In [1]:
```python
import pandas as pd
import matplotlib
import matplotlib.pyplot as plt
import numpy as np; np.random.seed(0)
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sb
```

In [2]:
```python
df = pd.read_csv("covid19_tweets.csv")
newdf = df.copy()
newdf = newdf.drop(['user_name','user_location','user_description','user_created','user
df.head()
```

Out[2]:

	user_name	user_location	user_description	user_created	user_followers	user_friends	user_favouri
0	ᏉᎥ☻լꂅϮ	astroworld	wednesday addams as a disney princess keepin i...	2017-05-26 05:46:42	624	950	187
1	Tom Basile us	New York, NY	Husband, Father, Columnist & Commentator. Auth...	2009-04-16 20:06:23	2253	1677	
2	Time4fisticuffs	Pewee Valley, KY	#Christian #Catholic #Conservative #Reagan #Re...	2009-02-28 18:57:41	9275	9525	72
3	ethel mertz	Stuck in the Middle	#Browns #Indians #ClevelandProud #[]_[] #Cavs ...	2019-03-07 01:45:06	197	987	14
4	DIPR-J&K	Jammu and Kashmir	🖊️Official Twitter handle of Department of Inf...	2017-02-12 06:45:15	101009	168	1

In [3]:
```python
import re
def clean_text(s):
    s = s.replace("Covid19","COVID19")
    s = s.replace("covid19","COVID19")
    s = s.replace("coronavirus","COVID19")
    s = s.replace('#','')
    s = s.replace('📍',"")
    s = s.replace('🏫',"")
    s = s.replace('💯',"")
    s = s.replace('🧵',"")
    s = s.replace('🔊',"")
    s = s.replace("●", "")
    s = s.replace("♡", "")
    s = s.replace("🙃", "")
    s = s.replace("🤔", "")
    s = s.replace("😉", "")
    s = s.replace("⬇", "")
    s = s.replace("🔴", "")
    s = s.replace("🤷", "")
    s = s.replace("🐞", "")
    s = s.replace("🚨", "")
    s = s.replace("🙌", "")
    s = s.replace("👑", "")
    s = s.replace("🔥", "")
    s = s.replace("👇", "")
    s = s.replace("👀", "")
    s = s.replace('ðŸ�ž', "")
    s = s.replace('ðŸ¤·â€�â™', "")
    s = s.replace("ðŸ”´", "")
    s = s.replace("€™", "")
    s = s.replace("ƒ¼", "")
    s = s.replace("â€˜", "")
    s = s.replace("â€™", "")
    s = s.replace("ðŸ˜˜", "")
    s = s.replace("ðŸ”Š", "")
    s = s.replace("&amp;", "&")
    s = s.replace("ðŸ§©", "")
    s = s.replace(":", "")
    s = s.replace(";", "")
    s = s.replace("'", "")
    s = s.replace("|", "")
    s = s.replace("//", "")
    s = s.replace("/", "")
    s = s.replace("-", "")
    s = s.replace("\n", "")
    s = s.replace("https", "")
    return str(s)
```

In [4]:
```
def clean_tags(s):
    s = str(s).upper()
    s = s.replace("[", "")
    s = s.replace("]", "")
    s = s.replace("'", "")
    s = s.replace("CORONAVIRUS","COVID19")
    s = s.replace("CORONAVIRUS, COVID19","COVID19")
    s = s.replace("COVID19, COVID19","COVID19")

    return str(s).upper()
```

In [5]:
```
df["plaintext"] = ''
df["plainhashtags"] = ''
for i, row in df.iterrows():
    df.at[i, "plain_text"] = clean_text(row.text)
    df.at[i, "plain_hashtags"] = clean_tags(row.hashtags)
```

In [6]:
```
df.head()
```

Out[6]:

	user_name	user_location	user_description	user_created	user_followers	user_friends	user_favouri
0	Ꮙi☻⌊ℭ†	astroworld	wednesday addams as a disney princess keepin i...	2017-05-26 05:46:42	624	950	187

	user_name	user_location	user_description	user_created	user_followers	user_friends	user_favouri
1	Tom Basile us	New York, NY	Husband, Father, Columnist & Commentator. Auth...	2009-04-16 20:06:23	2253	1677	
2	Time4fisticuffs	Pewee Valley, KY	#Christian #Catholic #Conservative #Reagan #Re...	2009-02-28 18:57:41	9275	9525	72
3	ethel mertz	Stuck in the Middle	#Browns #Indians #ClevelandProud #[]_[] #Cavs ...	2019-03-07 01:45:06	197	987	14
4	DIPR-J&K	Jammu and Kashmir	✏Official Twitter handle of Department of Inf...	2017-02-12 06:45:15	101009	168	1

In [7]:
```python
import spacy
nlp = spacy.load('en_core_web_sm')
for i, row in df.iterrows():
    #if i % 1000 == 0:
       # print(i)
    if(row["plain_text"] and len(str(row["plain_text"])) < 1000000):
        doc = nlp(str(row["plain_text"]))
        adjectives = []
        nouns = []
        verbs = []
        lemmas = []

        for token in doc:
            lemmas.append(token.lemma_)
            if token.pos_ == "ADJ":
                adjectives.append(token.lemma_)
            if token.pos_ == "NOUN" or token.pos_ == "PROPN":
                nouns.append(token.lemma_)
            if token.pos_ == "VERB":
                verbs.append(token.lemma_)

        df.at[i, "selftext_lemma"] = " ".join(lemmas)
        df.at[i, "selftext_nouns"] = " ".join(nouns)
        df.at[i, "selftext_adjectives"] = " ".join(adjectives)
        df.at[i, "selftext_verbs"] = " ".join(verbs)
        df.at[i, "selftext_nav"] = " ".join(nouns+adjectives+verbs)
        df.at[i, "no_tokens"] = len(lemmas)
```

In [8]:
```python
df['plain_hashtags'].nunique()
```

Out[8]:
```
21669
```

In [9]:
```python
# group by category, count distinct user locations and user posts
cat_df = df.groupby('plain_hashtags') \
           .agg({'user_location': pd.Series.nunique,
                 'user_name': pd.Series.count}) \
           .rename(columns={'user_location': 'num_locations',
                            'user_name': 'num_posts'}) \
           .sort_values('num_posts', ascending=False)

# show top 5 records
cat_df.head(8)
```

Out[9]:

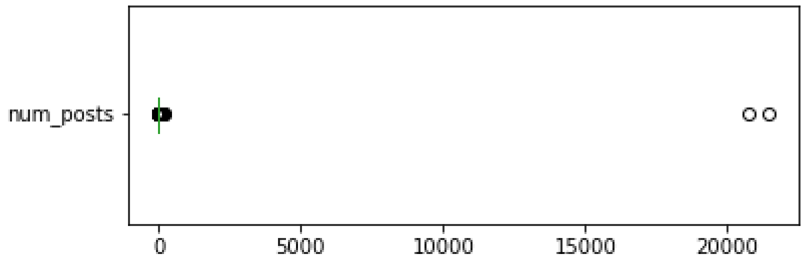
plain_hashtags	num_locations	num_posts
NAN	5847	21434
COVID19	5785	20747
COVID19UPDATE, COVID19PANDEMIC	0	181
COVID19UPDATES, COVID19	43	163
INDIAFIGHTSCORONA, COVID19	35	113
COVID19, PANDEMIC	66	113
MONEYFORTHEPEOPLE, COVID19	66	94
COVID19, COVID_19	28	82

In [10]:
```
cat_df.describe()
```

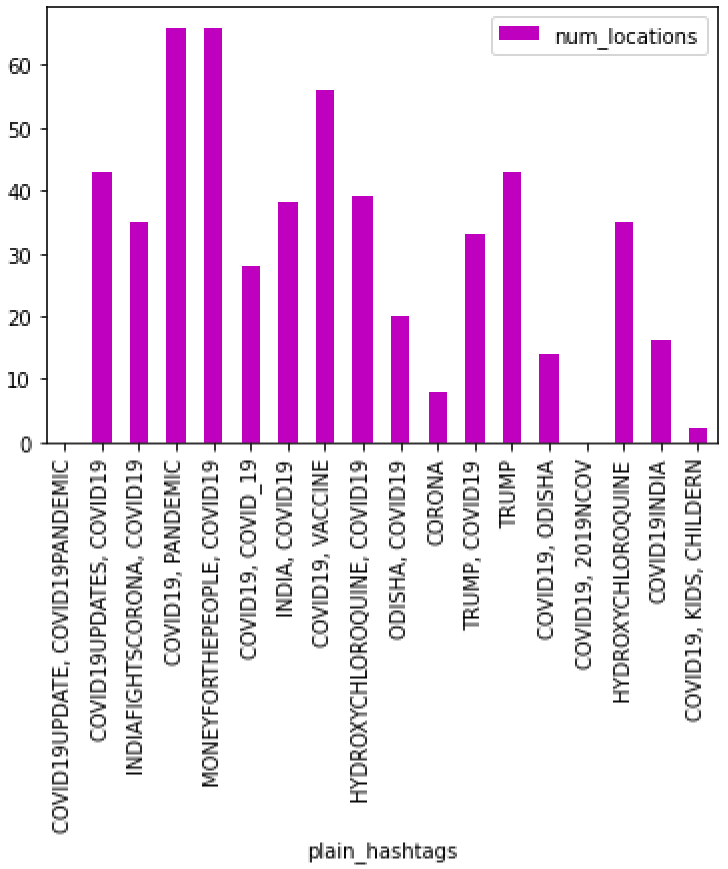
Out[10]:

	num_locations	num_posts
count	21669.000000	21669.000000
mean	1.581891	3.435138
std	55.889327	202.654735
min	0.000000	1.000000
25%	1.000000	1.000000
50%	1.000000	1.000000
75%	1.000000	1.000000
max	5847.000000	21434.000000

In [11]:
```
cat_df[['num_posts']].plot(kind='box', vert=False, figsize=(6, 2));
```



In [12]:
```
cat_df[['num_locations']][2:20].plot(kind='bar', color = 'm');
```



In [13]:
```
# create a data frame slice
sub_df = df[df['plain_hashtags']=='COVID19']

# sample cleaned text and tokens tagged as nouns
sub_df[['plain_text', 'selftext_nouns']].sample(2)
```

Out[13]:

	plain_text	selftext_nouns
43128	So its safe enough to open schools and send fo...	school work covid19 election t.colHJpbY78Pg
37897	Watch ER Doctor 'We Are Not Overwhelming the ...	ER doctor Health Care System Lies COVID19 t.co...

In [14]:
```
def my_tokenizer(text):
    return text.split() if text != None else []
```

In [15]:
```
tokens = sub_df.selftext_nouns.map(my_tokenizer).sum()
```

In [16]:
```
from collections import Counter

counter = Counter(tokens)
counter.most_common(20)
```

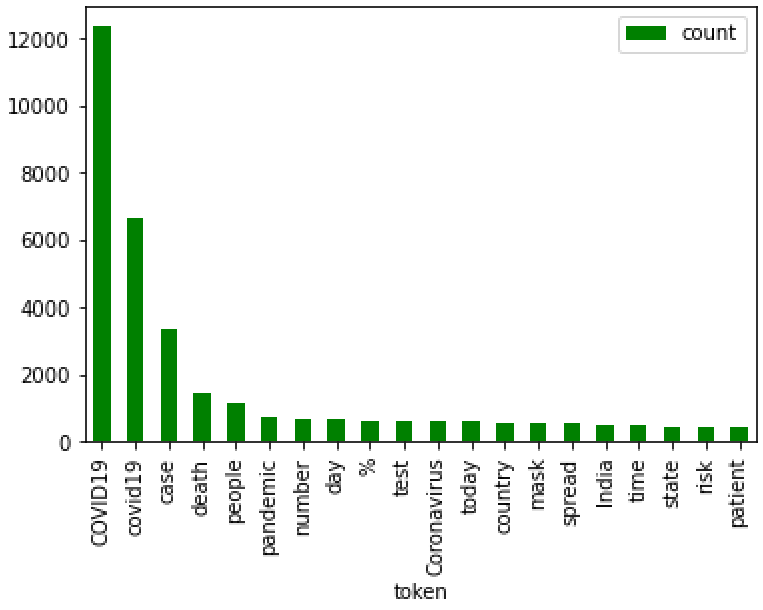
Out[16]:
```
[('COVID19', 12375),
 ('covid19', 6631),
 ('case', 3336),
 ('death', 1422),
 ('people', 1140),
 ('pandemic', 740),
 ('number', 684),
 ('day', 654),
 ('%', 601),
 ('test', 593),
 ('Coronavirus', 587),
 ('today', 587),
 ('country', 539),
 ('mask', 539),
 ('spread', 516),
 ('India', 482),
 ('time', 478),
 ('state', 443),
 ('risk', 439),
 ('patient', 433)]
```

In [17]:

```
from spacy.lang.en.stop_words import STOP_WORDS

def remove_stopwords(tokens):
    """Remove stopwords from a list of tokens."""
    return [t for t in tokens if t not in STOP_WORDS]

# rebuild counter
counter = Counter(remove_stopwords(tokens))
```

In [18]:

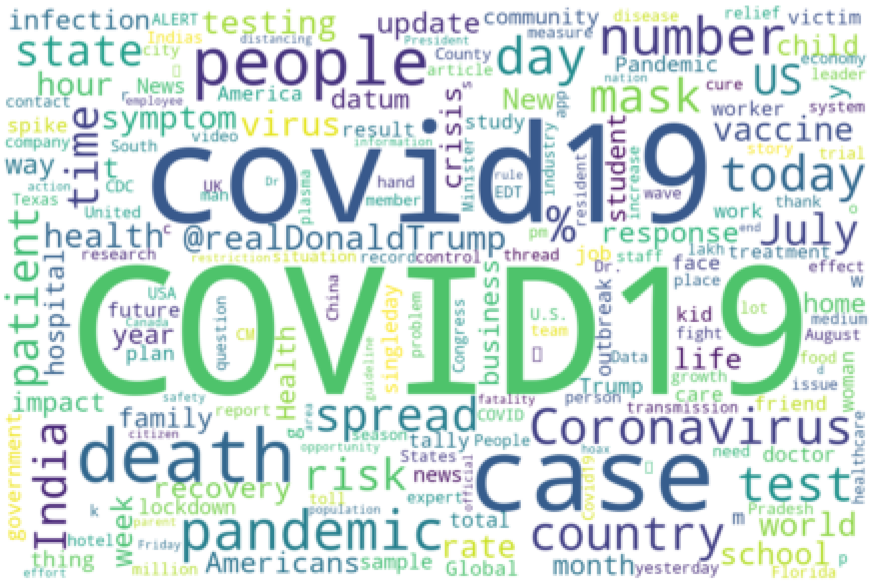
```
# convert list of tuples into data frame
freq_df = pd.DataFrame.from_records(counter.most_common(20),
                                    columns=['token', 'count'])

# create bar plot
freq_df.plot(kind='bar', x='token', color = 'g');
```



In [19]:

```
from wordcloud import WordCloud

def wordcloud(counter):
    wc = WordCloud(width=1200, height=800,
                   background_color="white",
                   max_words=200)
    wc.generate_from_frequencies(counter)

    # Plot
    fig=plt.figure(figsize=(6, 4))
    plt.imshow(wc, interpolation='bilinear')
    plt.axis("off")
    plt.tight_layout(pad=0)
    plt.show()
```

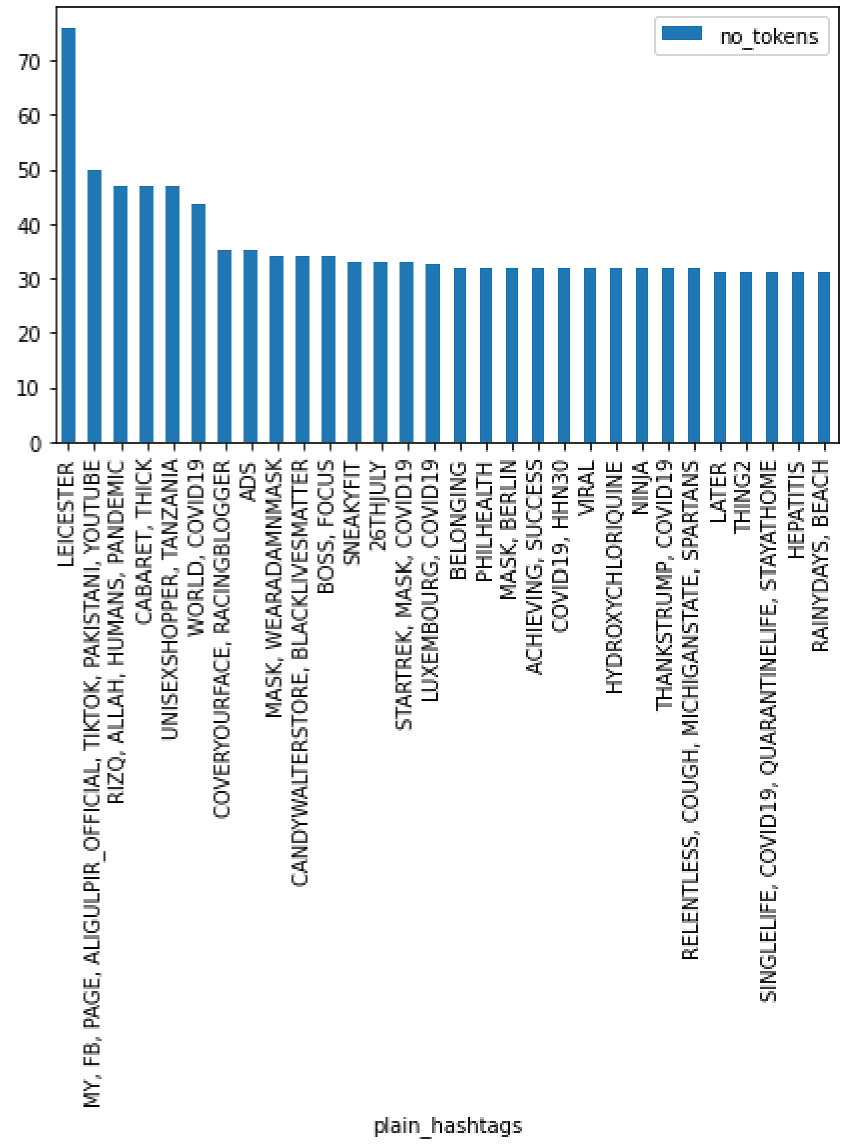
In [20]:
```
wordcloud(counter)
```



In [21]:
```
df['no_tokens'] = df.selftext_lemma\
  .map(lambda l: 0 if l==None else len(l.split()))
```

In [22]:
```
# mean number of tokens by category
prueba = df.groupby(['plain_hashtags']) \
  .agg({'no_tokens':'mean'}) \
  .sort_values(by='no_tokens', ascending=False);
prueba[:30].plot(kind='bar', figsize=(7,4))
```

Out[22]:
```
<AxesSubplot:xlabel='plain_hashtags'>
```



In [23]:
```
df.head()
```

Out[23]:

	user_name	user_location	user_description	user_created	user_followers	user_friends	user_favouri
0	ᏉᎥ☻ɭ€Ϯ	astroworld	wednesday addams as a disney princess keepin i...	2017-05-26 05:46:42	624	950	187
1	Tom Basile us	New York, NY	Husband, Father, Columnist & Commentator. Auth...	2009-04-16 20:06:23	2253	1677	
2	Time4fisticuffs	Pewee Valley, KY	#Christian #Catholic #Conservative #Reagan #Re...	2009-02-28 18:57:41	9275	9525	72
3	ethel mertz	Stuck in the Middle	#Browns #Indians #ClevelandProud #[]_[] #Cavs ...	2019-03-07 01:45:06	197	987	14

	user_name	user_location	user_description	user_created	user_followers	user_friends	user_favouri
4	DIPR-J&K	Jammu and Kashmir	🖉 Official Twitter handle of Department of Inf...	2017-02-12 06:45:15	101009	168	1

5 rows × 23 columns

In [24]:
```
df.describe()
```

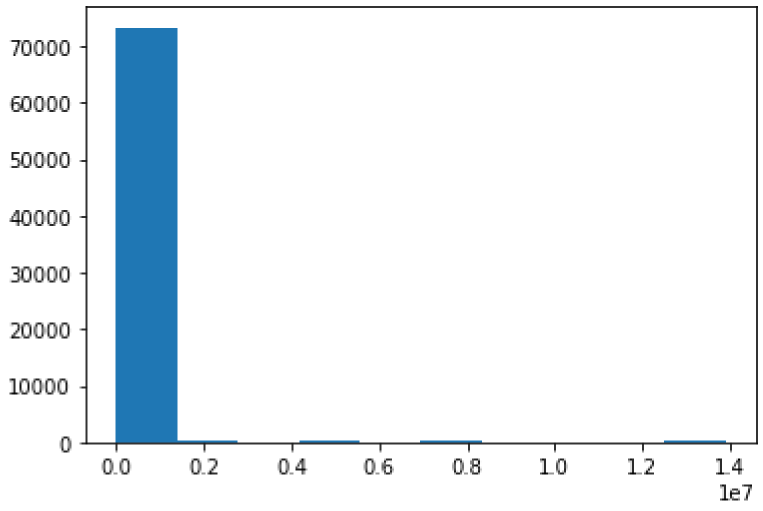
Out[24]:

	user_followers	user_friends	user_favourites	no_tokens
count	7.443600e+04	74436.000000	7.443600e+04	74436.000000
mean	1.059513e+05	2154.721170	1.529747e+04	19.765812
std	8.222900e+05	9365.587474	4.668971e+04	5.178983
min	0.000000e+00	0.000000	0.000000e+00	2.000000
25%	1.660000e+02	153.000000	2.200000e+02	17.000000
50%	9.600000e+02	552.000000	1.927000e+03	21.000000
75%	5.148000e+03	1780.250000	1.014800e+04	23.000000
max	1.389284e+07	497363.000000	2.047197e+06	76.000000

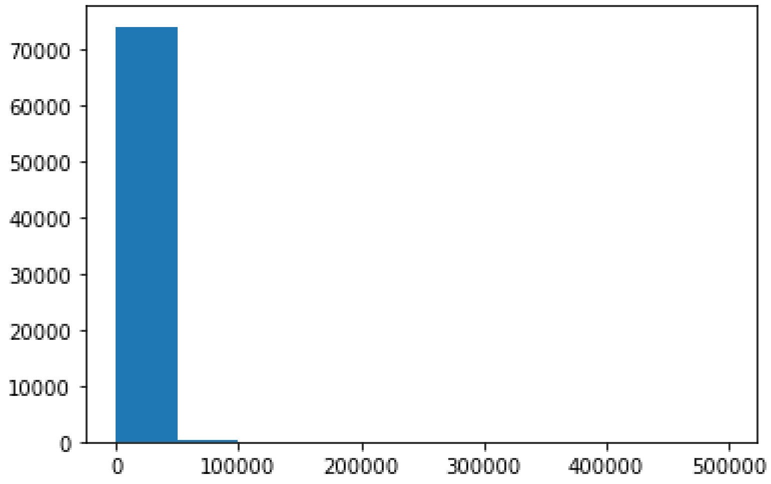
In [25]:
```
df.columns
```

Out[25]:
```
Index(['user_name', 'user_location', 'user_description', 'user_created',
       'user_followers', 'user_friends', 'user_favourites', 'user_verified',
       'date', 'text', 'hashtags', 'source', 'is_retweet', 'plaintext',
       'plainhashtags', 'plain_text', 'plain_hashtags', 'selftext_lemma',
       'selftext_nouns', 'selftext_adjectives', 'selftext_verbs',
       'selftext_nav', 'no_tokens'],
      dtype='object')
```

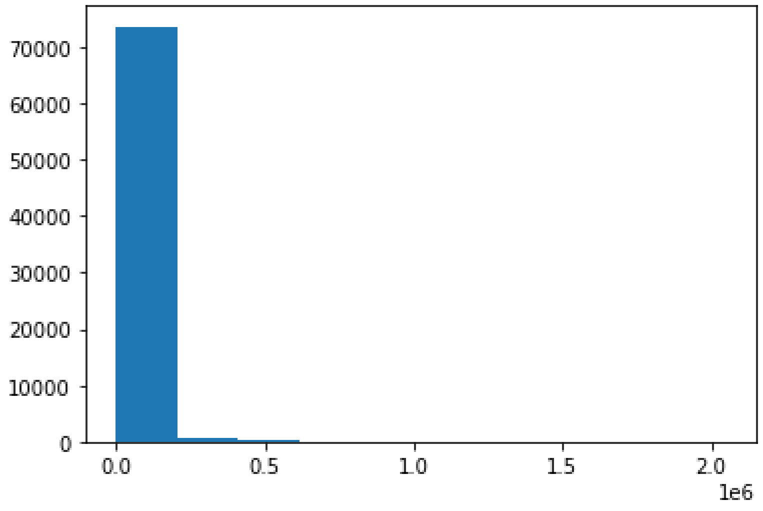
In [26]:
```
c1 = df['user_followers']
c2 = df['user_friends']
c3 = df['user_favourites']


hist = plt.hist(c1)
```



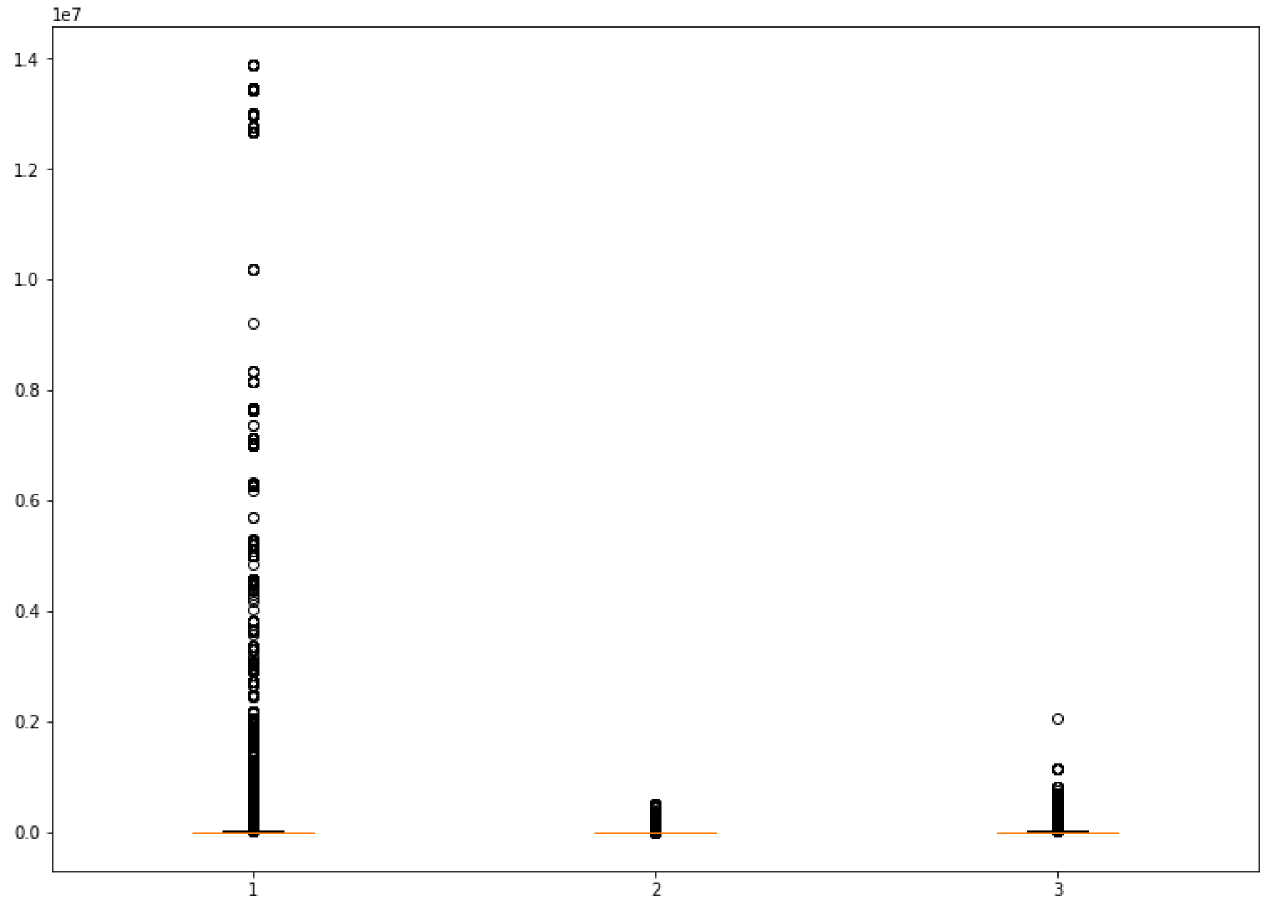
In [27]:
```
hist = plt.hist(c2)
```



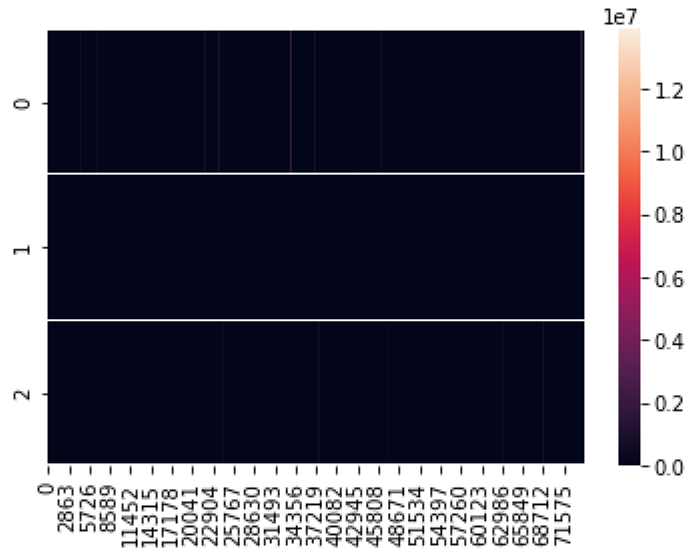
In [28]:
```
hist = plt.hist(c3)
```



In [29]:
```
myData = [c1, c2, c3]
fig = plt.figure(figsize=(10,7))
ax = fig.add_axes([0, 0, 1, 1])
bp = ax.boxplot(myData)
plt.show()
```



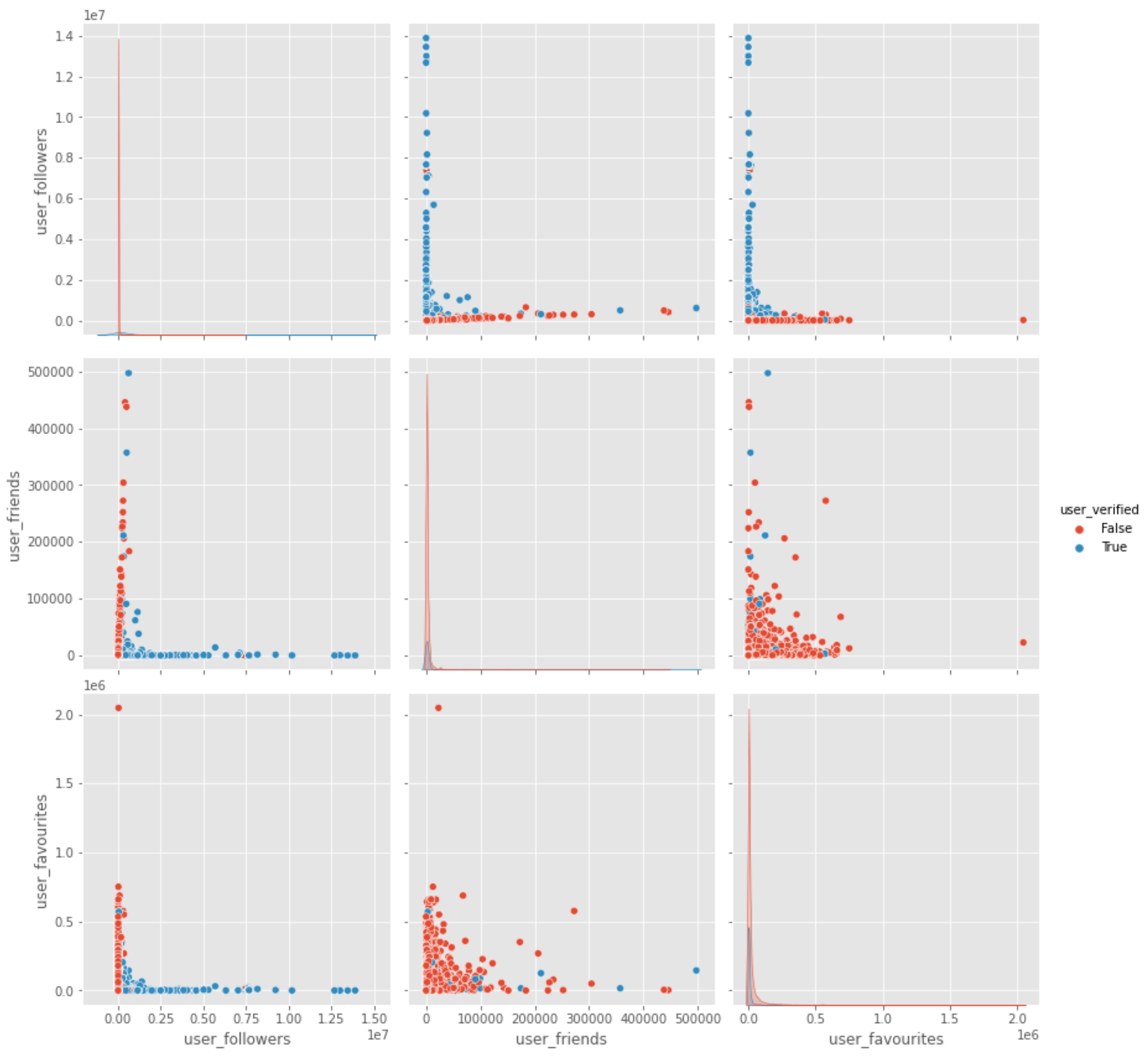
In [30]:
```
hplot=[c1, c2, c3]
ax = sb.heatmap(hplot)
plt.show()
```



In [31]:
```
from sklearn.cluster import KMeans
from sklearn.metrics import pairwise_distances_argmin_min

%matplotlib inline
from mpl_toolkits.mplot3d import Axes3D
plt.rcParams['figure.figsize'] = (16, 9)
plt.style.use('ggplot')
```

In [32]:
```
sb.pairplot(df.dropna(), hue='user_verified',height=4,vars=["user_followers","user_frie
```

Out[32]:
```
<seaborn.axisgrid.PairGrid at 0x254081e86d0>
```

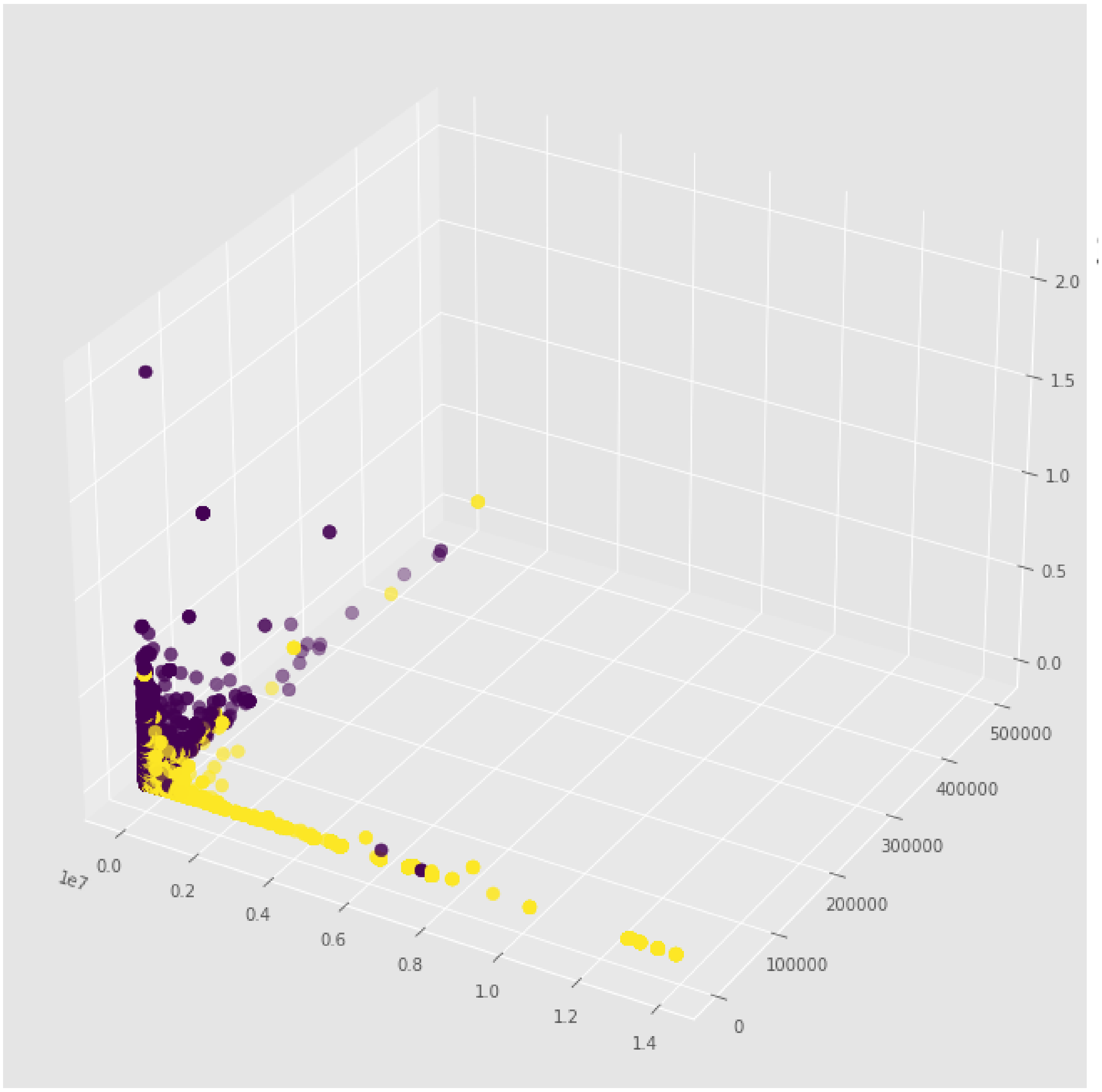


In [33]:
```
X = np.array(df[["user_followers","user_friends","user_favourites"]])
y = np.array(df['user_verified'])
X.shape
print(len(y))
```

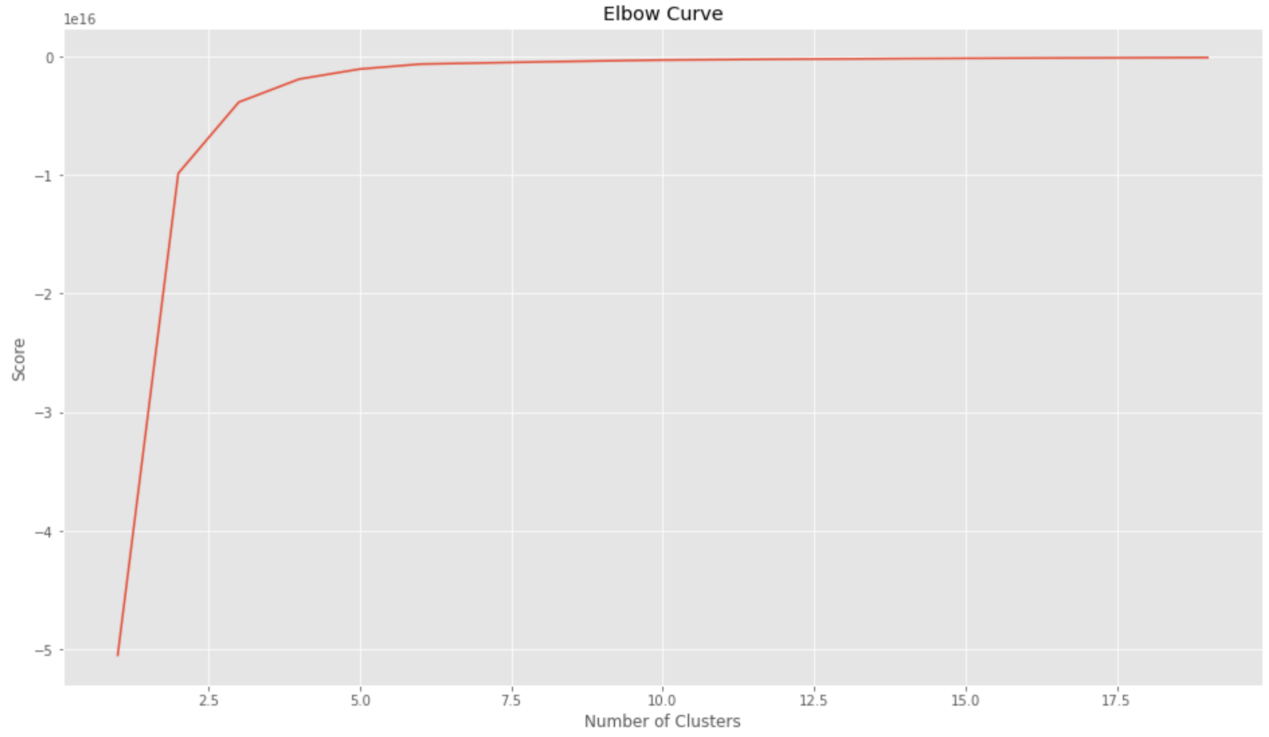
```
74436
```

In [34]:
```
fig = plt.figure()
ax = Axes3D(fig)
asignar=[]
for row in y:
    asignar.append(row)
ax.scatter(X[:, 0], X[:, 1], X[:, 2], c=asignar,s=60)
```

Out[34]:
```
<mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x2540d6aba00>
```



In [35]:
```
Nc = range(1, 20)
kmeans = [KMeans(n_clusters=i) for i in Nc]
kmeans
score = [kmeans[i].fit(X).score(X) for i in range(len(kmeans))]
score
plt.plot(Nc,score)
plt.xlabel('Number of Clusters')
plt.ylabel('Score')
plt.title('Elbow Curve')
plt.show()
```

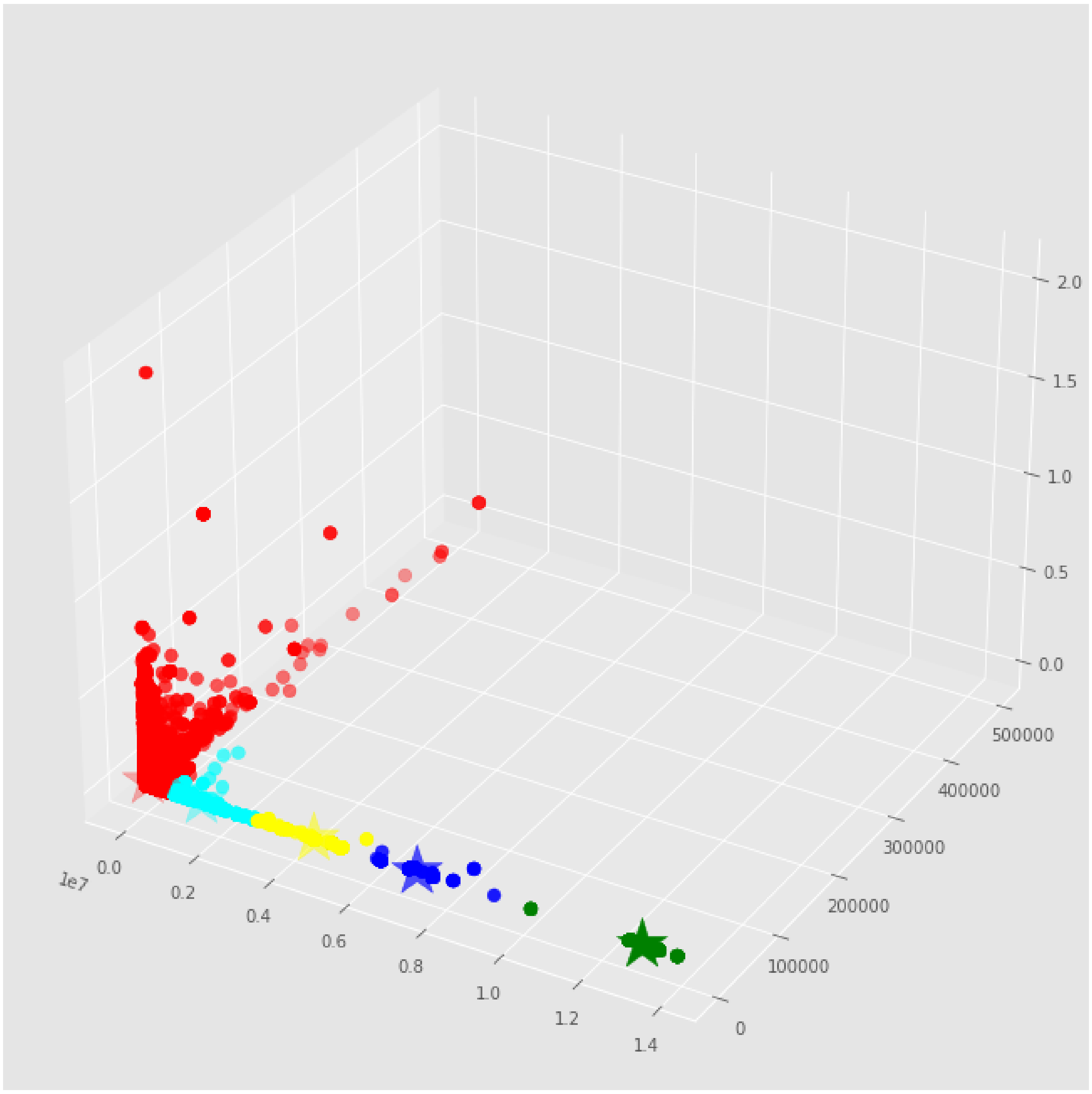


In [36]:
```
kmeans = KMeans(n_clusters=5).fit(X)
centroids = kmeans.cluster_centers_
print(centroids)
```

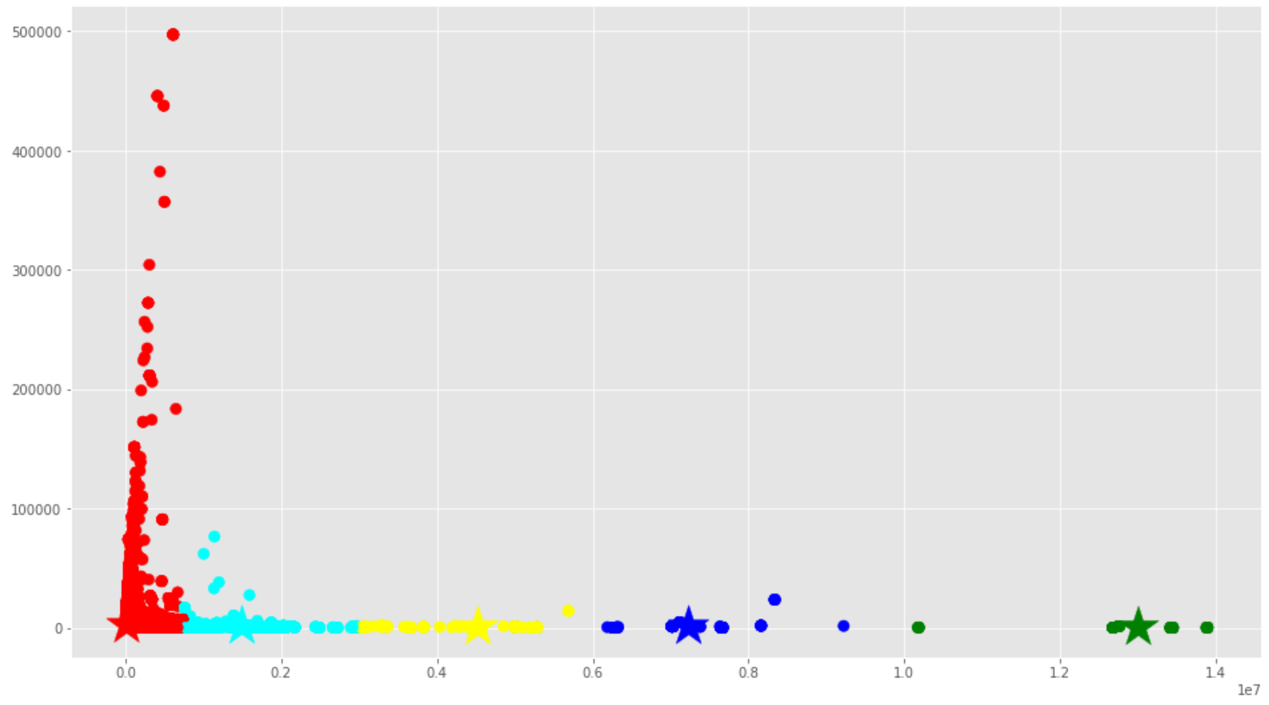
```
[[1.62123806e+04 2.18009121e+03 1.55466387e+04]
 [1.30086912e+07 2.19937888e+02 8.03913043e+01]
 [7.23356640e+06 9.89986441e+02 2.55654915e+03]
 [1.49737634e+06 1.25520724e+03 4.73517978e+03]
 [4.52857518e+06 4.74606383e+02 2.90532270e+03]]
```

In [37]:
```
# Predicting the clusters
labels = kmeans.predict(X)
# Getting the cluster centers
C = kmeans.cluster_centers_
colores=['red','green','blue','cyan','yellow']
asignar=[]
for row in labels:
    asignar.append(colores[row])
fig = plt.figure()
ax = Axes3D(fig)
ax.scatter(X[:, 0], X[:, 1], X[:, 2], c=asignar,s=60)
ax.scatter(C[:, 0], C[:, 1], C[:, 2], marker='*', c=colores, s=1000)
```

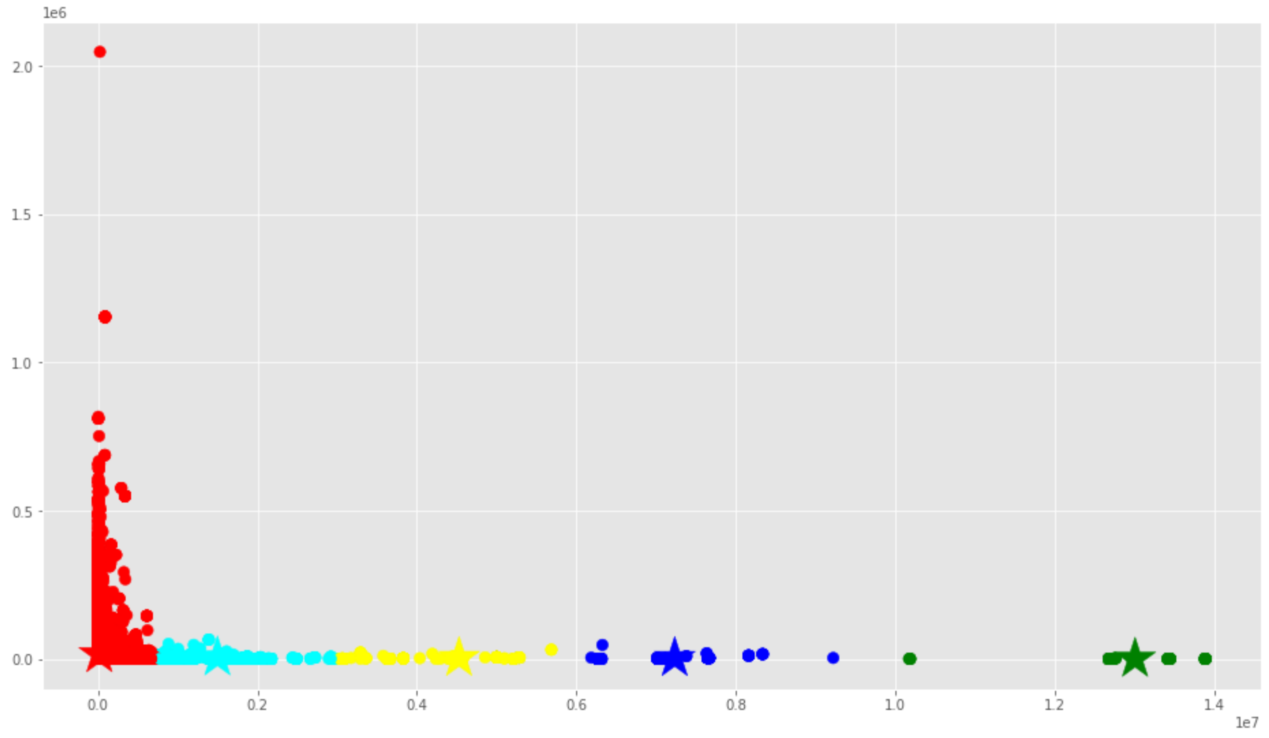
Out[37]:
```
<mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x2540d9153a0>
```



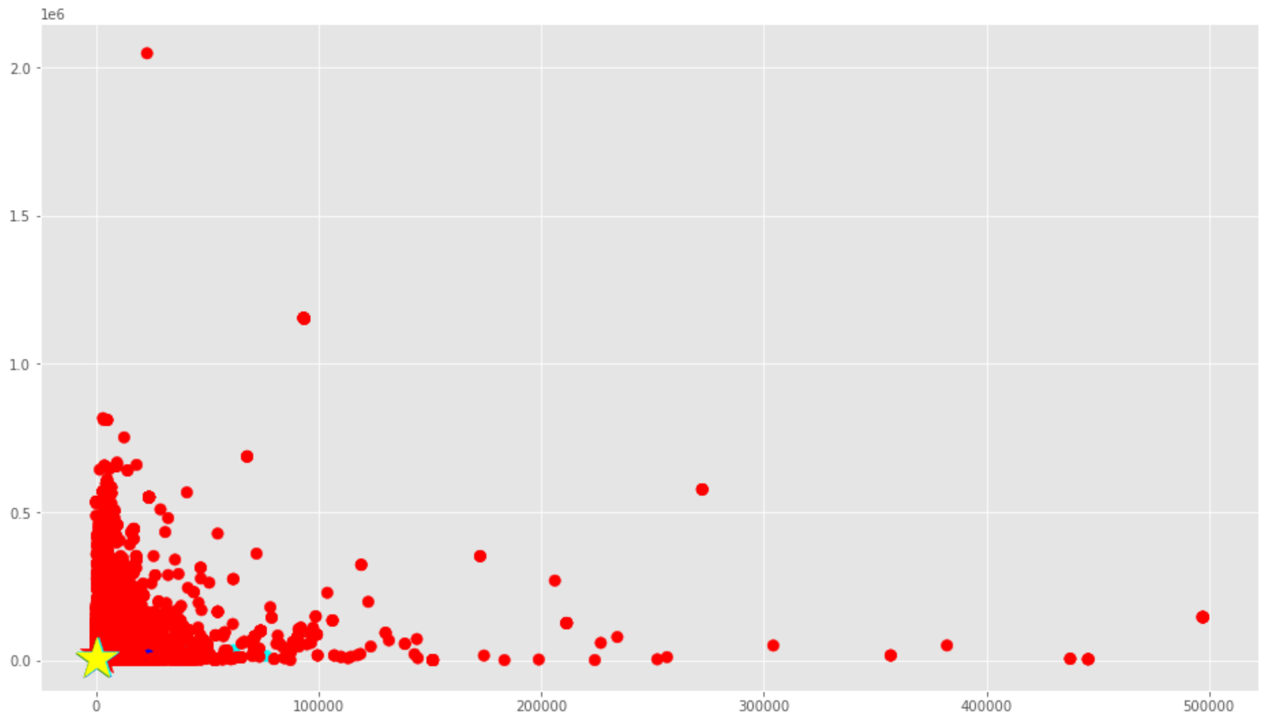
In [39]:
```
f1 = df['user_followers'].values
f2 = df['user_friends'].values
plt.scatter(f1, f2, c=asignar, s=70)
plt.scatter(C[:, 0], C[:, 1], marker='*', c=colores, s=1000)
plt.show()
```



In [40]:
```
f1 = df['user_followers'].values
f2 = df['user_favourites'].values
plt.scatter(f1, f2, c=asignar, s=70)
plt.scatter(C[:, 0], C[:, 2], marker='*', c=colores, s=1000)
plt.show()
```



In [41]:
```
f1 = df['user_friends'].values
f2 = df['user_favourites'].values
plt.scatter(f1, f2, c=asignar, s=70)
plt.scatter(C[:, 1], C[:, 2], marker='*', c=colores, s=1000)
plt.show()
```



In [42]:
```
copy = pd.DataFrame()
copy['user_verified']=df['user_verified'].values
copy['user_verified']=df['user_verified'].values
copy['label'] = labels;
cantidadGrupo = pd.DataFrame()
cantidadGrupo['color']=colores
cantidadGrupo['user_verified']=copy.groupby('label').size()
cantidadGrupo
```

Out[42]:

	color	user_verified
0	red	72897
1	green	161
2	blue	295
3	cyan	801
4	yellow	282

In [43]:
```
group_referrer_index = copy['label'] == 0
group_referrals = copy[group_referrer_index]
diversidadGrupo = pd.DataFrame()
diversidadGrupo['cantidad']=group_referrals.groupby('user_verified').size()
diversidadGrupo
```

Out[43]:

	cantidad
user_verified	
False	65069
True	7828

In [44]:
```
closest, _ = pairwise_distances_argmin_min(kmeans.cluster_centers_, X)
```

```
closest
```

Out[44]:
```
array([33916, 70675, 21017, 69690, 32871], dtype=int64)
```

In [45]:
```
users = df['user_followers'].values
for row in closest:
    print(users[row])
```

```
15615
12997738
7114528
1470499
4528913
```

In [46]:
```
X_new = np.array([[1.5,8500000,200050]]) #nuevo objeto
new_labels = kmeans.predict(X_new)
print(new_labels)
```

```
[0]
```

In [ ]: