Assignment 2

Part 1

In [2]:
```
import pandas as pd #importing the library pandas to be able to analyze the a
df=pd.read_csv('results.csv') #importing the data into python
```

In [3]:
```
df.head() #viewing the first 5 rows of the data
```

Out[3]:

	date	home_team	away_team	home_score	away_score	tournament	city	country	n
0	1872-11-30	Scotland	England	0	0	Friendly	Glasgow	Scotland	
1	1873-03-08	England	Scotland	4	2	Friendly	London	England	
2	1874-03-07	Scotland	England	2	1	Friendly	Glasgow	Scotland	
3	1875-03-06	England	Scotland	2	2	Friendly	London	England	
4	1876-03-04	Scotland	England	3	0	Friendly	Glasgow	Scotland	

In [4]:
```
x=df['home_score']-df['away_score'] #the variable x is the diffrence between
```

In [5]:
```
x[0:5]
```

Out[5]:
```
0    0
1    2
2    1
3    0
4    3
dtype: int64
```

In [6]:
```
import numpy as np
conditions=[(x<0),(x>0),(x==0)]
values=['lose','win','draw']
```

In [7]:
```
df['results_home']=np.select(conditions,values)
```

In [8]:
```
df.head()
```

Out[8]:

	date	home_team	away_team	home_score	away_score	tournament	city	country	n
0	1872-11-30	Scotland	England	0	0	Friendly	Glasgow	Scotland	
1	1873-03-08	England	Scotland	4	2	Friendly	London	England	
2	1874-03-07	Scotland	England	2	1	Friendly	Glasgow	Scotland	
3	1875-03-06	England	Scotland	2	2	Friendly	London	England	
4	1876-03-04	Scotland	England	3	0	Friendly	Glasgow	Scotland	

In [9]:
```
df['results_home'].value_counts()
```

Out[9]:
```
win     21009
lose    12224
draw     9955
Name: results_home, dtype: int64
```

In [10]:
```
df['results_home'].value_counts(normalize=True)
```

Out[10]:
```
win     0.486455
lose    0.283042
draw    0.230504
Name: results_home, dtype: float64
```

In [11]:
```
x=df['results_home'].value_counts()
```

In [12]:
```
x=np.array(x)
x
```

Out[12]:
```
array([21009, 12224,  9955], dtype=int64)
```

In [13]:
```
x.sum()
```

Out[13]:
```
43188
```

In [14]:
```
df_noneutral=df[df['neutral']==False]
df_noneutral.shape
```

Out[14]:
```
(32481, 10)
```

In [15]:
```
df_noneutralbraz=df_noneutral[df_noneutral['country']=='Brazil'] #probability
df_noneutralbraz
```

Out[15]:

	date	home_team	away_team	home_score	away_score	tournament	city	co
503	5/11/1919	Brazil	Chile	6	0	Copa América	Rio de Janeiro	
508	5/18/1919	Brazil	Argentina	3	1	Copa América	Rio de Janeiro	
512	5/26/1919	Brazil	Uruguay	2	2	Copa América	Rio de Janeiro	
513	5/29/1919	Brazil	Uruguay	1	0	Copa América	Rio de Janeiro	
515	6/1/1919	Brazil	Argentina	3	3	Friendly	Rio de Janeiro	
...	...	...	...	...	...	...	...	
42513	7/5/2021	Brazil	Peru	1	0	Copa América	Rio de Janeiro	
42529	7/10/2021	Brazil	Argentina	0	1	Copa América	Rio de Janeiro	
42756	9/9/2021	Brazil	Peru	2	0	FIFA World Cup qualification	Recife	
42916	10/14/2021	Brazil	Uruguay	4	1	FIFA World Cup qualification	Manaus	
42956	11/11/2021	Brazil	Colombia	1	0	FIFA World Cup qualification	São Paulo	

354 rows × 10 columns

In [16]:
```
df_noneutralbrazFriendly=df_noneutralbraz[df_noneutralbraz['tournament']=='Fr
df_noneutralbrazFriendly #probability of Brazil Winning in their land in frie
```

Out[16]:

	date	home_team	away_team	home_score	away_score	tournament	city	co
515	6/1/1919	Brazil	Argentina	3	3	Friendly	Rio de Janeiro	
681	10/29/1922	Brazil	Paraguay	3	1	Friendly	São Paulo	
1334	8/1/1930	Brazil	France	3	2	Friendly	Rio de Janeiro	
1338	8/10/1930	Brazil	Yugoslavia	4	1	Friendly	Rio de Janeiro	
1341	8/17/1930	Brazil	United States	4	3	Friendly	Rio de Janeiro	
...	...	...	...	...	...	...	...	
37054	6/7/2015	Brazil	Mexico	2	0	Friendly	São Paulo	
37074	6/10/2015	Brazil	Honduras	1	0	Friendly	Porto Alegre	
38756	1/26/2017	Brazil	Colombia	1	0	Friendly	Rio de Janeiro	
40804	6/5/2019	Brazil	Qatar	2	0	Friendly	Brasília	
40870	6/9/2019	Brazil	Honduras	7	0	Friendly	Porto Alegre	

187 rows × 10 columns

In [17]:
```
x=df_noneutralbrazFriendly['results_home'].value_counts(normalize=True)
x
```

Out[17]:
```
win     0.754011
draw    0.192513
lose    0.053476
Name: results_home, dtype: float64
```

In [18]:
```
import statsmodels.api as sm
from statsmodels.stats.proportion import proportion_confint
x=df_noneutralbrazFriendly['results_home'].value_counts()
x=np.array(x)
x
```

Out[18]:
```
array([141,  36,  10], dtype=int64)
```

In [20]:
```
N=x.sum()
CI_braz=proportion_confint(count=x[0], nobs=N, alpha=(1-.95))
CI_braz
```

Out[20]: (0.6922838397217296, 0.815737550652602)

This means there is a 95% probability that Brazil winning in a friendly tournament will fall between the upper and lower bound of this interval.

In [21]:
```
df_noneutralgre=df_noneutral[df_noneutral['country']=='Greece']
```

In [25]:
```
df_noneutralgreFriendly=df_noneutralgre[df_noneutralgre['tournament']=='Frier
```

In [26]:
```
df_noneutralgreFriendly.shape
```

Out[26]: (126, 10)

In [28]:
```
df_noneutralgreFriendly['results_home'].value_counts(normalize=True)
x=df_noneutralgreFriendly['results_home'].value_counts()
x=np.array(x)
N=x.sum()
CI_greece=proportion_confint(count=x[0], nobs=N, alpha=(1-.95))
CI_greece
```

Out[28]: (0.3114005769651982, 0.4822502166855954)

There is a 95% probability of Greece winning in a friendly tournament will fall between the upper and lower bound of this interval.

In [32]:
```
df_noneutralegy=df_noneutral[df_noneutral['country']=='Egypt']
df_noneutralegyFriendly=df_noneutralegy[df_noneutralegy['tournament']=='Frier
df_noneutralegyFriendly['results_home'].value_counts(normalize=True)
```

Out[32]:
```
win     0.551724
lose    0.241379
draw    0.206897
Name: results_home, dtype: float64
```

In [33]:
```
x=df_noneutralegyFriendly['results_home'].value_counts()
x=np.array(x)
N=x.sum()
CI_egy=proportion_confint(count=x[0], nobs=N, alpha=(1-.95))
CI_egy
```

Out[33]:
```
(0.47077769679111225, 0.6326705790709567)
```

In [35]:
```
ci_friendly = {}
ci_friendly['country'] = ['Brazil','Greece','Egypt']
ci_friendly['lb'] = [CI_braz[0],CI_greece[0],CI_egy[0]]
ci_friendly['ub'] = [CI_braz[1],CI_greece[1],CI_egy[1]]
df_ci= pd.DataFrame(ci_friendly)
df_ci
```

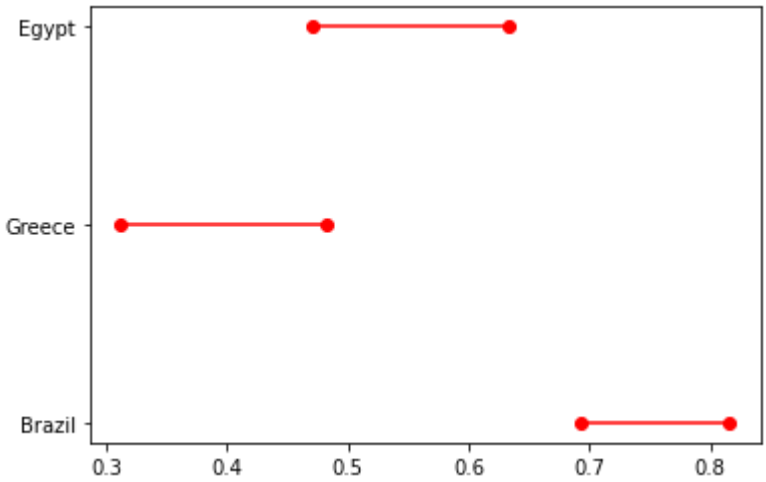
Out[35]:

	country	lb	ub
0	Brazil	0.692284	0.815738
1	Greece	0.311401	0.482250
2	Egypt	0.470778	0.632671

In [45]:
```
from scipy.stats import norm,t
import statsmodels.api as sm
from statsmodels.stats.proportion import proportion_confint
import matplotlib.pyplot as plt
from pandas.api.types import CategoricalDtype
```

In [38]:
```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['country']))
```

Out[38]:
```
([<matplotlib.axis.YTick at 0x19642985340>,
  <matplotlib.axis.YTick at 0x19642971b80>,
  <matplotlib.axis.YTick at 0x19642962a30>],
 [Text(0, 0, 'Brazil'), Text(0, 1, 'Greece'), Text(0, 2, 'Egypt')])
```



we can compute from this data that Brazil has the highest chance of winning a friendly match in their home land.This might be because of the extraordinary vibes of the fans cheering when they are playing in their own country.

In [22]:
```
l=list(df['tournament'].value_counts().index)
l
```

Out[22]:
```
['Friendly',
 'FIFA World Cup qualification',
 'UEFA Euro qualification',
 'African Cup of Nations qualification',
 'FIFA World Cup',
 'Copa América',
 'African Cup of Nations',
 'AFC Asian Cup qualification',
 'CECAFA Cup',
 'CFU Caribbean Cup qualification',
 'Merdeka Tournament',
 'British Championship',
 'Gulf Cup',
 'AFC Asian Cup',
 'Gold Cup',
 'Island Games',
 'UEFA Euro',
 'COSAFA Cup',
 'UEFA Nations League',
```

In [31]:
```
x=df['home_score']-df['away_score']
conditions=[(x<0),(x>0), (x==0)]
values=['win','lose','draw']
df['results_away']=np.select(conditions,values)
df
```

Out[31]:

	date	home_team	away_team	home_score	away_score	tournament	city
0	1872-11-30	Scotland	England	0	0	Friendly	Glasgow
1	1873-03-08	England	Scotland	4	2	Friendly	London
2	1874-03-07	Scotland	England	2	1	Friendly	Glasgow
3	1875-03-06	England	Scotland	2	2	Friendly	London
4	1876-03-04	Scotland	England	3	0	Friendly	Glasgow
...	...	...	...	...	...	...	...
43183	2/1/2022	Suriname	Guyana	2	1	Friendly	Paramaribo
43184	2/2/2022	Burkina Faso	Senegal	1	3	African Cup of Nations	Yaoundé
43185	2/3/2022	Cameroon	Egypt	0	0	African Cup of Nations	Yaoundé
43186	2/5/2022	Cameroon	Burkina Faso	3	3	African Cup of Nations	Yaoundé
43187	2/6/2022	Senegal	Egypt	0	0	African Cup of Nations	Yaoundé

43188 rows × 11 columns

In [33]:
```
df_noneutral=df[df['neutral']==False]
```

In [37]:
```
df_noneutralbrazil=df_noneutral[df_noneutral['away_team']=='Brazil']
df_noneutralbrazilFriendly=df_noneutralbrazil[df_noneutralbrazil['tournament'
x=df_noneutralbrazilFriendly['results_away'].value_counts()
x=np.array(x)
x
```

Out[37]:
```
array([98, 37, 37], dtype=int64)
```

In [38]:
```
N=x.sum()
CI_brazilFriendly=proportion_confint(count=x[2], nobs=N, alpha=(1-.95))
CI_brazilFriendly
```

Out[38]: (0.1537085316208902, 0.27652402651864466)

There is a 95% probability that Brazil losing in a friendly match as the away team falls between the upper and lower bound of this interval.

In [40]:
```
df_noneutralbrazil=df_noneutral[df_noneutral['away_team']=='Brazil']
df_noneutralbrazilFriendly=df_noneutralbrazil[df_noneutralbrazil['tournament'
x=df_noneutralbrazilFriendly['results_away'].value_counts()
x=np.array(x)
x
N=x.sum()
CI_brazilFIFA=proportion_confint(count=x[0], nobs=N, alpha=(1-.95))
CI_brazilFIFA
```

Out[40]: (0.35008783332691606, 0.6007318388042314)

There is a 95% probability that Brazil losing in the Fifa world cup qualifications as the away team falls between the upper and lower bound of this interval.

In [41]:
```
df_noneutralbrazil=df_noneutral[df_noneutral['away_team']=='Brazil']
df_noneutralbrazilCA=df_noneutralbrazil[df_noneutralbrazil['tournament']=='Co
x=df_noneutralbrazilCA['results_away'].value_counts()
x=np.array(x)
x
N=x.sum()
CI_brazilCA=proportion_confint(count=x[2], nobs=N, alpha=(1-.95))
CI_brazilCA
```

Out[41]: (0.0786225906928602, 0.37299031253294623)

This means that there is a 95% probability that Brazil losing as the away team in Coupa America falls between the upper and lower bounds of this interval.

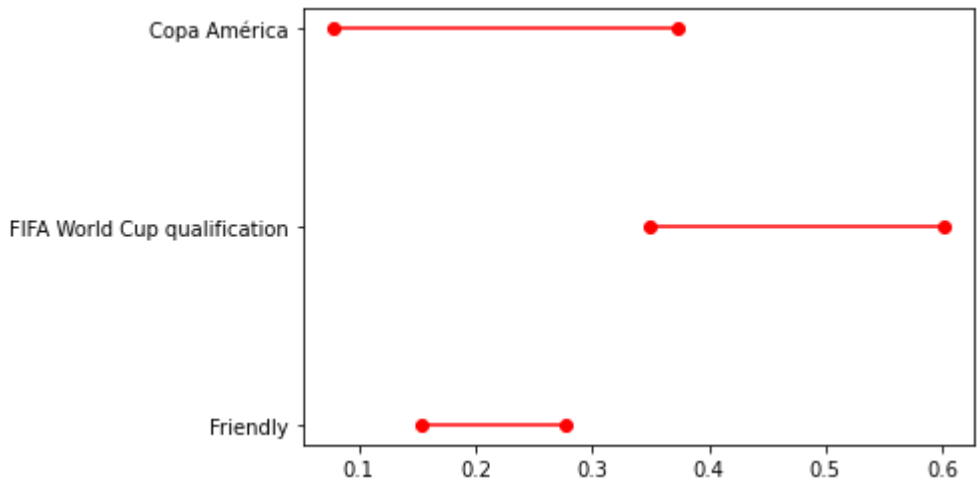
In [43]:
```
ci_tour = {}
ci_tour['tournament'] = ['Friendly','FIFA World Cup qualification','Copa Amér
ci_tour['lb'] = [CI_brazilFriendly[0],CI_brazilFIFA[0],CI_brazilCA[0]]
ci_tour['ub'] = [CI_brazilFriendly[1],CI_brazilFIFA[1],CI_brazilCA[1]]
df_ci= pd.DataFrame(ci_tour)
df_ci
```

Out[43]:

	tournament	lb	ub
0	Friendly	0.153709	0.276524
1	FIFA World Cup qualification	0.350088	0.600732
2	Copa América	0.078623	0.372990

In [46]:
```
for lb,ub,y in zip(df_ci['lb'],df_ci['ub'],range(len(df_ci))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(df_ci)),list(df_ci['tournament']))
```

Out[46]:
```
([<matplotlib.axis.YTick at 0x152d4cab0d0>,
  <matplotlib.axis.YTick at 0x152d4c9a910>,
  <matplotlib.axis.YTick at 0x152d4c83d00>],
 [Text(0, 0, 'Friendly'),
  Text(0, 1, 'FIFA World Cup qualification'),
  Text(0, 2, 'Copa América')])
```



This means that Brazil has the highest chance of losing in The FIFA World cup. This might be because they face very strong oponents and winning is harder than in Friendly or Copa America.

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Part 2

In this part, I am going to analyze the daily reported number of covid cases and deaths.

In [4]:
```
import pandas as pd
dy=pd.read_csv('coviddata.csv',encoding='latin-1')
```

In [5]:
```
dy.head()
```

Out[5]:

	date	iso3c	country	income	region	continent	dcases	ddeaths	population	weel
0	2/24/2020	AFG	Afghanistan	Low income	South Asia	Asia	5	0	38041754	
1	2/25/2020	AFG	Afghanistan	Low income	South Asia	Asia	0	0	38041754	
2	2/26/2020	AFG	Afghanistan	Low income	South Asia	Asia	0	0	38041754	
3	2/27/2020	AFG	Afghanistan	Low income	South Asia	Asia	0	0	38041754	
4	2/28/2020	AFG	Afghanistan	Low income	South Asia	Asia	0	0	38041754	

In [6]:
```
dy['country'].unique() #returns numoy array of unique values in that column
```

Out[6]:
```
array(['Afghanistan', 'Angola', 'Albania', 'Andorra',
       'United Arab Emirates', 'Argentina', 'Armenia',
       'Antigua & Barbuda', 'Australia', 'Austria', 'Azerbaijan',
       'Burundi', 'Belgium', 'Benin', 'Burkina Faso', 'Bangladesh',
       'Bulgaria', 'Bahrain', 'Bahamas', 'Bosnia & Herzegovina',
       'Belarus', 'Belize', 'Bolivia', 'Brazil', 'Barbados', 'Brunei',
       'Bhutan', 'Botswana', 'Central African Republic', 'Canada',
       'Switzerland', 'Chile', 'China', 'Côte d\x92Ivoire', 'Cameroon',
       'Congo - Kinshasa', 'Congo - Brazzaville', 'Colombia', 'Comoros',
       'Cape Verde', 'Costa Rica', 'Cuba', 'Cyprus', 'Czechia', 'Germany',
       'Djibouti', 'Dominica', 'Denmark', 'Dominican Republic', 'Algeria',
       'Ecuador', 'Egypt', 'Spain', 'Estonia', 'Ethiopia', 'Finland',
       'Fiji', 'France', 'Gabon', 'United Kingdom', 'Georgia', 'Ghana',
       'Guinea', 'Gambia', 'Guinea-Bissau', 'Equatorial Guinea', 'Greece',
       'Grenada', 'Guatemala', 'Guyana', 'Honduras', 'Croatia', 'Haiti',
       'Hungary', 'Indonesia', 'India', 'Ireland', 'Iran', 'Iraq',
       'Iceland', 'Israel', 'Italy', 'Jamaica', 'Jordan', 'Japan',
       'Kazakhstan', 'Kenya', 'Kyrgyzstan', 'Cambodia', 'Kiribati',
       'St. Kitts & Nevis', 'South Korea', 'Kuwait', 'Laos', 'Lebanon',
       'Liberia', 'Libya', 'St. Lucia', 'Liechtenstein', 'Sri Lanka',
       'Lesotho', 'Lithuania', 'Luxembourg', 'Latvia', 'Morocco',
       'Monaco', 'Moldova', 'Madagascar', 'Maldives', 'Mexico',
       'Marshall Islands', 'North Macedonia', 'Mali', 'Malta',
       'Myanmar (Burma)', 'Montenegro', 'Mongolia', 'Mozambique',
       'Mauritania', 'Mauritius', 'Malawi', 'Malaysia', 'Namibia',
       'Niger', 'Nigeria', 'Nicaragua', 'Netherlands', 'Norway', 'Nepal',
       'New Zealand', 'Oman', 'Pakistan', 'Panama', 'Peru', 'Philippines',
       'Palau', 'Papua New Guinea', 'Poland', 'Portugal', 'Paraguay',
       'Palestinian Territories', 'Qatar', 'Romania', 'Russia', 'Rwanda',
       'Saudi Arabia', 'Sudan', 'Senegal', 'Singapore', 'Solomon Islands',
       'Sierra Leone', 'El Salvador', 'San Marino', 'Somalia', 'Serbia',
       'South Sudan', 'São Tomé & Príncipe', 'Suriname', 'Slovakia',
       'Slovenia', 'Sweden', 'Eswatini', 'Seychelles', 'Syria', 'Chad',
       'Togo', 'Thailand', 'Tajikistan', 'Timor-Leste',
       'Trinidad & Tobago', 'Tunisia', 'Turkey', 'Tanzania', 'Uganda',
       'Ukraine', 'Uruguay', 'United States', 'Uzbekistan',
       'St. Vincent & Grenadines', 'Venezuela', 'Vietnam', 'Vanuatu',
       'Samoa', 'Yemen', 'South Africa', 'Zambia', 'Zimbabwe'],
      dtype=object)
```

In [7]:
```
from pandas.api.types import CategoricalDtype
```

In [8]:
```
cats=['Fri','Sat','Sun','Mon','Tue','Wed','Thu']
cat_type=CategoricalDtype(categories=cats,ordered=True)
dy['weekdays']=dy['weekdays'].astype(cat_type)
```

In [9]:
```
cats=['Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec'
cat_type=CategoricalDtype(categories=cats,ordered=True)
```

In [10]:
```
dy['month']=dy['month'].astype(cat_type)
```

In [11]:
```
dyegy=dy[dy['country']=='Egypt']
import numpy as np
```

In [12]:
```
stats=dyegy.groupby("weekdays").agg({"dcases":[np.mean,np.std,np.size]})
```

In [13]:
```
stats=pd.DataFrame(stats)
stats.shape
```

Out[13]:
```
(7, 3)
```

In [14]:
```
stats
```

Out[14]:

	dcases		
	mean	std	size
weekdays			
Fri	567.161616	428.533849	99
Sat	558.806122	421.803605	98
Sun	545.520408	422.358748	98
Mon	561.846939	442.137949	98
Tue	566.153061	419.125460	98
Wed	561.479592	406.337812	98
Thu	567.683673	410.020004	98

In [15]:
```
stats.columns
```

Out[15]:
```
MultiIndex([('dcases', 'mean'),
            ('dcases',  'std'),
            ('dcases', 'size')],
           )
```

In [16]:
```
stats.columns=['mean','std','size']
stats.columns
```

Out[16]:
```
Index(['mean', 'std', 'size'], dtype='object')
```

In [17]:
```
import scipy
import scipy.stats
from scipy.stats import norm,t
import statsmodels.api as sm
from statsmodels.stats.proportion import proportion_confint
import matplotlib.pyplot as plt
```

In [18]:
```
def get_ci_lb(x, alpha=0.05):
    sample_s=np.std(x)
    sample_mean=np.mean(x)
    sample_size=len(x)
    margin_of_error = t.ppf(1 - alpha/2,sample_size-1)*sample_s/np.sqrt(sampl
    return sample_mean - margin_of_error
```

In [19]:
```
x=dyegy['dcases']
```

In [20]:
```
get_ci_lb(x)
```

Out[20]:
```
529.7945911276133
```

In [21]:
```
def get_ci_ub(x,alpha=0.05):
    sample_s=np.std(x)
    sample_mean=np.mean(x)
    sample_size=len(x)
    margin_of_error=t.ppf(1-alpha/2,sample_size-1)*sample_s/np.sqrt(sample_si
    return sample_mean + margin_of_error
```

In [22]:
```
get_ci_ub(x)
```

Out[22]:
```
592.694491841819
```

In [23]:
```
ci_dcases=statsm=dyegy.groupby("weekdays").agg({"dcases":[np.mean,np.std,np.s
statsm
```

Out[23]:

	dcases				
	mean	std	size	get_ci_lb	get_ci_ub
weekdays					
Fri	567.161616	428.533849	99	481.692047	652.631185
Sat	558.806122	421.803605	98	474.239849	643.372396
Sun	545.520408	422.358748	98	460.842836	630.197981
Mon	561.846939	442.137949	98	473.203887	650.489990
Tue	566.153061	419.125460	98	482.123722	650.182401
Wed	561.479592	406.337812	98	480.014014	642.945170
Thu	567.683673	410.020004	98	485.479863	649.887484

In [24]:
```
statsm.index
```

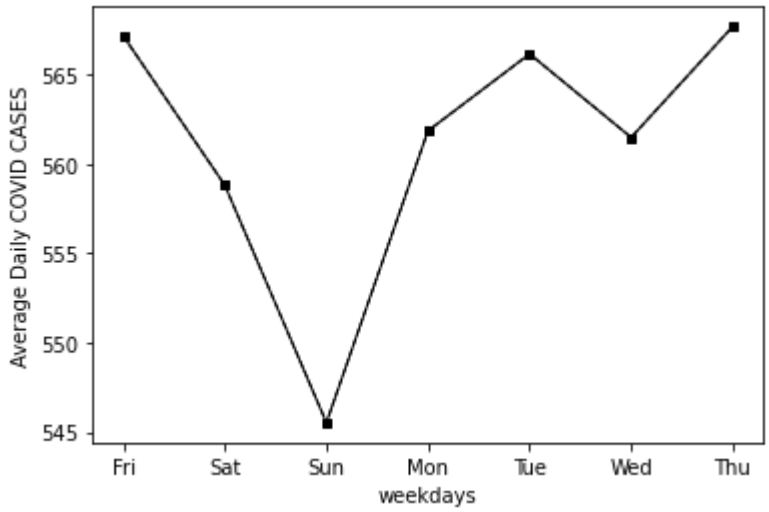
Out[24]:
```
CategoricalIndex(['Fri', 'Sat', 'Sun', 'Mon', 'Tue', 'Wed', 'Thu'], categor
ies=['Fri', 'Sat', 'Sun', 'Mon', 'Tue', 'Wed', 'Thu'], ordered=True, dtype
='category', name='weekdays')
```

In [25]:
```
statsm.columns=['mean','std','size','lb','ub']
statsm['weekdays']=statsm.index
statsm
```

Out[25]:

weekdays	mean	std	size	lb	ub	weekdays
Fri	567.161616	428.533849	99	481.692047	652.631185	Fri
Sat	558.806122	421.803605	98	474.239849	643.372396	Sat
Sun	545.520408	422.358748	98	460.842836	630.197981	Sun
Mon	561.846939	442.137949	98	473.203887	650.489990	Mon
Tue	566.153061	419.125460	98	482.123722	650.182401	Tue
Wed	561.479592	406.337812	98	480.014014	642.945170	Wed
Thu	567.683673	410.020004	98	485.479863	649.887484	Thu

In [26]:
```
plt.plot( 'weekdays', 'mean', data=statsm, marker='s', color='black', markers
plt.plot( 'weekdays', 'mean', data=statsm, marker='o', color='black',  marker
plt.xlabel("weekdays")
plt.ylabel("Average Daily COVID CASES")
plt.show()
```



Average covid cases were the highest on Thurdays and Fridays which makes sense since these are weekend days when people go out the most. Places are generally more crowded on Thursday and Friday so the average cases are greater.

In [27]:
```
dy['date'][0]
```

Out[27]: '2/24/2020'

In [28]:
```
dy['year'] = pd. DatetimeIndex(dy['date']). year
```

In [29]:
```
dy['year'][0]
```

Out[29]: 2020

In [30]:
```
statsdcases=dy.groupby(['country','year','weekdays']).agg({"dcases": [np.mean
statsdcases
```

Out[30]:

			dcases				
			mean	std	size	get_ci_lb	get_ci_ub
country	year	weekdays					
Afghanistan	2020	Fri	194.590909	244.064166	44.0	120.388621	268.793197
		Sat	154.068182	199.677228	44.0	93.360756	214.775608
		Sun	168.386364	229.780402	44.0	98.526736	238.245991
		Mon	146.266667	186.407350	45.0	90.263699	202.269634
		Tue	154.888889	177.833837	45.0	101.461690	208.316088
...	...	...	...	...	...	...	...
Zimbabwe	2021	Sun	284.538462	467.821587	52.0	154.296100	414.780823
		Mon	403.730769	732.665296	52.0	199.755448	607.706090
		Tue	636.403846	1017.270305	52.0	353.193985	919.613707
		Wed	725.826923	1548.422407	52.0	294.743373	1156.910474
		Thu	701.173077	1177.666598	52.0	373.308603	1029.037551

2618 rows × 5 columns

In [31]:
```
statsdcases=statsdcases.reset_index()
statsdcases #tranferring the data index into columns
```

Out[31]:

	country	year	weekdays	dcases				
				mean	std	size	get_ci_lb	get_ci_ub
0	Afghanistan	2020	Fri	194.590909	244.064166	44.0	120.388621	268.793197
1	Afghanistan	2020	Sat	154.068182	199.677228	44.0	93.360756	214.775608
2	Afghanistan	2020	Sun	168.386364	229.780402	44.0	98.526736	238.245991
3	Afghanistan	2020	Mon	146.266667	186.407350	45.0	90.263699	202.269634
4	Afghanistan	2020	Tue	154.888889	177.833837	45.0	101.461690	208.316088
...	...	...	...	...	...	...	...	...
2613	Zimbabwe	2021	Sun	284.538462	467.821587	52.0	154.296100	414.780823
2614	Zimbabwe	2021	Mon	403.730769	732.665296	52.0	199.755448	607.706090
2615	Zimbabwe	2021	Tue	636.403846	1017.270305	52.0	353.193985	919.613707
2616	Zimbabwe	2021	Wed	725.826923	1548.422407	52.0	294.743373	1156.910474
2617	Zimbabwe	2021	Thu	701.173077	1177.666598	52.0	373.308603	1029.037551

2618 rows × 8 columns

In [32]:
```
statsEgy=statsdcases[(statsdcases['country']=='Egypt') & (statsdcases['year']
statsEgy #filtering the data concerning Egypt in 2021
```

Out[32]:

	country	year	weekdays	dcases				
				mean	std	size	get_ci_lb	get_ci_ub
721	Egypt	2021	Fri	681.188679	328.472810	53.0	590.650360	771.726999
722	Egypt	2021	Sat	681.019231	332.058434	52.0	588.573573	773.464889
723	Egypt	2021	Sun	659.038462	339.218303	52.0	564.599483	753.477440
724	Egypt	2021	Mon	681.942308	372.374333	52.0	578.272632	785.611984
725	Egypt	2021	Tue	688.538462	345.451081	52.0	592.364266	784.712657
726	Egypt	2021	Wed	677.692308	320.514693	52.0	588.460448	766.924168
727	Egypt	2021	Thu	677.346154	324.265921	52.0	587.069945	767.622363

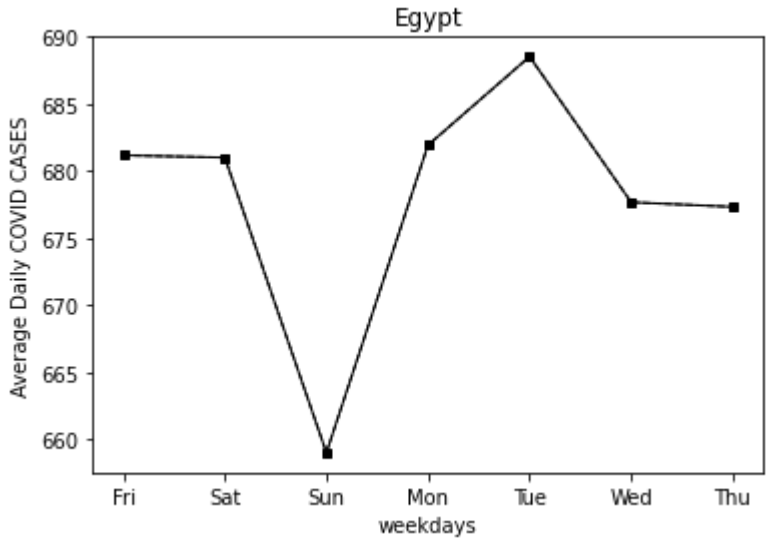
In [33]:
```
statsEgy.columns
```

Out[33]:
```
MultiIndex([( 'country',          ''),
            (    'year',          ''),
            ('weekdays',          ''),
            (  'dcases',      'mean'),
            (  'dcases',       'std'),
            (  'dcases',      'size'),
            (  'dcases', 'get_ci_lb'),
            (  'dcases', 'get_ci_ub')],
           )
```

In [34]:
```
statsEgy.columns=['country','year','weekdays','mean','std','size','lb','ub']
```

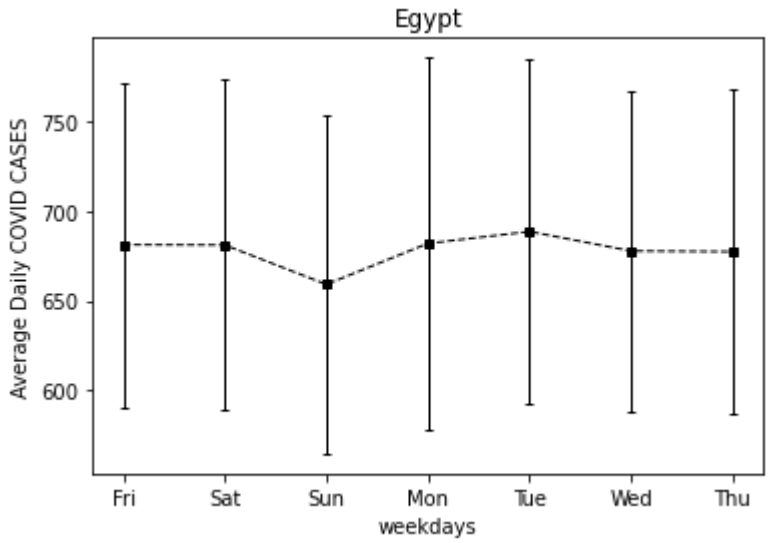
The average daily covid cases by weekdays in Egypt.

In [35]:
```
plt.plot( 'weekdays', 'mean', data=statsEgy, marker='s', color='black', marke
plt.plot( 'weekdays', 'mean', data=statsEgy, marker='o', color='black',  mark
plt.xlabel("weekdays")
plt.ylabel("Average Daily COVID CASES")
plt.title("Egypt")
plt.show()
```



In [36]:

```
ci_lb_ub=[statsEgy['lb'],statsEgy['ub']]
err = np.abs(ci_lb_ub - statsEgy['mean'].to_numpy())
plt.errorbar('weekdays', 'mean',  yerr=err, data=statsEgy,marker='s', capsize
             color='black', markersize=4, linewidth=1, linestyle='--')
plt.xlabel("weekdays")
plt.ylabel("Average Daily COVID CASES")
plt.title("Egypt")
plt.show()
```



Comparing between 2020 and 2021

In [37]:
```
statsEgy21=statsdcases[(statsdcases['country']=='Egypt')
                       & (statsdcases['year']==2021)]
statsEgy21
```

Out[37]:

	country	year	weekdays	dcases				
				mean	std	size	get_ci_lb	get_ci_ub
721	Egypt	2021	Fri	681.188679	328.472810	53.0	590.650360	771.726999
722	Egypt	2021	Sat	681.019231	332.058434	52.0	588.573573	773.464889
723	Egypt	2021	Sun	659.038462	339.218303	52.0	564.599483	753.477440
724	Egypt	2021	Mon	681.942308	372.374333	52.0	578.272632	785.611984
725	Egypt	2021	Tue	688.538462	345.451081	52.0	592.364266	784.712657
726	Egypt	2021	Wed	677.692308	320.514693	52.0	588.460448	766.924168
727	Egypt	2021	Thu	677.346154	324.265921	52.0	587.069945	767.622363

In [38]:
```
statsEgy20=statsdcases[(statsdcases['country']=='Egypt')
                       & (statsdcases['year']==2020)]
statsEgy20
```

Out[38]:

	country	year	weekdays	dcases				
				mean	std	size	get_ci_lb	get_ci_ub
714	Egypt	2020	Fri	435.782609	492.233906	46.0	289.607182	581.958035
715	Egypt	2020	Sat	420.652174	470.933268	46.0	280.802256	560.502092
716	Egypt	2020	Sun	417.195652	471.579503	46.0	277.153827	557.237478
717	Egypt	2020	Mon	426.086957	478.249996	46.0	284.064239	568.109674
718	Egypt	2020	Tue	427.804348	454.462692	46.0	292.845587	562.763108
719	Egypt	2020	Wed	430.108696	454.125153	46.0	295.250172	564.967219
720	Egypt	2020	Thu	443.717391	462.180035	46.0	306.466863	580.967920

In [39]:
```
statsEgy20.columns=['country','year','weekdays','mean','std','size','lb','ub'
statsEgy21.columns=['country','year','weekdays','mean','std','size','lb','ub'
x=statsEgy20['weekdays']
x
```

Out[39]:
```
714    Fri
715    Sat
716    Sun
717    Mon
718    Tue
719    Wed
720    Thu
Name: weekdays, dtype: category
Categories (7, object): ['Fri' < 'Sat' < 'Sun' < 'Mon' < 'Tue' < 'Wed' < 'T
hu']
```

In [40]:
```
y1=statsEgy20['mean']
y1
```

Out[40]:
```
714    435.782609
715    420.652174
716    417.195652
717    426.086957
718    427.804348
719    430.108696
720    443.717391
Name: mean, dtype: float64
```

In [41]:
```
y2=statsEgy21['mean']
y2
```

Out[41]:
```
721    681.188679
722    681.019231
723    659.038462
724    681.942308
725    688.538462
726    677.692308
727    677.346154
Name: mean, dtype: float64
```

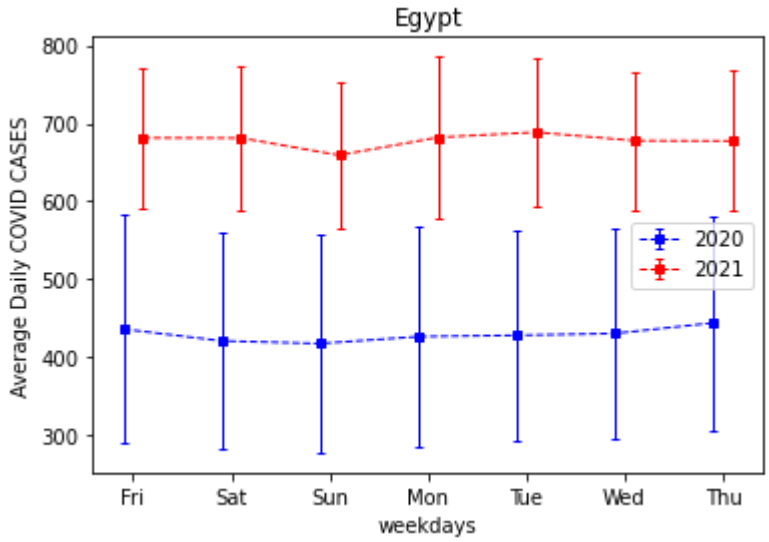
In [42]:
```
ci_lb_ub20=[statsEgy20['lb'],statsEgy20['ub']]
err20 = np.abs(ci_lb_ub20 - statsEgy20['mean'].to_numpy())
```

In [43]:
```
ci_lb_ub21=[statsEgy21['lb'],statsEgy21['ub']]
err21 = np.abs(ci_lb_ub21 - statsEgy21['mean'].to_numpy())
```

In [44]:
```
from matplotlib.transforms import Affine2D
```

In [45]:

```
fig, ax = plt.subplots()

trans1 = Affine2D().translate(-0.1, 0.0) + ax.transData
trans2 = Affine2D().translate(+0.1, 0.0) + ax.transData
plt.errorbar('weekdays', 'mean',  yerr=err20, data=statsEgy20,marker='s', cap
             color='blue', markersize=4, linewidth=1, linestyle='--',transfor
plt.errorbar('weekdays', 'mean',  yerr=err21, data=statsEgy21,marker='s', cap
             color='red', markersize=4, linewidth=1, linestyle='--',transform
plt.legend(['2020','2021'])
plt.xlabel("weekdays")
plt.ylabel("Average Daily COVID CASES")
plt.title("Egypt")
plt.show()
```



Average cases in the year 2021 were generally higher than in 2020 since the virus got more spread and eassily transmitted.

In [46]:
```
ratio=dy['ddeaths']/dy['dcases']
dy['fatality rate']=ratio
dy=dy.replace([np.inf, -np.inf], np.nan).dropna(axis=0)
dy
```

Out[46]:

	date	iso3c	country	income	region	continent	dcases	ddeaths	populati
0	2/24/2020	AFG	Afghanistan	Low income	South Asia	Asia	5	0	380417
12	3/7/2020	AFG	Afghanistan	Low income	South Asia	Asia	3	0	380417
16	3/11/2020	AFG	Afghanistan	Low income	South Asia	Asia	3	0	380417
19	3/14/2020	AFG	Afghanistan	Low income	South Asia	Asia	3	0	380417
20	3/15/2020	AFG	Afghanistan	Low income	South Asia	Asia	6	0	380417
...	...	...	...	...	...	...	...	...	
122837	12/26/2021	ZWE	Zimbabwe	Lower middle income	Sub-Saharan Africa	Africa	605	6	146454
122838	12/27/2021	ZWE	Zimbabwe	Lower middle income	Sub-Saharan Africa	Africa	1098	17	146454
122839	12/28/2021	ZWE	Zimbabwe	Lower middle income	Sub-Saharan Africa	Africa	2099	32	146454
122841	12/30/2021	ZWE	Zimbabwe	Lower middle income	Sub-Saharan Africa	Africa	4180	57	146454
122842	12/31/2021	ZWE	Zimbabwe	Lower middle income	Sub-Saharan Africa	Africa	1530	7	146454

97597 rows × 13 columns

Fatality rate is the number of deaths divided by the number of cases. A high fatality rate mmans a large number of the people who got the virus died from it. A low fatlity rate means a low number of deaths from the people who got affected.

In [47]:

```
 cont=dy.groupby(['continent','year']).agg({"fatality rate": [np.mean, np.std
cont=cont.reset_index()
cont= pd.DataFrame(cont)
cont
```

Out[47]:

	continent	year	fatality rate				
			mean	std	size	get_ci_lb	get_ci_ub
0	Africa	2020	0.028318	0.097518	10557	0.026458	0.030179
1	Africa	2021	0.033592	0.128916	13666	0.031430	0.035753
2	Asia	2020	0.024008	0.091818	11902	0.022358	0.025657
3	Asia	2021	0.024049	0.102663	15521	0.022434	0.025665
4	Europe	2020	0.039555	0.127914	11960	0.037263	0.041848
5	Europe	2021	0.027052	0.126590	14411	0.024985	0.029119
6	North America(continent)	2020	0.034215	0.099669	4412	0.031273	0.037157
7	North America(continent)	2021	0.029106	0.131691	5980	0.025767	0.032444
8	Oceania	2020	0.034105	0.113399	652	0.025385	0.042826
9	Oceania	2021	0.011527	0.069382	1081	0.007386	0.015668
10	South America(continent)	2020	0.043354	0.105435	3331	0.039772	0.046936
11	South America(continent)	2021	0.034072	0.102934	4124	0.030930	0.037215

In [48]:
```
region=dy.groupby(['region','year']).agg({"fatality rate": [np.mean, np.std,
region=region.reset_index()
region= pd.DataFrame(region)
region
```

Out[48]:

	region	year	fatality rate				
			mean	std	size	get_ci_lb	get_ci_ub
0	East Asia & Pacific	2020	0.026686	0.098206	3971	0.023631	0.029742
1	East Asia & Pacific	2021	0.017356	0.071641	6133	0.015563	0.019149
2	Europe & Central Asia	2020	0.035287	0.117588	14216	0.033354	0.037220
3	Europe & Central Asia	2021	0.026095	0.120581	16996	0.024282	0.027908
4	Latin America & Caribbean	2020	0.038925	0.106369	7101	0.036450	0.041399
5	Latin America & Caribbean	2021	0.032524	0.125291	9374	0.029988	0.035061
6	Middle East & North Africa	2020	0.033866	0.115923	5820	0.030887	0.036845
7	Middle East & North Africa	2021	0.031742	0.103973	7181	0.029337	0.034147
8	North America(region)	2020	0.029540	0.030874	642	0.027147	0.031933
9	North America(region)	2021	0.013263	0.008370	730	0.012655	0.013872
10	South Asia	2020	0.018443	0.037943	2115	0.016826	0.020061
11	South Asia	2021	0.025788	0.135790	2732	0.020694	0.030882
12	Sub-Saharan Africa	2020	0.026405	0.099908	8949	0.024334	0.028475
13	Sub-Saharan Africa	2021	0.033196	0.137515	11637	0.030697	0.035695

In [49]:
```
 income=dy.groupby(['income','year']).agg({"fatality rate": [np.mean, np.std,
income=income.reset_index()
income= pd.DataFrame(income)
income
```

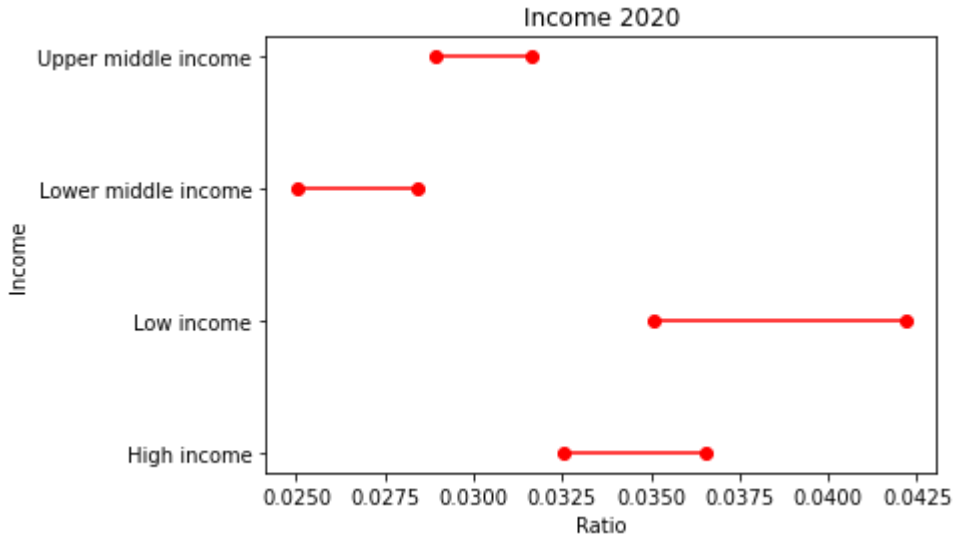
Out[49]:

	income	year	fatality rate				
			mean	std	size	get_ci_lb	get_ci_ub
0	High income	2020	0.034568	0.124601	14860	0.032564	0.036572
1	High income	2021	0.015613	0.090810	18514	0.014305	0.016921
2	Low income	2020	0.038623	0.138915	5844	0.035061	0.042185
3	Low income	2021	0.043604	0.163124	7113	0.039813	0.047396
4	Lower middle income	2020	0.026722	0.084758	9373	0.025005	0.028438
5	Lower middle income	2021	0.031586	0.119050	12745	0.029518	0.033653
6	Upper middle income	2020	0.030269	0.077354	12737	0.028925	0.031612
7	Upper middle income	2021	0.033358	0.122827	16411	0.031479	0.035238

In [50]:
```
income20=income[(income['year']==2020)]
income21=income[(income['year']==2021)]
income20.columns
income20.columns=['continent','year','mean','std','size','get_ci_lb','get_ci_
income21.columns
income21.columns=['continent','year','mean','std','size','get_ci_lb','get_ci_
```

In [51]:
```
 import matplotlib.pyplot as plt
for lb,ub,y in zip(income20['get_ci_lb'],income20['get_ci_ub'],range(len(incc
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(income20)),list(income20['continent']))
plt.xlabel("Ratio")
plt.ylabel("Income")
plt.title("Income 2020")
```

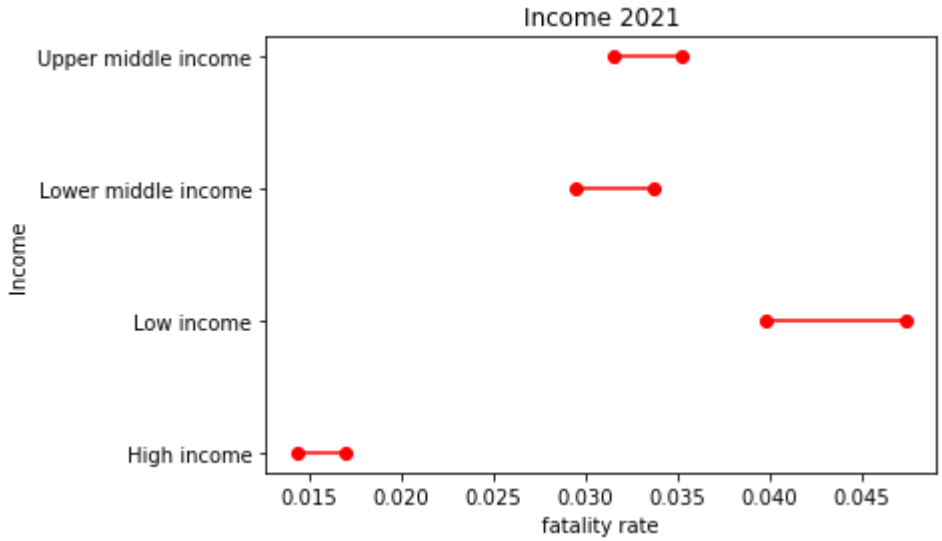
Out[51]: Text(0.5, 1.0, 'Income 2020')



High income people have the lowest fatality rate meaning they have the smallest number of deaths compared to the number of cases.This may beacuase they have access to the best healthcare so they are able to better treat themselves when they have covid. Alternatively, people with low income have the highest death rate(fatality rate) compared to the cases affected since they have no access to healthcare.

In [52]:
```
 import matplotlib.pyplot as plt
for lb,ub,y in zip(income21['get_ci_lb'],income21['get_ci_ub'],range(len(inco
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(income21)),list(income21['continent']))
plt.xlabel("fatality rate")
plt.ylabel("Income")
plt.title("Income 2021")
```

Out[52]: Text(0.5, 1.0, 'Income 2021')

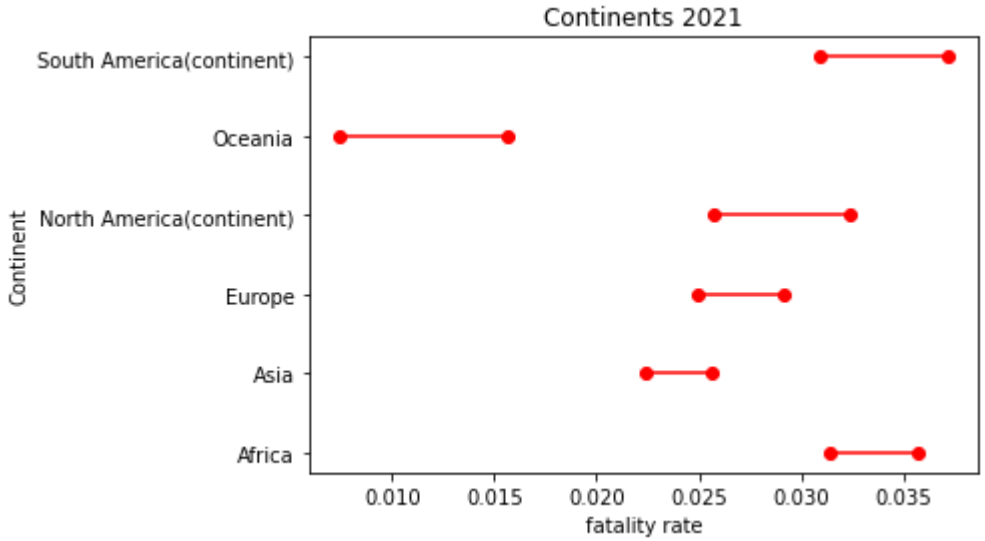


In [53]:
```
cont20=cont[(cont['year']==2020)]
cont21=cont[(cont['year']==2021)]
cont20.columns
cont20.columns=['continent','year','mean','std','size','get_ci_lb','get_ci_ub
cont21.columns
cont21.columns=['continent','year','mean','std','size','get_ci_lb','get_ci_ub
```

In [54]:

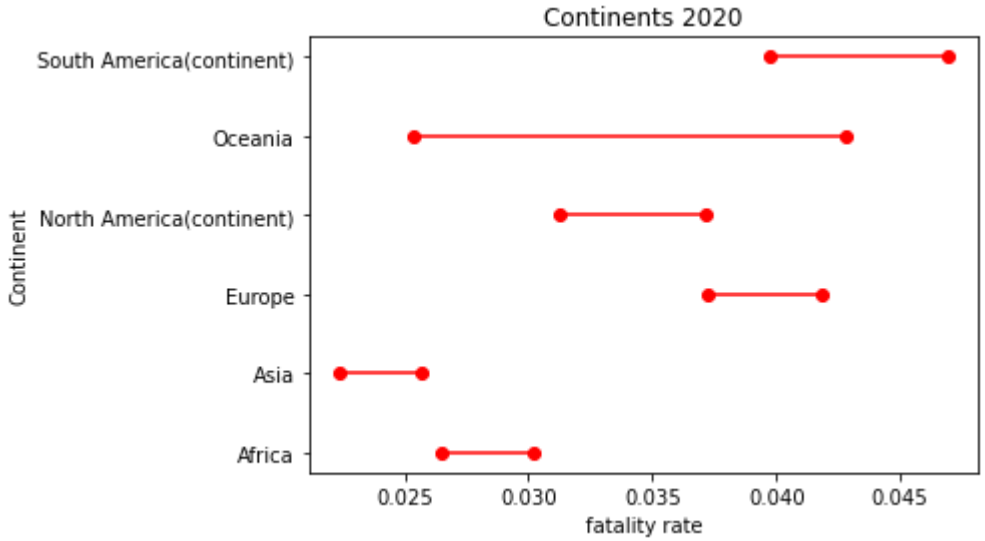
```
import matplotlib.pyplot as plt
for lb,ub,y in zip(cont21['get_ci_lb'],cont21['get_ci_ub'],range(len(cont))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(cont21)),list(cont21['continent']))
plt.xlabel("fatality rate")
plt.ylabel("Continent")
plt.title("Continents 2021")
```

Out[54]: Text(0.5, 1.0, 'Continents 2021')



In [55]:
```
import matplotlib.pyplot as plt
for lb,ub,y in zip(cont20['get_ci_lb'],cont20['get_ci_ub'],range(len(cont))):
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(cont20)),list(cont20['continent']))
plt.xlabel("fatality rate")
plt.ylabel("Continent")
plt.title("Continents 2020")
```

Out[55]: Text(0.5, 1.0, 'Continents 2020')

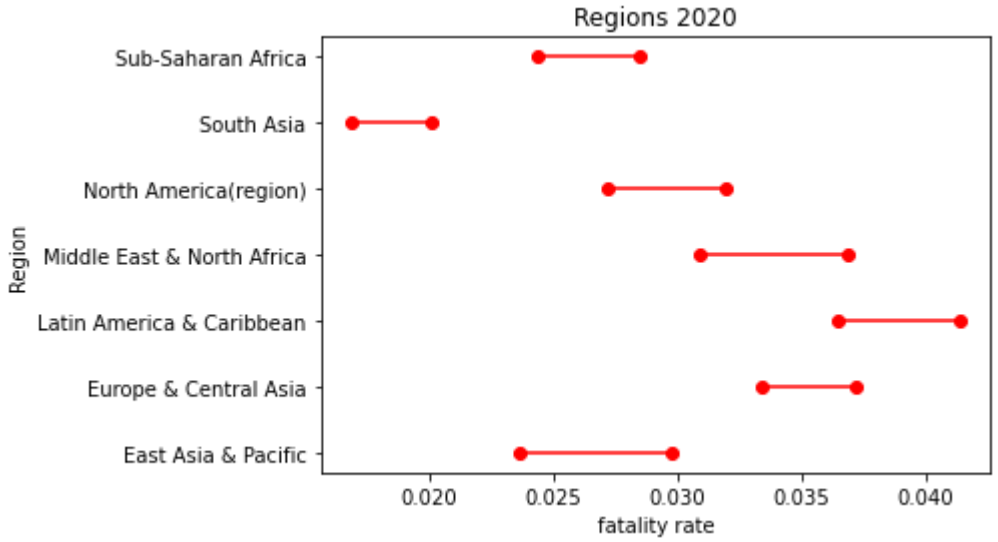


In [56]:
```
region20=region[(region['year']==2020)]
region21=region[(region['year']==2021)]
region20.columns
region20.columns=['continent','year','mean','std','size','get_ci_lb','get_ci_
region21.columns
region21.columns=['continent','year','mean','std','size','get_ci_lb','get_ci_
```

In [57]:

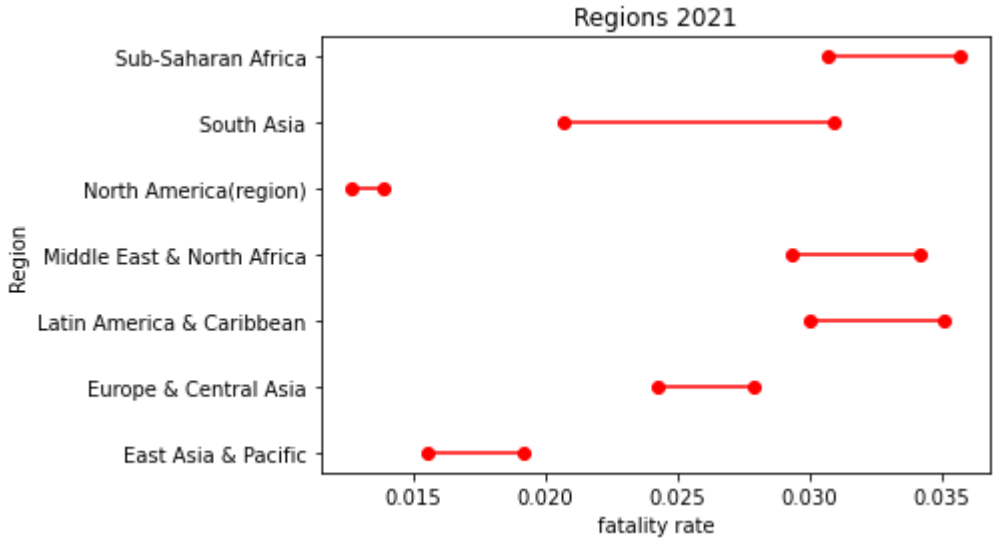
```
 import matplotlib.pyplot as plt
for lb,ub,y in zip(region20['get_ci_lb'],region20['get_ci_ub'],range(len(regi
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(region20)),list(region20['continent']))
plt.xlabel("fatality rate")
plt.ylabel("Region")
plt.title("Regions 2020")
```

Out[57]: Text(0.5, 1.0, 'Regions 2020')



In [58]:
```
 import matplotlib.pyplot as plt
for lb,ub,y in zip(region21['get_ci_lb'],region21['get_ci_ub'],range(len(regi
    plt.plot((lb,ub),(y,y),'ro-')
plt.yticks(range(len(region21)),list(region21['continent']))
plt.xlabel("fatality rate")
plt.ylabel("Region")
plt.title("Regions 2021")
```

Out[58]: Text(0.5, 1.0, 'Regions 2021')



In [59]:
```
stats=dy.groupby("continent").agg({"ddeaths": [np.mean, np.std, np.size]})
stats
import numpy as np
```

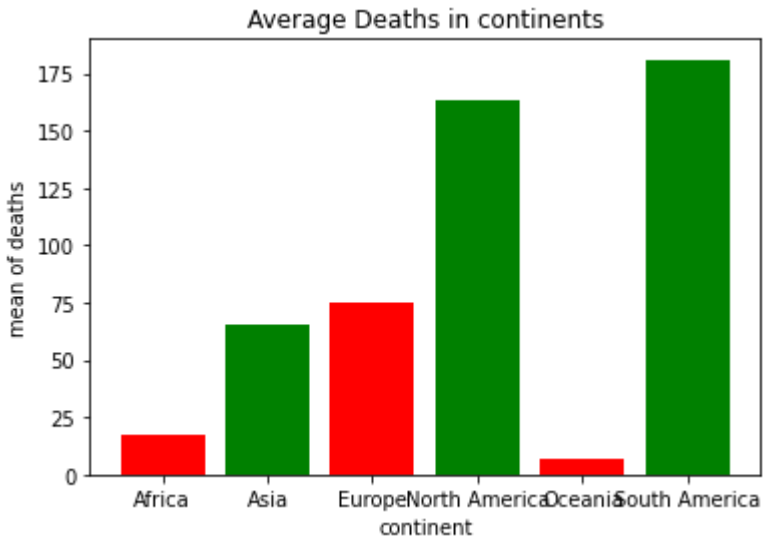
In [60]:
```
stats
```

Out[60]:

	ddeaths		
	mean	std	size
continent			
Africa	9.347769	36.504450	24223
Asia	45.938336	204.005223	27423
Europe	57.795533	146.199253	26371
North America(continent)	117.674846	406.957770	10392
Oceania	2.073283	4.848733	1733
South America(continent)	155.452314	382.304438	7455

In [61]:

```
# x-coordinates of left sides of bars
left = [1, 2, 3, 4, 5,6]
# heights of bars
height = [17, 65, 75, 163, 7,181]

# labels for bars
tick_label = ['Africa', 'Asia', 'Europe', 'North America', 'Oceania','South A

# plotting a bar chart
plt.bar(left,height, tick_label = tick_label,
        width = 0.8, color = ['red', 'green'])



# naming the x-axis
plt.xlabel('continent')
# naming the y-axis
plt.ylabel('mean of deaths')
# plot title
plt.title('Average Deaths in continents')

# function to show the plot
plt.show()
```



Oceania and Africa have the lowest death rates from the covid 19 pandemic.At the start of the pandemic, it was feared that poorer countries, particularly in Africa, could be devastated by the virus due to poor hygiene and lower quality healthcare systems in most communities. But paradoxically, it is possible these challenging living conditions may have actually helped impoverished countries to better cope with the coronavirus.

In [62]:
```
dy.columns
```

Out[62]:
```
Index(['date', 'iso3c', 'country', 'income', 'region', 'continent', 'dcases',
       'ddeaths', 'population', 'weekdays', 'month', 'year', 'fatality rate'],
      dtype='object')
```

In [63]:
```
dy['totcases'] = dy.groupby(['iso3c'])['dcases'].cumsum()
```

In [64]:
```
dy.loc[dy['iso3c']=='EGY'].head(6)
```

Out[64]:

	date	iso3c	country	income	region	continent	dcases	ddeaths	population	we
34049	2/14/2020	EGY	Egypt	Lower middle income	Middle East & North Africa	Africa	1	0	100388073	
34065	3/1/2020	EGY	Egypt	Lower middle income	Middle East & North Africa	Africa	1	0	100388073	
34069	3/5/2020	EGY	Egypt	Lower middle income	Middle East & North Africa	Africa	1	0	100388073	
34070	3/6/2020	EGY	Egypt	Lower middle income	Middle East & North Africa	Africa	12	0	100388073	
34072	3/8/2020	EGY	Egypt	Lower middle income	Middle East & North Africa	Africa	34	1	100388073	
34073	3/9/2020	EGY	Egypt	Lower middle income	Middle East & North Africa	Africa	6	0	100388073	

In [65]:
```
dy['totdeaths'] = dy.groupby(['iso3c'])['ddeaths'].cumsum()
dy['totdeaths'].loc[dy['iso3c']=='EGY']
```

Out[65]:
```
34049        0
34065        0
34069        0
34070        0
34072        1
            ...
34731    21637
34732    21665
34733    21693
34734    21725
34735    21750
Name: totdeaths, Length: 664, dtype: int64
```

In [66]:
```
dy['cfr']=dy['totdeaths']/dy['totcases']
```

In [67]:
```
import matplotlib.pyplot as plt
```

In [68]:
```
dy_egy=dy.loc[dy['iso3c']=='EGY']
```

In [69]:
```
dy_egy['date']=pd.to_datetime(dy_egy['date'],format='%m-%d-%y')
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
~\anaconda3\lib\site-packages\pandas\core\tools\datetimes.py in _to_datetim
e_with_format(arg, orig_arg, name, tz, fmt, exact, errors, infer_datetime_f
ormat)
    508         try:
--> 509             values, tz = conversion.datetime_to_datetime64(arg)
    510             dta = DatetimeArray(values, dtype=tz_to_dtype(tz))

~\anaconda3\lib\site-packages\pandas\_libs\tslibs\conversion.pyx in pandas.
_libs.tslibs.conversion.datetime_to_datetime64()

TypeError: Unrecognized value type: <class 'str'>

During handling of the above exception, another exception occurred:

ValueError                                Traceback (most recent call last)
~\AppData\Local\Temp/ipykernel_27904/1184565397.py in <module>
----> 1 dy_egy['date']=pd.to_datetime(dy_egy['date'],format='%m-%d-%y')

~\anaconda3\lib\site-packages\pandas\core\tools\datetimes.py in to_datetime
(arg, errors, dayfirst, yearfirst, utc, format, exact, unit, infer_datetime
_format, origin, cache)
    885             result = arg.map(cache_array)
    886         else:
--> 887             values = convert_listlike(arg._values, format)
    888             result = arg._constructor(values, index=arg.index, name
=arg.name)
    889     elif isinstance(arg, (ABCDataFrame, abc.MutableMapping)):

~\anaconda3\lib\site-packages\pandas\core\tools\datetimes.py in _convert_li
stlike_datetimes(arg, format, name, tz, unit, errors, infer_datetime_forma
t, dayfirst, yearfirst, exact)
    391
    392     if format is not None:
--> 393         res = _to_datetime_with_format(
    394             arg, orig_arg, name, tz, format, exact, errors, infer_d
atetime_format
    395         )

~\anaconda3\lib\site-packages\pandas\core\tools\datetimes.py in _to_datetim
e_with_format(arg, orig_arg, name, tz, fmt, exact, errors, infer_datetime_f
ormat)
    511             return DatetimeIndex._simple_new(dta, name=name)
    512         except (ValueError, TypeError):
--> 513             raise err
    514
    515

~\anaconda3\lib\site-packages\pandas\core\tools\datetimes.py in _to_datetim
e_with_format(arg, orig_arg, name, tz, fmt, exact, errors, infer_datetime_f
ormat)
    498
    499         # fallback
```

```
--> 500         res = _array_strptime_with_fallback(
    501             arg, name, tz, fmt, exact, errors, infer_datetime_forma
t
    502         )

~\anaconda3\lib\site-packages\pandas\core\tools\datetimes.py in _array_strp
time_with_fallback(arg, name, tz, fmt, exact, errors, infer_datetime_forma
t)
    434
    435     try:
--> 436         result, timezones = array_strptime(arg, fmt, exact=exact, e
rrors=errors)
    437         if "%Z" in fmt or "%z" in fmt:
    438             return _return_parsed_timezone_results(result, timezone
s, tz, name)

~\anaconda3\lib\site-packages\pandas\_libs\tslibs\strptime.pyx in pandas._l
ibs.tslibs.strptime.array_strptime()

ValueError: time data '2/14/2020' does not match format '%m-%d-%y' (match)
```

In [ ]:
```
plt.plot( 'date', 'cfr', data=dy_egy,  color='black', markersize=4,     linew
plt.xlabel("")
plt.ylabel("CFR")
plt.show()
```

fatality rate in Egypt was low at first then it increased drastically until reaching peak then it decreased agains steeply and finally it oncreased and stayed at an average probability.

In [ ]:

In [ ]:

In [ ]: