In [ ]:
```
import pandas as pd
import datetime as dt
import matplotlib.pyplot as plt
import statsmodels.tsa.api as sts

tweet_data = pd.read_csv('tweets_01-08-2021.csv')
```

In [ ]:
```
#Converting the 'date' column into a datetime variable
#and appending the new column to the dataframe
tweet_data["datetime"]=tweet_data["date"].apply(lambda x : dt.datetime.strptime(
tweet_data["month_year"]=tweet_data["datetime"].apply(lambda x : str(x.month)+"-
tweet_data.head()
```

Out[ ]:

	id	text	isRetweet	isDeleted	device	favorites	retweets
0	98454970654916608	Republicans and Democrats have both created ou...	f	f	TweetDeck	49	255
1	1234653427789070336	I was thrilled to be back in the Great city of...	f	f	Twitter for iPhone	73748	17404
2	1218010753434820614	RT @CBS_Herridge: READ: Letter to surveillance...	t	f	Twitter for iPhone	0	7396
3	1304875170860015617	The Unsolicited Mail In Ballot Scam is a major...	f	f	Twitter for iPhone	80527	23502
4	1218159531554897920	RT @MZHemingway: Very friendly telling of even...	t	f	Twitter for iPhone	0	9081

In [ ]:
```
#2. When did Trump start tweeting from an iPhone?
iphone_tweet_dates=tweet_data[tweet_data["device"]=="Twitter for iPhone"]["datet
print(f"Trump started tweeting from an iPhone on {min(iphone_tweet_dates).date()
```

```
Trump started tweeting from an iPhone on 2012-12-11 at 01:20:01
```

In [ ]:
```
def tweet_keyword_occurrences(keyword_list):
    '''
    This function searches for every keyword in the list passed as argument
    within the parent dataframe and returns a dataframe that only contains
    tweets that have those keywords in them.

    PARAMETERS
    ------------------------
    keyword_list: list
    List of keywords to search for in the tweet_data dataframe.

    RETURNS
    ------------------------
    pandas dataframe
    A copy of the parent dataframe that only contains logs of tweets
    that contain the specified keywords within them.
    '''
    return tweet_data[tweet_data["text"].str.contains('|'.join(keyword_list), ca
```

In [ ]:
```
#3. How many tweets has Trump posted about immigration?
keywords=['immigrant', 'immigrants', 'immigration']
immigration_tweets=tweet_keyword_occurrences(keywords)
print(f"Trump has posted {immigration_tweets.shape[0]} tweets about immigration.
```

```
Trump has posted 433 tweets about immigration.
```

In [ ]:
```
#4. How many of Trump’s tweets mention Fox News?
fox_news_mention_keywords=['@foxnews', '@foxandfriends', '@oreillyfactor', '@sea
fox_news_tweets=tweet_keyword_occurrences(fox_news_mention_keywords)
print(f"{fox_news_tweets.shape[0]} of Trump's tweets mention Fox News.")
```

```
2151 of Trump's tweets mention Fox News.
```

In [ ]:
```
#5. How many of Trump’s tweets mention the show “The Apprentice”?
apprentice_mention_keywords=['@apprenticenbc', '@celebapprentice']
apprentice_tweets=tweet_keyword_occurrences(apprentice_mention_keywords)
print(f"{apprentice_tweets.shape[0]} of Trump's tweets mention the show \"The Ap
```

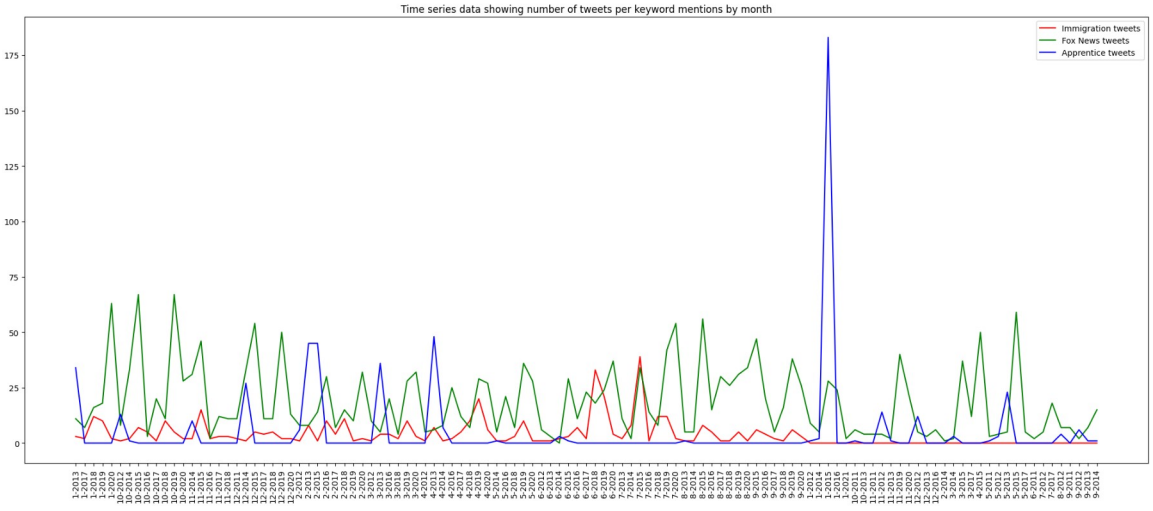
```
534 of Trump's tweets mention the show "The Apprentice".
```

In [ ]:
```
def frame_month_year_aggregator(df, name):
    '''
    This function groups the number of tweets made within a month and
    adds a column to the passed dataframe containing the count of said
    tweets in a given month

    PARAMETERS
    ------------------------
    df: pandas dataframe
    The dataframe to be modified. Contains a subset of the twitter log data

    name: string
    The name of the type of tweets contained in the dataframe

    RETURNS
    ------------------------
    pandas dataframe
    A dataframe containing a new column containing the count of tweets
    posted within a given month

    '''
    return df.groupby(["month_year"]).agg({"id":"count"}).reset_index().rename(c
```

In [ ]:
```
immigration_tweets_agg=frame_month_year_aggregator(immigration_tweets, "immigrat
fox_news_tweets_agg=frame_month_year_aggregator(fox_news_tweets, "fox_news_tweet
apprentice_tweets_agg=frame_month_year_aggregator(apprentice_tweets, "apprentice

time_series_plot_data=immigration_tweets_agg.merge(fox_news_tweets_agg.merge(app
```

In [ ]:
```
plt.rcParams["figure.figsize"]=(25,10)
plt.plot(time_series_plot_data["month_year"], time_series_plot_data["count_immig
plt.plot(time_series_plot_data["month_year"], time_series_plot_data["count_fox_n
plt.plot(time_series_plot_data["month_year"], time_series_plot_data["count_appre
plt.xticks(rotation=90)
plt.legend()
plt.title("Time series data showing number of tweets per keyword mentions by mon
```

Out[ ]:
```
Text(0.5, 1.0, 'Time series data showing number of tweets per keyword mentions b
y month')
```



In [ ]:
```
sts.stattools.grangercausalitytests(time_series_plot_data[["count_immigration_tw

# Based on the p values observed through this causality test (all of which are
# significantly more than 0.05), we can safely reject the null hypothesis
# and confidently say that Trump's mention of Fox News in his tweets did NOT
# act as a significant predictor of him tweeting about immigration in the
# following month.
```

```
Granger Causality
number of lags (no zero) 1
ssr based F test:         F=1.4430  , p=0.2322  , df_denom=111, df_num=1
ssr based chi2 test:   chi2=1.4820  , p=0.2235  , df=1
likelihood ratio test: chi2=1.4724  , p=0.2250  , df=1
parameter F test:         F=1.4430  , p=0.2322  , df_denom=111, df_num=1
```

Out[ ]:
```
{1: ({'ssr_ftest': (1.442960403130599, 0.23221776602375147, 111.0, 1),
   'ssr_chi2test': (1.4819593329449394, 0.223468217944988, 1),
   'lrtest': (1.4724095352112272, 0.22496590781357595, 1),
   'params_ftest': (1.4429604031305783, 0.2322177660237488, 111.0, 1.0)},
  [<statsmodels.regression.linear_model.RegressionResultsWrapper at 0x1e7509c7cd
0>,
   <statsmodels.regression.linear_model.RegressionResultsWrapper at 0x1e74f7cd5d
0>,
   array([[0., 1., 0.]])])}
```

In [ ]:
```
sts.stattools.grangercausalitytests(time_series_plot_data[["count_immigration_tw

#Since the p values are significantly more than 0.05, we can confidently
#state that Trump mentioning The Apprentice in the previous month was NOT
#a significant predictor of him tweeting about immigration in the following
#month
```

```
Granger Causality
number of lags (no zero) 1
ssr based F test:         F=0.2648  , p=0.6079  , df_denom=111, df_num=1
ssr based chi2 test:   chi2=0.2719  , p=0.6020  , df=1
likelihood ratio test: chi2=0.2716  , p=0.6023  , df=1
parameter F test:         F=0.2648  , p=0.6079  , df_denom=111, df_num=1
```

Out[ ]:
```
{1: ({'ssr_ftest': (0.2647754314717014, 0.6078812355547889, 111.0, 1),
   'ssr_chi2test': (0.2719315242141798, 0.6020390227971363, 1),
   'lrtest': (0.2716077111854247, 0.602255339439602, 1),
   'params_ftest': (0.26477543147168375, 0.6078812355547972, 111.0, 1.0)},
  [<statsmodels.regression.linear_model.RegressionResultsWrapper at 0x1e75027d45
0>,
   <statsmodels.regression.linear_model.RegressionResultsWrapper at 0x1e7503f479
0>,
   array([[0., 1., 0.]])])}
```

In conclusion, the Granger causality tests tell us that Fox News had **very little influence** on Trump with regards to his talk about immigration. There are, however, alternative explanations that can be explored to investigate any potential causality further:

- There could be a greater time delay between the Granger causation, something that can be tested for by inputting different time lags between the time series datasets.
- Trump tweeting/mentioning Fox News in his tweets may not be a good enough indicator of him being influenced by them. We do not know average sentiment within the tweets these mentions were made, neither has there been any text analysis to better understand the context in which these tweets have been made.