	4	3	2	4	3	
Sorethroat	11	23	31	8	37	
Shivering	1	0	0	1	0	
AbdominalPain	4	5	0	5	1	
ExcessSweat	7	2	1	1	5	
LossBalance	0	0	1	3	2	
RedRash	2	1	0	1	1	
Numbness	0	0	0	0	0	
Headaches	13	22	11	2	22	
Cough	12	40	41	7	47	
Chills	6	25	37	1	33	
LossTaste	3	0	1	0	2	
Wheezing	2	1	3	0	2	
Fever	13	37	51	5	54	
Vomiting	2	2	2	4	3	
Runnynose	13	38	39	3	41	
Chestpain	3	12	7	3	9	

28 rows x 28 columns

```
In [57]: #Creat combined_data to
difference_data.to_csv('/Users/alanoudalturki/Desktop/DifferenceSymptoms.
new_data = pd.read_csv("/Users/alanoudalturki/Desktop/COVIDsymptoms.csv")
my_new_list = list(new_data['Symptoms'])

combined_data = pd.DataFrame(columns=my_new_list,index=my_new_list)
```

```
In [58]: #The combined function receives two symptoms as parameters and outputs
#a formatted string that contains the actual number of times the two
#symptoms appear together in the Data dataset as well as the difference
#between the observed and predicted rates at which they would have
#occurred by chance.

def combined_function(items1,items2):
    return "{diff} ({common})".format(diff = symptomCrossDifference(items1,
        (items1,items2))
```

```
In [59]: comb = combined_function('Shortnessofbreath','Fatigue')
print(comb)
```

4 (64)

```
In [60]: #the combined data Except for the cells where a symptom appears with
#itself, which will be filled with 'NaN,'the outcome of executing the
#combined function for each pair of symptoms in my list will be fully
#populated in the DataFrame.

for items1 in my_list:
    for items2 in my_list:
        if(items1 == items2):
            combined_data.at[items1,items2] = 'NaN'
        else:
            combined_data.at[items1,items2] = combined_function(items1,items2)
```

```
In [61]: #save the Table
combined_data.to_csv('/Users/alanoudalturki/Desktop/CombinedSymptoms.csv')
```

```
In [62]: combined_data
```

```
Out[62]:
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	LossSmell	Fatigue	Difficultybreathing	SlurredSpeech	Diarrhea	Los
LossSmell	NaN	1 (17)	2 (16)	0 (11)	4 (21)	
Fatigue	5 (17)	NaN	26 (68)	3 (8)	23 (79)	
Difficultybreathing	8 (16)	13 (68)	NaN	7 (12)	10 (70)	
SlurredSpeech	2 (11)	0 (8)	1 (12)	NaN	2 (14)	
Diarrhea	8 (21)	14 (79)	8 (70)	10 (14)	NaN	
LossAppetite	4 (18)	8 (84)	3 (58)	2 (8)	7 (59)	

Bluish	0 (2)	0 (1)	0 (3)	0 (3)	1 (4)
MuscleAches	8 (22)	26 (118)	14 (74)	3 (13)	15 (81)
Pinkeye	1 (8)	2 (16)	0 (16)	1 (10)	2 (21)
UnexplainedRash	3 (13)	2 (15)	0 (13)	3 (10)	1 (20)
Shortnessofbreath	2 (10)	4 (64)	2 (51)	1 (4)	1 (55)
JointPain	4 (16)	3 (60)	2 (59)	4 (16)	3 (70)
Sorethroat	11 (25)	23 (96)	31 (73)	8 (14)	37 (84)
Shivering	1 (7)	0 (41)	0 (36)	1 (9)	0 (40)
AbdominalPain	4 (14)	5 (35)	0 (30)	5 (13)	1 (41)
ExcessSweat	7 (16)	2 (14)	1 (10)	1 (4)	5 (17)
LossBalance	0 (8)	0 (17)	1 (18)	3 (14)	2 (23)
RedRash	2 (8)	1 (4)	0 (14)	1 (9)	1 (18)
Numbness	0 (2)	0 (23)	0 (9)	0 (4)	0 (13)
Headaches	13 (32)	22 (119)	11 (76)	2 (12)	22 (97)
Cough	12 (32)	40 (124)	41 (82)	7 (15)	47 (102)
Chills	6 (12)	25 (75)	37 (57)	1 (3)	33 (53)
LossTaste	3 (32)	0 (56)	1 (40)	0 (9)	2 (48)
Wheezing	2 (14)	1 (67)	3 (59)	0 (10)	2 (64)
Fever	13 (33)	37 (120)	51 (97)	5 (16)	54 (108)
Vomiting	2 (15)	2 (59)	2 (41)	4 (9)	3 (49)
Runnynose	13 (33)	38 (115)	39 (86)	3 (16)	41 (100)
Chestpain	3 (11)	12 (71)	7 (56)	3 (8)	9 (58)

28 rows × 28 columns

In []: