DSO110 - Final Group Project - Lottery

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Background

Albi and Barbra have chosen the “Mega Millions Winning Numbers” dataset because the lottery is something that is familiar and accessible to a wide range of people worldwide; it would be difficult to find someone who hasn’t dreamed of hitting the jackpot and changing their life forever. However, it is also widely accepted that the lottery is not set up to favor the player. In the case of Mega Millions, although there is a 1 in 24 chance of winning something, the odds of choosing all 6 numbers correctly to win the jackpot is 1 in 302,575,350 - a fact that is posted openly on both the New York Lottery and Mega Millions websites. By analyzing the winning numbers data as well as complementary datasets on lottery retailers, lottery aid to local school districts, and monies recouped from the lottery winnings of public aid recipients, Albi and Barbra hope to glean insight to make actionable suggestions on how lottery players can get the best return on their investment as well as to demonstrate for the average person whether the lottery serves any societal good or whether it may be best to abstain from playing altogether.

Data Wrangling

In [1]:
```
import pandas as pd
import seaborn as sns
import matplotlib.mlab as mlab
import matplotlib.pyplot as plt
import math
import numpy as np
from numpy import nan
import datetime as dt
from datetime import date
```

Import data.

1. Winning numbers May 17, 2002 to November 26, 2021

In [2]:
```
Winning_Numbers = pd.read_csv("Lottery_Mega_Millions_Winning_Numbers__Beginni
pd.set_option("display.max_columns", None)
Winning_Numbers.head()
```

Out[2]:

	Draw Date	Month	Day	Year	Weekday	Weekday.1	Quarter	Winning Numbers	Mega Ball	Multiplier	Fi
0	9/25/2020	9	25	2020	Fri	1	3	20 36 37 48 67	16	2.0	
1	9/29/2020	9	29	2020	Tue	0	3	14 39 43 44 67	19	3.0	
2	10/2/2020	10	2	2020	Fri	1	4	09 38 47 49 68	25	2.0	
3	10/6/2020	10	6	2020	Tue	0	4	15 16 18 39 59	17	3.0	
4	10/9/2020	10	9	2020	Fri	1	4	05 11 25 27 64	13	2.0	

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Convert 'Winning Numbers' to string and then separate terms into individual columns (5).

In [3]:
```
Winning_Numbers["AllNumbers"] = Winning_Numbers["Winning Numbers"].map(str) +
```

In [4]:
```
Winning_Numbers
```

Out[4]:

	Draw Date	Month	Day	Year	Weekday	Weekday.1	Quarter	Winning Numbers	Mega Ball	Multiplie
0	9/25/2020	9	25	2020	Fri	1	3	20 36 37 48 67	16	2.0
1	9/29/2020	9	29	2020	Tue	0	3	14 39 43 44 67	19	3.0
2	10/2/2020	10	2	2020	Fri	1	4	09 38 47 49 68	25	2.0
3	10/6/2020	10	6	2020	Tue	0	4	15 16 18 39 59	17	3.0
4	10/9/2020	10	9	2020	Fri	1	4	05 11 25 27 64	13	2.0
...	...	...	...	...	...	...	...	...	...	..
2031	11/12/2021	11	12	2021	Fri	1	4	30 32 42 46 48	15	2.0
2032	11/16/2021	11	16	2021	Tue	0	4	06 22 44 53 65	3	3.0
2033	11/19/2021	11	19	2021	Fri	1	4	05 23 52 53 59	18	5.0
2034	11/23/2021	11	23	2021	Tue	0	4	07 24 54 57 58	6	3.0
2035	11/26/2021	11	26	2021	Fri	1	4	07 27 37 42 59	2	2.0

2036 rows × 16 columns

In [5]:
```
df = Winning_Numbers['AllNumbers']
df2 = pd.DataFrame(df.str.split(" ").apply(pd.Series, 0).stack())
df2.index = df2.index.droplevel(-1)
df2.head(20)
```

Out[5]:

	0
0	20
0	36
0	37
0	48
0	67
0	16
1	14
1	39
1	43
1	44
1	67
1	19
2	09
2	38
2	47
2	49
2	68
2	25
3	15
3	16

In [6]:
```
df3 = Winning_Numbers['Draw Date']
df4 = Winning_Numbers['Weekday.1']
```

In [7]:
```
df3.head()
```

Out[7]:
```
0    9/25/2020
1    9/29/2020
2    10/2/2020
3    10/6/2020
4    10/9/2020
Name: Draw Date, dtype: object
```

In [8]:
```
df4.head()
```

Out[8]:
```
0    1
1    0
2    1
3    0
4    1
Name: Weekday.1, dtype: int64
```

In [9]:
```
merge1 = pd.merge(df3, df4,how='inner', left_index=True, right_index=True)
merge1.head(10)
```

Out[9]:

	Draw Date	Weekday.1
0	9/25/2020	1
1	9/29/2020	0
2	10/2/2020	1
3	10/6/2020	0
4	10/9/2020	1
5	10/13/2020	0
6	10/16/2020	1
7	10/20/2020	0
8	10/23/2020	1
9	10/27/2020	0

In [10]:
```
df2.head(10)
```

Out[10]:

	0
0	20
0	36
0	37
0	48
0	67
0	16
1	14
1	39
1	43
1	44

In [11]:
```
merged = pd.merge(merge1, df2,how='inner', left_index=True, right_index=True)
merged.columns = ['Date','WeekdayEncoded','WinNumber']
merged.reset_index(inplace=True)
merged.head(20)
# Winning_Numbers2['WeekdayEncoded'] = pd.DatetimeIndex(Winning_Numbers2['Dat
```

Out[11]:

	index	Date	WeekdayEncoded	WinNumber
0	0	9/25/2020	1	20
1	0	9/25/2020	1	36
2	0	9/25/2020	1	37
3	0	9/25/2020	1	48
4	0	9/25/2020	1	67
5	0	9/25/2020	1	16
6	1	9/29/2020	0	14
7	1	9/29/2020	0	39
8	1	9/29/2020	0	43
9	1	9/29/2020	0	44
10	1	9/29/2020	0	67
11	1	9/29/2020	0	19
12	2	10/2/2020	1	09
13	2	10/2/2020	1	38
14	2	10/2/2020	1	47
15	2	10/2/2020	1	49
16	2	10/2/2020	1	68
17	2	10/2/2020	1	25
18	3	10/6/2020	0	15
19	3	10/6/2020	0	16

In [12]:
```
Winning_Numbers2 = merged
Winning_Numbers2.head()
```

Out[12]:

	index	Date	WeekdayEncoded	WinNumber
0	0	9/25/2020	1	20
1	0	9/25/2020	1	36
2	0	9/25/2020	1	37
3	0	9/25/2020	1	48
4	0	9/25/2020	1	67

In [13]:
```
Winning_Numbers2[['Month','Day','Year']] =  Winning_Numbers2['Date'].str.spli
Winning_Numbers2.head(10)
```

Out[13]:

	index	Date	WeekdayEncoded	WinNumber	Month	Day	Year
0	0	9/25/2020	1	20	9	25	2020
1	0	9/25/2020	1	36	9	25	2020
2	0	9/25/2020	1	37	9	25	2020
3	0	9/25/2020	1	48	9	25	2020
4	0	9/25/2020	1	67	9	25	2020
5	0	9/25/2020	1	16	9	25	2020
6	1	9/29/2020	0	14	9	29	2020
7	1	9/29/2020	0	39	9	29	2020
8	1	9/29/2020	0	43	9	29	2020
9	1	9/29/2020	0	44	9	29	2020

In [14]:
```
Winning_Numbers2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12216 entries, 0 to 12215
Data columns (total 7 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   index           12216 non-null  int64 
 1   Date            12216 non-null  object
 2   WeekdayEncoded  12216 non-null  int64 
 3   WinNumber       12216 non-null  object
 4   Month           12216 non-null  object
 5   Day             12216 non-null  object
 6   Year            12216 non-null  object
dtypes: int64(2), object(5)
memory usage: 668.2+ KB
```

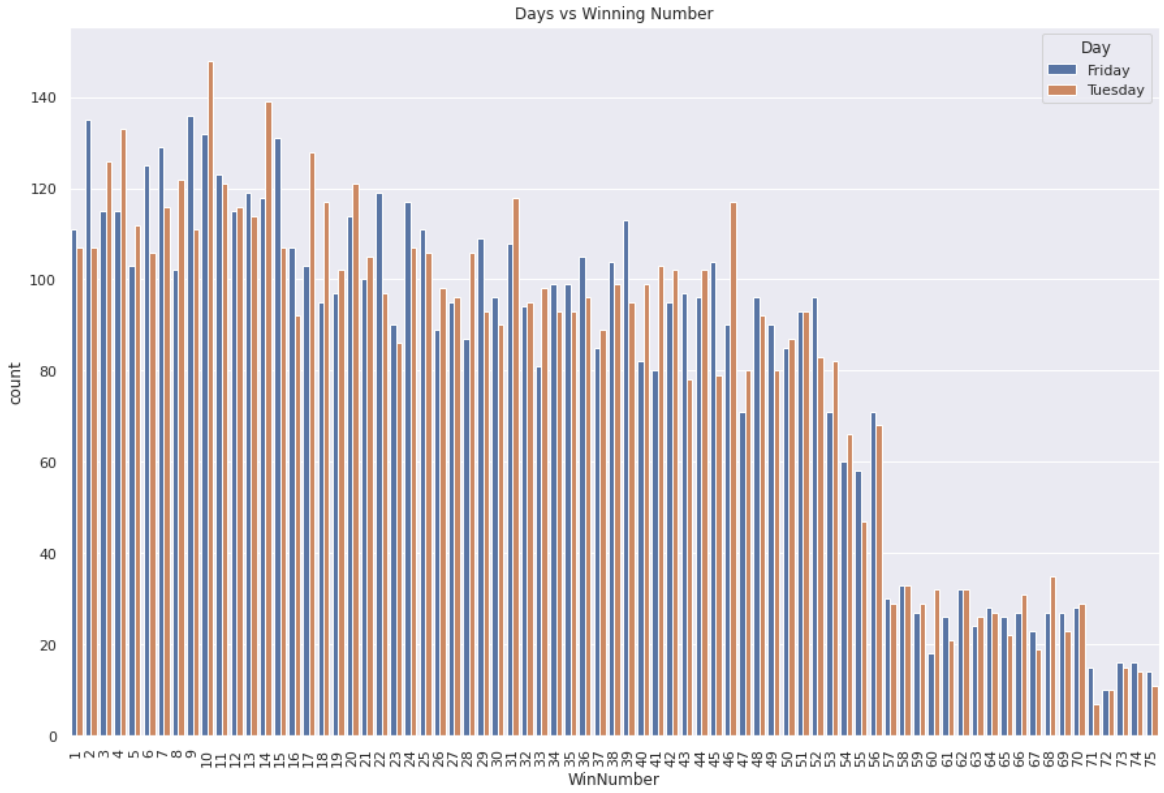
In [15]:
```
# Winning_Numbers2.column = Winning_Numbers2.column.str.strip()
Winning_Numbers2['WinNumber'] = Winning_Numbers2['WinNumber'].astype(int)
Winning_Numbers2['Year'] = Winning_Numbers2['Year'].astype(int)
Winning_Numbers2['Day'] = Winning_Numbers2['Day'].astype(int)
Winning_Numbers2['Year'] = Winning_Numbers2['Year'].astype(int)
Winning_Numbers2['Day'] = Winning_Numbers2['Day'].astype(int)
```

In [16]:
```
Winning_Numbers2.to_csv('WinningNumbersRevised.csv')
```

Data Exploration

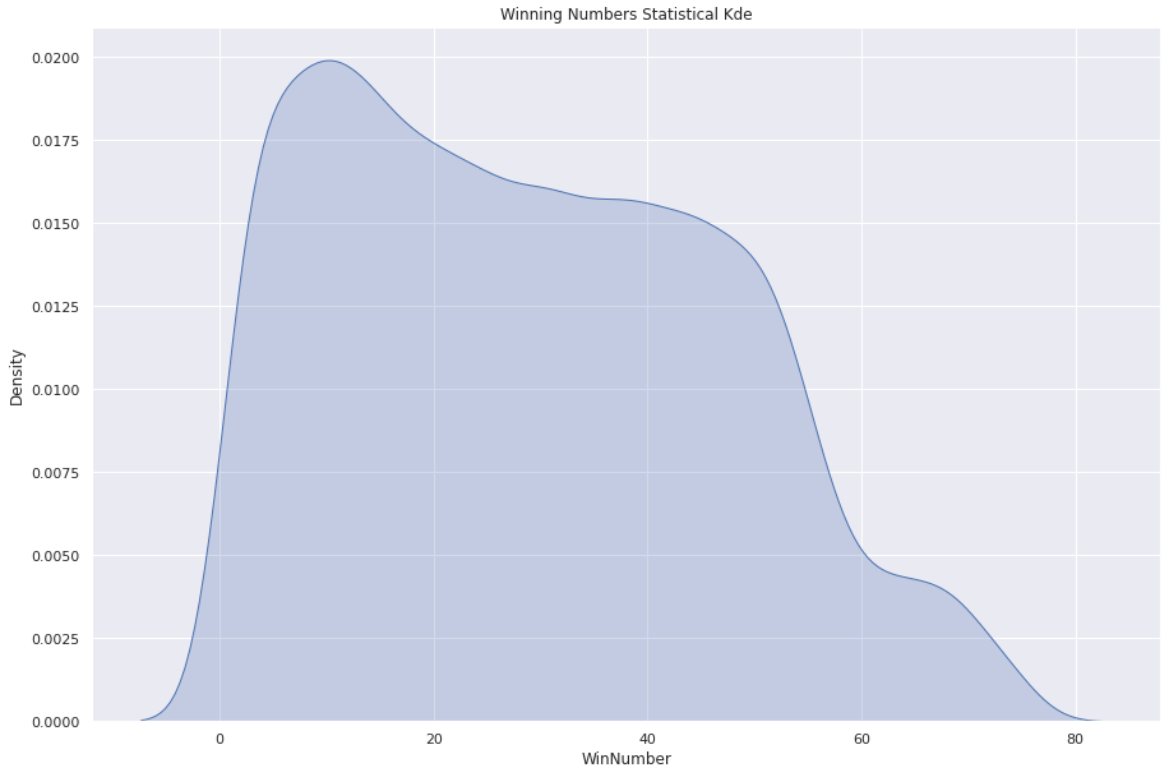
Exploring which day(Tuesday or Friday) to play which number.In other words we are looking at the distrubutive count of the Winning Numbers versus the day(Tuesday or Friday).

In [32]:
```
plt.figure(figsize=(15,10))
sns.countplot(x="WinNumber", hue="WeekdayEncoded", data=Winning_Numbers2)
plt.legend(title='Day', loc='upper right', labels=['Friday', 'Tuesday'])
plt.title('Days vs Winning Number')
plt.xticks(rotation = 'vertical')
plt.show()
```



The Kde plot showing the Winning Numbers Distrubution.We can see that median is at winning number 10.

In [30]:
```
plt.figure(figsize=(15,10))
import numpy as np
sns.kdeplot(Winning_Numbers2["WinNumber"],shade=True)
plt.title('Winning Numbers Statistical Kde')
plt.show()
```



In [19]:
```
import scipy.stats as stats
```

In [20]:
```
fvalue, pvalue = stats.f_oneway(Winning_Numbers2["WinNumber"], Winning_Number
print(pvalue)
```

```
0.0
```

In [21]:
```
most_frequent = Winning_Numbers2['WinNumber'].value_counts()[:20].sort_values
```

In [22]:
```
most_frequent_df = pd.DataFrame(most_frequent)
```

In [23]:
```
most_frequent_df.index.names = ['WinNumbers']
```

In [24]:
```
most_frequent_df
```

Out[24]:

WinNumbers	WinNumber
10	280
14	257
4	248
9	247
7	245
11	244
2	242
3	241
15	238
20	235
13	233
6	231
12	231
17	231
31	226
8	224
24	224
1	218
25	217
22	216

In [35]:
```
most_frequent_df = most_frequent_df.rename(columns={"WinNumber": "Frequency"}
```

Top 20 Most Occuring Winning Number

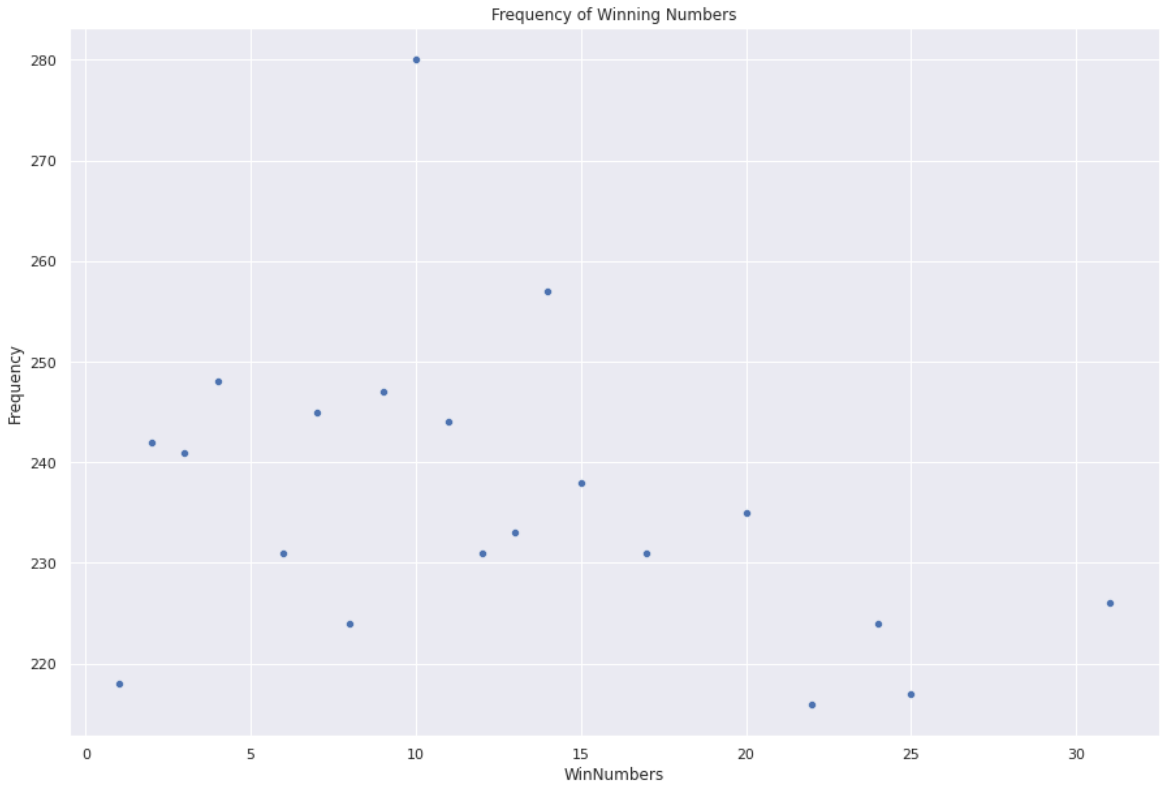
In [33]:
```
most_frequent_df.reset_index()
```

Out[33]:

	WinNumbers	Frequency
0	10	280
1	14	257
2	4	248
3	9	247
4	7	245
5	11	244
6	2	242
7	3	241
8	15	238
9	20	235
10	13	233
11	6	231
12	12	231
13	17	231
14	31	226
15	8	224
16	24	224
17	1	218
18	25	217
19	22	216

Scatterplot showing the spread of the 20 top most frequently occurring Winning Numbers

In [31]:
```
plt.figure(figsize=(15,10))
sns.scatterplot(data=most_frequent_df, x="WinNumbers", y="Frequency",palette=
plt.title('Frequency of Winning Numbers')
sns.set(style = "darkgrid")
plt.show()
```



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