Sprint 3_Graphic display of Multiple variables

July 8, 2022

1 IT Academy - Data Science

1.1 S03 T02: Graphic display of Multiple variables

1.1.1 Level 1: Practice with the notebook on GitHub "03 EXAMINING DATA" with seaborn and the dataset "tips".

[1]:
```
#import requested library
import pandas as pd
import numpy as np
import re
import matplotlib.pyplot as plt
import seaborn as sns
import joypy

import warnings
warnings.filterwarnings('ignore')

import os
os.chdir("/Users/giorgiatrupia/Dropbox (Personal)/CODING/Python/DATASETS")
```

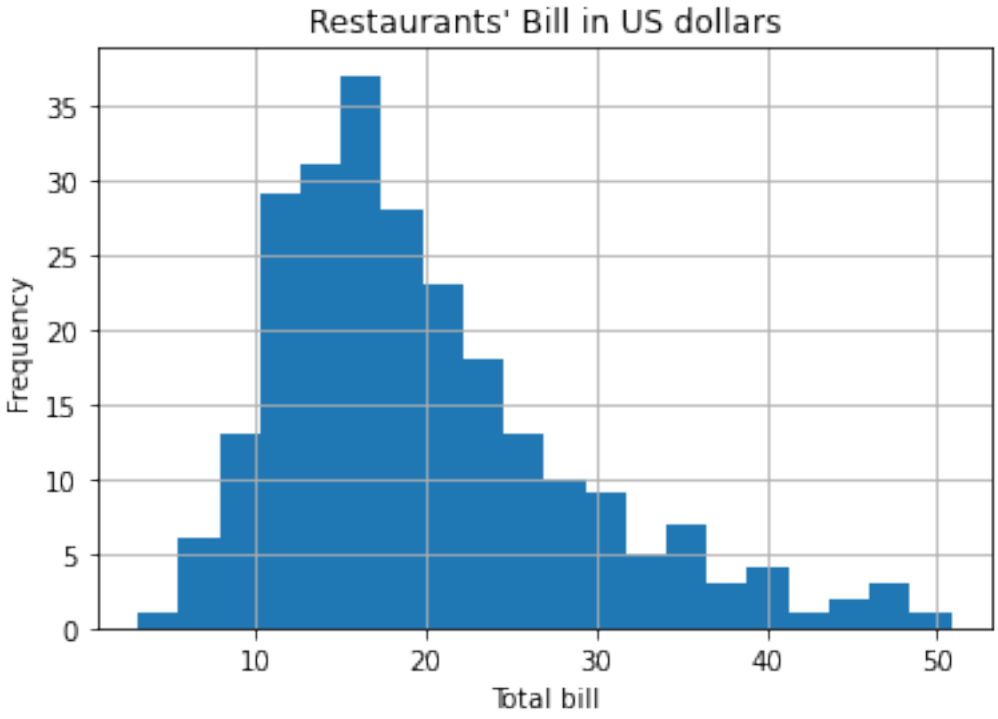
[2]:
```
#Download the date set 'tips' and upload it to a panda's Dataframe.
#import data on tips expenses statistics
tips = pd.read_csv('tips.csv', sep=',', encoding='utf8')

#show  subset of rows to display (=10)
tips.sample(3)
```

[2]:

	total_bill	tip	sex	smoker	day	time	size
84	15.98	2.03	Male	No	Thur	Lunch	2
239	29.03	5.92	Male	No	Sat	Dinner	3
31	18.35	2.50	Male	No	Sat	Dinner	4

[3]:
```
# Histogram Plot to show data density

tips.hist(['total_bill'], bins=20)
plt.title('Restaurants\' Bill in US dollars')
plt.ylabel('Frequency')
```

```
plt.xlabel('Total bill')
plt.show()
# --> Data trail off to the right: Right skewed and unimodal distribution of␣
 ↪total bill spending at restaurants.

tips.hist(['tip'], bins=15)
plt.title('Restaurants\' Tips in US dollars')
plt.ylabel('Frequency')
plt.xlabel('Tips')
plt.show()

# --> Data trail off to the left: left skewed and bimodal distribution of tips␣
 ↪at restaurants.
```



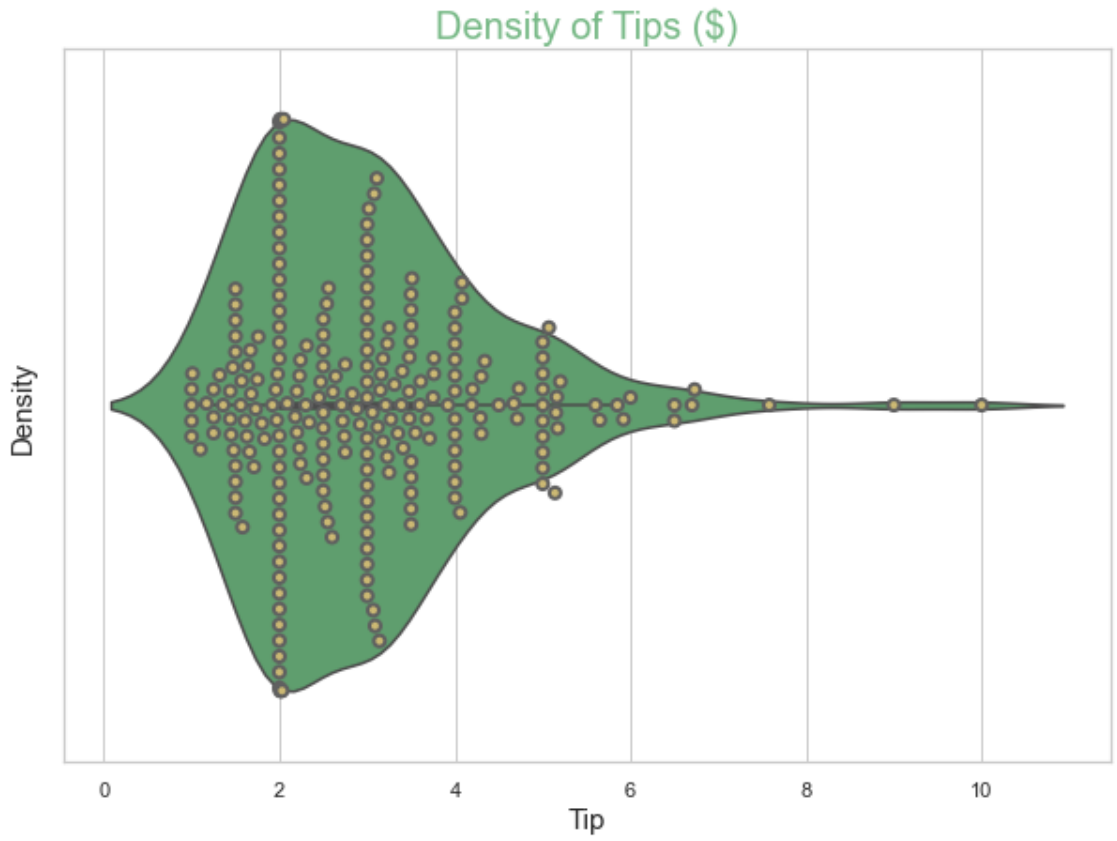
[4]:
```
#show data statistic
tips.describe().round(2)
```

[4]:

	total_bill	tip	size
count	244.00	244.00	244.00
mean	19.79	3.00	2.57
std	8.90	1.38	0.95
min	3.07	1.00	1.00
25%	13.35	2.00	2.00
50%	17.80	2.90	2.00
75%	24.13	3.56	3.00
max	50.81	10.00	6.00

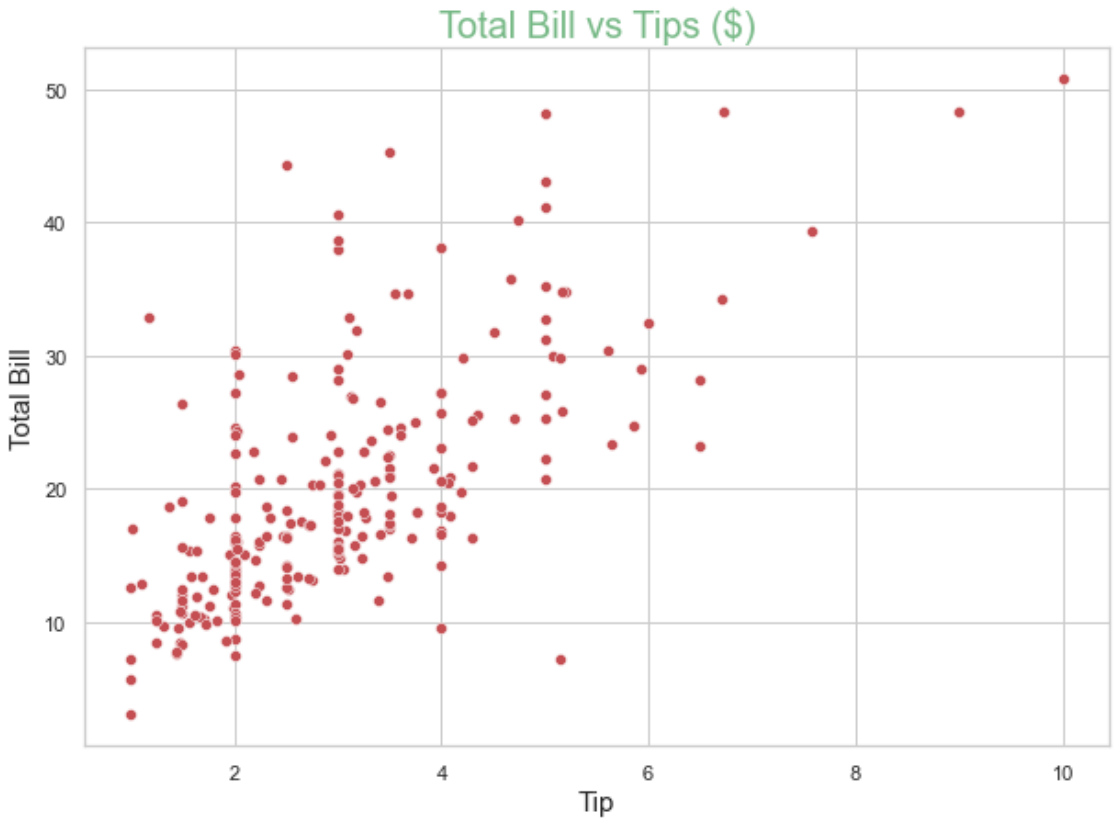
Plot with one numerical variable

[5]:
```
sns.set(style='whitegrid')
plt.figure(figsize =(10, 7))
sns.violinplot(x='tip', data=tips, color="g")
sns.swarmplot(x='tip', data=tips, color="y", linewidth=2, size=6)
plt.title('Density of Tips ($)', fontsize=20, color='g', alpha=0.8)
plt.xlabel('Tip', fontsize=15)
plt.ylabel('Density', fontsize=15)
plt.show()
```



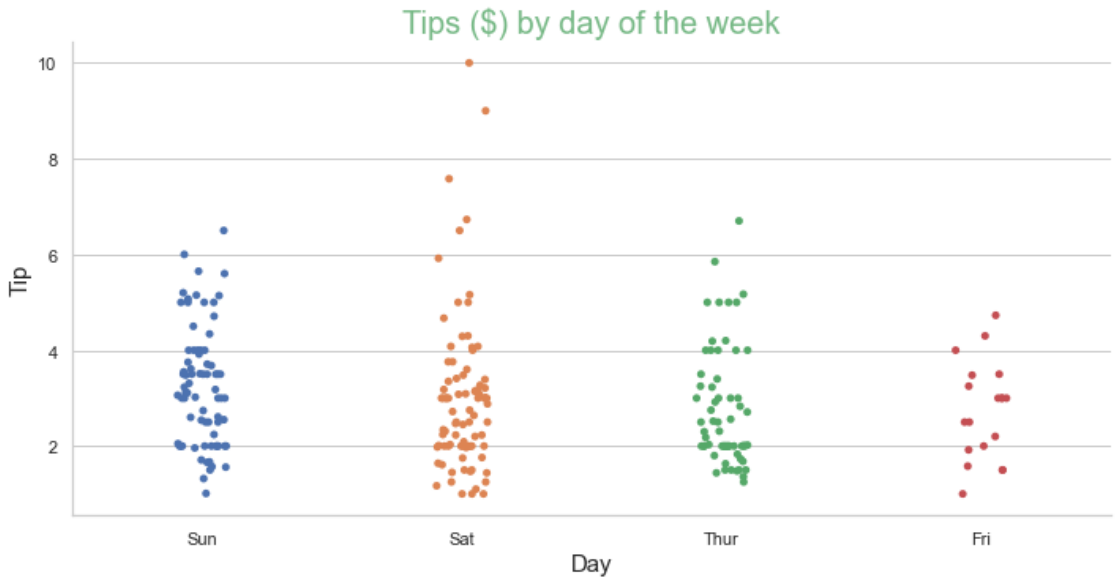
Plot with two numerical variables

[6]:
```
sns.set(style='whitegrid')
plt.figure(figsize =(10, 7))
sns.scatterplot(x='tip', y='total_bill', data=tips, color= "r")
plt.title('Total Bill vs Tips ($)', fontsize=20, color='g', alpha=0.8)
plt.ylabel('Total Bill', fontsize=15)
plt.xlabel('Tip', fontsize=15)
plt.show()
```



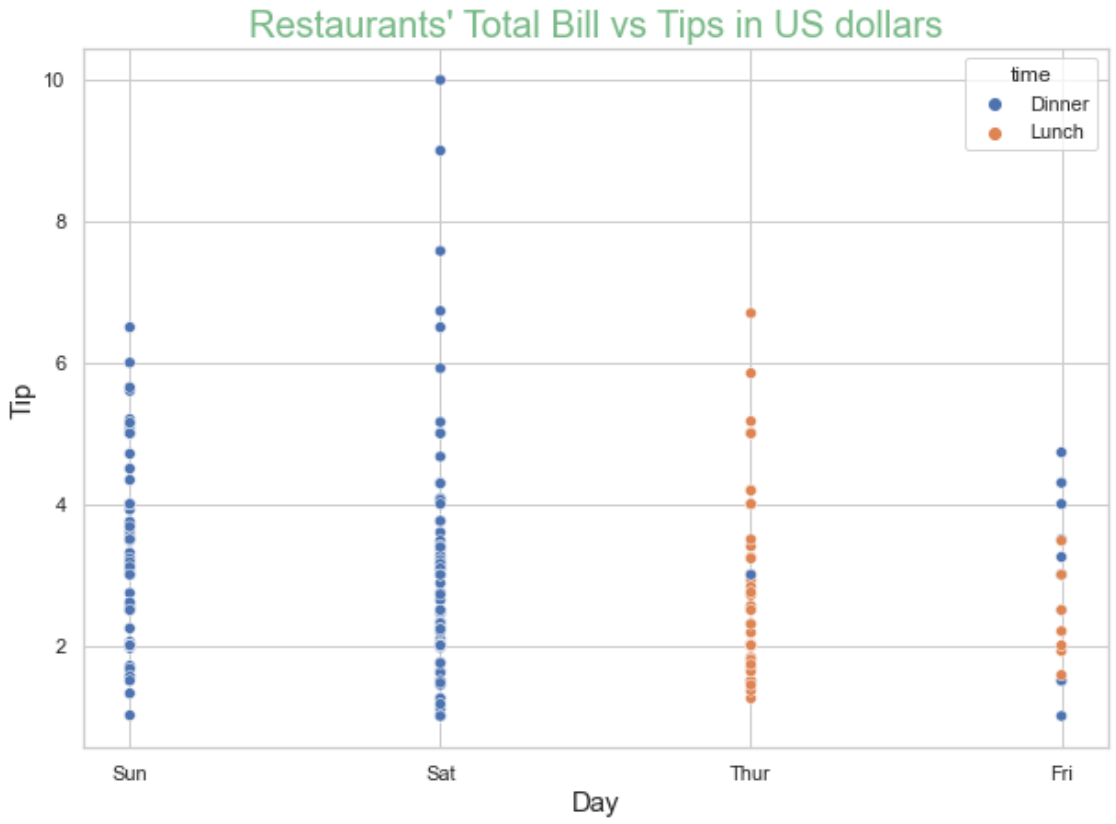
Plot with one numerical and one categorical variable

[7]:
```
sns.catplot(x='day', y='tip', data=tips, height=5, aspect=2)
plt.title('Tips ($) by day of the week', fontsize=20, color='g', alpha=0.8)
plt.ylabel('Tip', fontsize=15)
plt.xlabel('Day', fontsize=15)
plt.show()
```



Plot with one numerical and two categorical variables

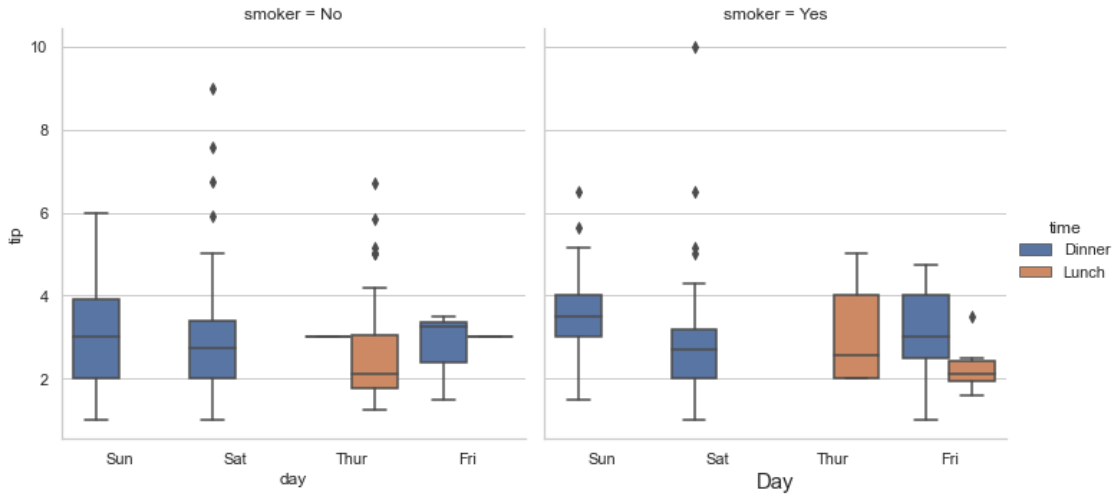
[8]:
```
plt.figure(figsize =(10, 7))
sns.scatterplot(x='day', y='tip', data=tips, hue='time')
plt.title('Restaurants\' Total Bill vs Tips in US dollars', fontsize=20,␣
 ↪color='g', alpha=0.8)
plt.ylabel('Tip', fontsize=15)
plt.xlabel('Day', fontsize=15)
plt.show()
```



Plot with one numerical and three categorical variables

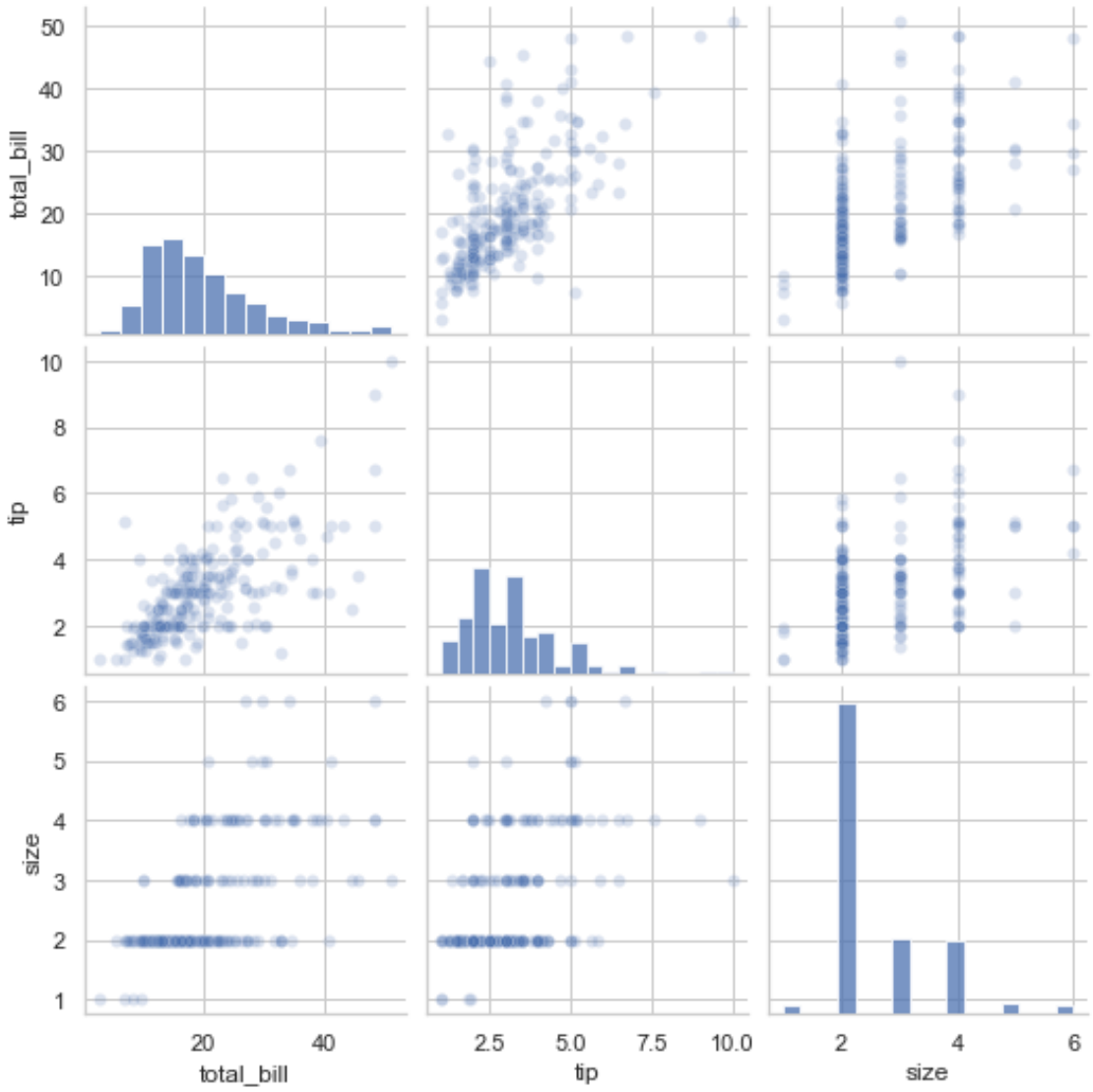
[9]:
```
plt.figure(figsize =(10, 7))
sns.catplot(x='day', y='tip', hue='time', col='smoker',
                kind='box', data=tips[tips.tip < 245])
plt.ylabel('Tip', fontsize=15)
plt.xlabel('Day', fontsize=15)
plt.show()
```

```
<Figure size 720x504 with 0 Axes>
```



Matrix Plot: pairwise relationship

[10]:
```
sns.pairplot(tips, diag_kind='hist', plot_kws={'alpha': 0.2})
plt.show()
```



1.1.2 Level 2: Repeat the exercise with the dataset movies.dat.

[11]:
```
#Download the date set 'movies' and upload it to a panda's Dataframe.
#import data on movies
file = "movies.dat"
columns = ['ID', 'TITLE', 'GENRES']
movies = pd.read_table(file, sep='::', header=None, names=columns, encoding =␣
 ↪"ISO-8859-1", engine='python')

#show  subset of rows to display (=10)
movies.sample(3)
```

[11]:
```
        ID                                TITLE           GENRES
2097  2166          Return to Paradise (1998)    Drama|Romance
816    827  Convent, The (Convento, O) (1995)            Drama
3867  3937                     Runaway (1984)  Sci-Fi|Thriller
```

[12]:
```
#extract year of movies from title and create new column
pattern = "\(([1-2]+[0-9]+[0-9]+[0-9]+)\)"
movies["YEAR"] = movies["TITLE"].apply(lambda x: int(re.search(pattern, x).
 ↪group(1)))
pattern = "\(.+\)|\s\-.+"
movies["TITLE"] = movies["TITLE"].apply(lambda x: re.sub(pattern, "", x))
movies = movies [['ID', 'TITLE', 'YEAR', 'GENRES']]

movies.sample(3)
```

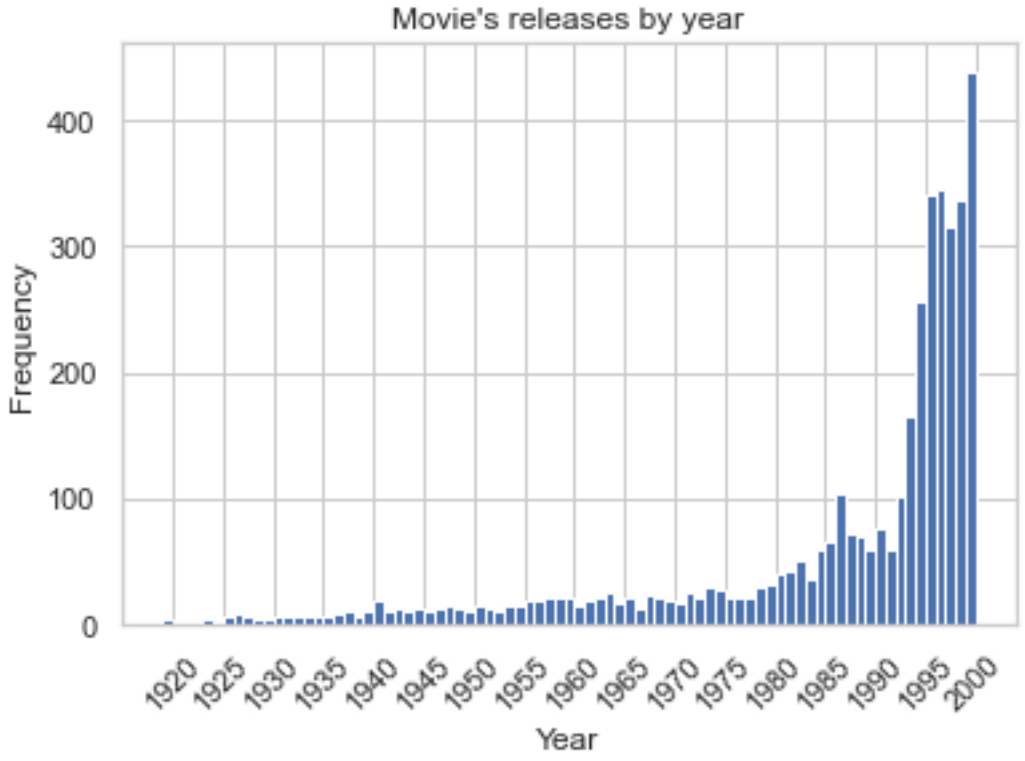
[12]:
```
        ID                                          TITLE  YEAR    GENRES
620    625                                  Asfour Stah   1990     Drama
2446  2515  Children of the Corn II: The Final Sacrifice   1993    Horror
2116  2185                                    I Confess   1953  Thriller
```

[13]:
```
#create dummy variables of movies's genres
dummyGenres = movies.GENRES.str.get_dummies(sep='|')
movies = movies.join(dummyGenres)

movies.sample(3)
```

[13]:
```
        ID            TITLE  YEAR     GENRES  Action  Adventure  Animation  \
1164  1180    Hear My Song   1991     Comedy       0          0          0
2967  3036  Quest for Fire   1981  Adventure       0          1          0
3019  3088          Harvey   1950     Comedy       0          0          0

      Children's  Comedy  Crime  …  Fantasy  Film-Noir  Horror  Musical  \
1164           0       1      0  …        0          0       0        0
2967           0       0      0  …        0          0       0        0
3019           0       1      0  …        0          0       0        0

      Mystery  Romance  Sci-Fi  Thriller  War  Western
1164        0        0       0         0    0        0
2967        0        0       0         0    0        0
3019        0        0       0         0    0        0

[3 rows x 22 columns]
```

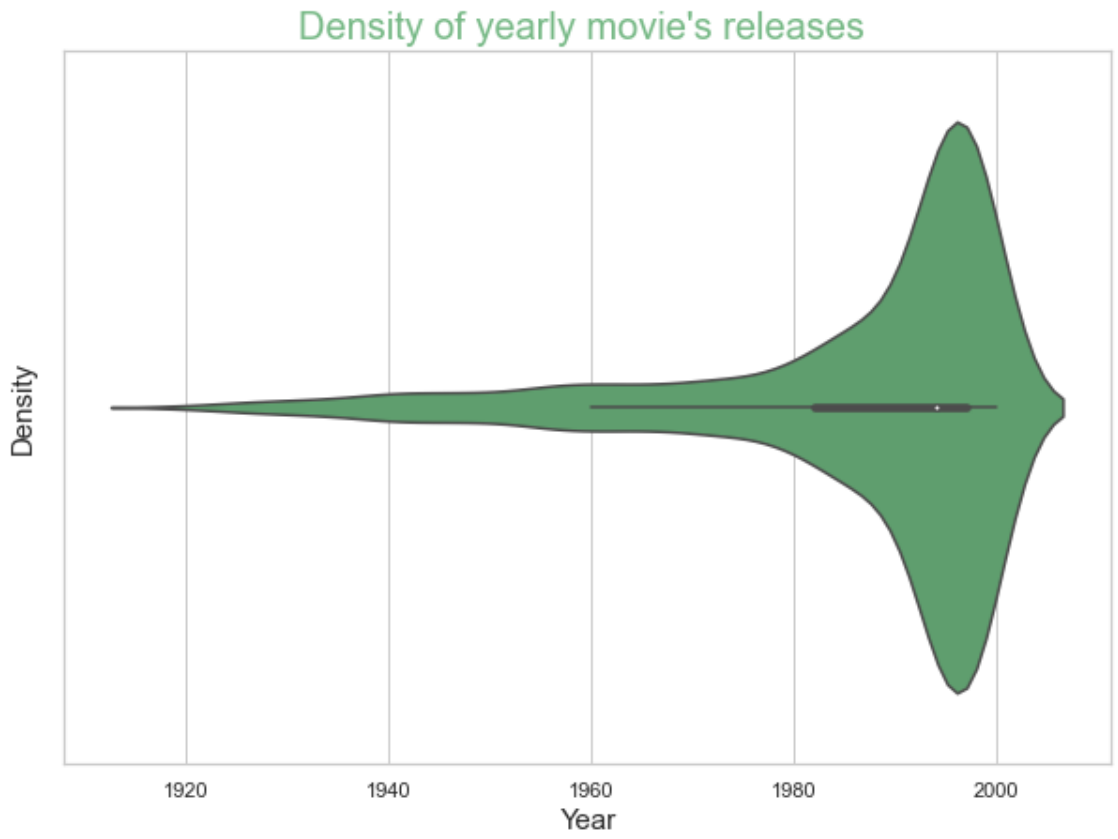
[14]:
```
movies.hist(['YEAR'], bins=len(movies.YEAR.value_counts()))
plt.title('Movie\'s releases by year')
plt.ylabel('Frequency')
plt.xlabel('Year')
```

```
plt.xticks(range(1920,2001,5) ,rotation=45)
plt.show()
```



Plot with one numerical variable

[15]:
```
sns.set(style='whitegrid')
plt.figure(figsize =(10, 7))
sns.violinplot(x='YEAR', data=movies, color="g")
plt.title('Density of yearly movie\'s releases ', fontsize=20, color='g',␣
 ↪alpha=0.8)
plt.xlabel('Year', fontsize=15)
plt.ylabel('Density', fontsize=15)
plt.show()
```



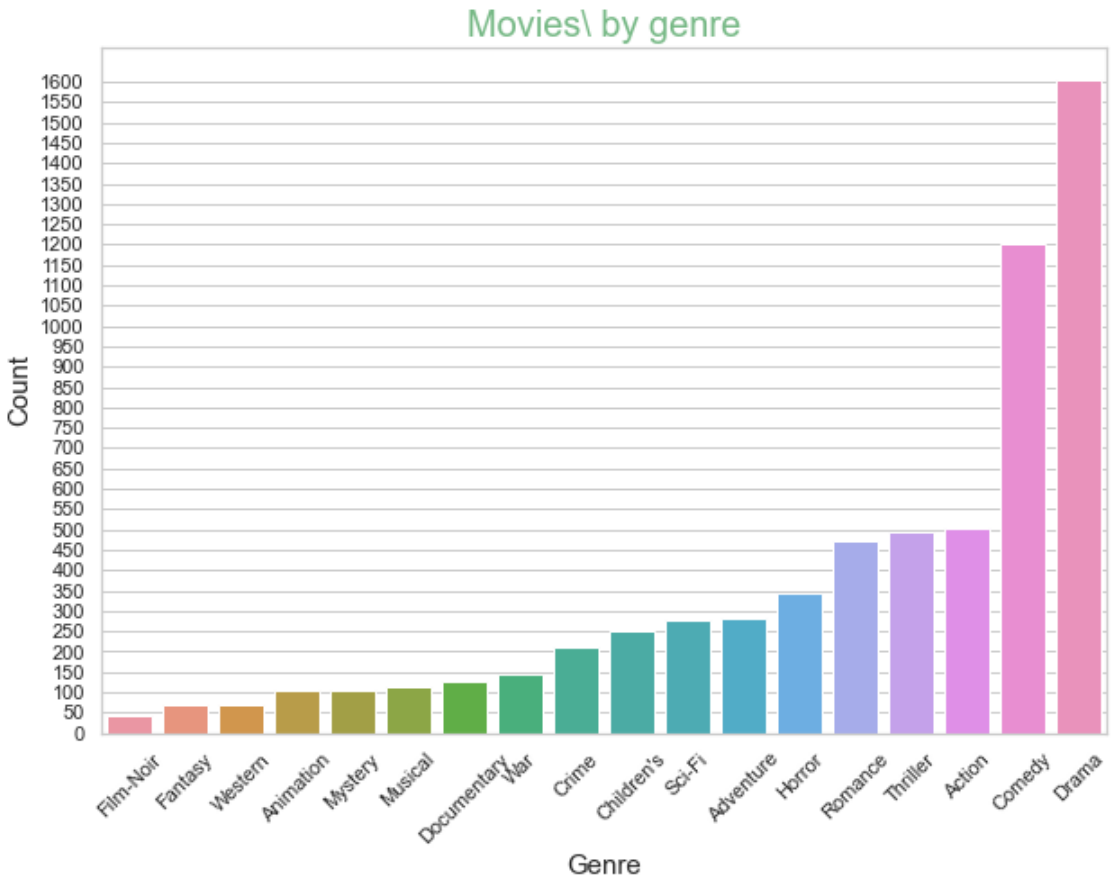
Plot with one numerical and one categorical variable

[16]:
```
data1 = dummyGenres.apply(np.sum).sort_values()
data1
```

[16]:
```
Film-Noir        44
Fantasy          68
Western          68
Animation       105
Mystery         106
Musical         114
Documentary     127
War             143
Crime           211
Children's      251
Sci-Fi          276
Adventure       283
Horror          343
Romance         471
Thriller        492
Action          503
```

```
Comedy          1200
Drama           1603
dtype: int64
```

[17]:
```
plt.figure(figsize =(10, 7))
sns.set_style("whitegrid")
sns.barplot(x=data1.index, y=data1.values)
plt.title('Movies\ by genre', fontsize=20, color='g', alpha=0.8)
plt.xlabel("Genre", fontsize=15)
plt.ylabel("Count", fontsize=15)
plt.yticks(range(0,1601,50))
plt.xticks(rotation=45)
plt.show()
```



Plot with one numerical and two categorical variables

1.1.3 Level 3: show your creativity.

[19]:
```
# Create new categorical variable using var year

# take first and last year to create bins of decades as string variable
firstYear = movies["YEAR"].min()
lastYear = movies["YEAR"].max()
bins = list(range(firstYear-10, lastYear+10, 10))
decades = [(str(x+1)) for x in bins]
decades.pop()

print(decades)
```

```
['1910', '1920', '1930', '1940', '1950', '1960', '1970', '1980', '1990', '2000']
```

[20]:
```
# create dataframe of movies' genre by year
data2 = movies.groupby("YEAR")[dummyGenres.columns].sum()
data2.head(3)
```

[20]:

YEAR	Action	Adventure	Animation	Children's	Comedy	Crime	Documentary	Drama	Fantasy	Film-Noir	Horror	Musical	Mystery	Romance	Sci-Fi	Thriller	War	Western
1919	1	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0
1920	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1921	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[21]:
```
#map year to corresponding decade
data2.reset_index(inplace=True)
data2["YEAR"] = pd.cut(data2.YEAR, bins, labels=decades)
data2.rename(columns={"YEAR": "DECADE"}, inplace=True)

#group genres by decade
data2 = data2.groupby("DECADE")[dummyGenres.columns].sum()
data2
```

[21]:

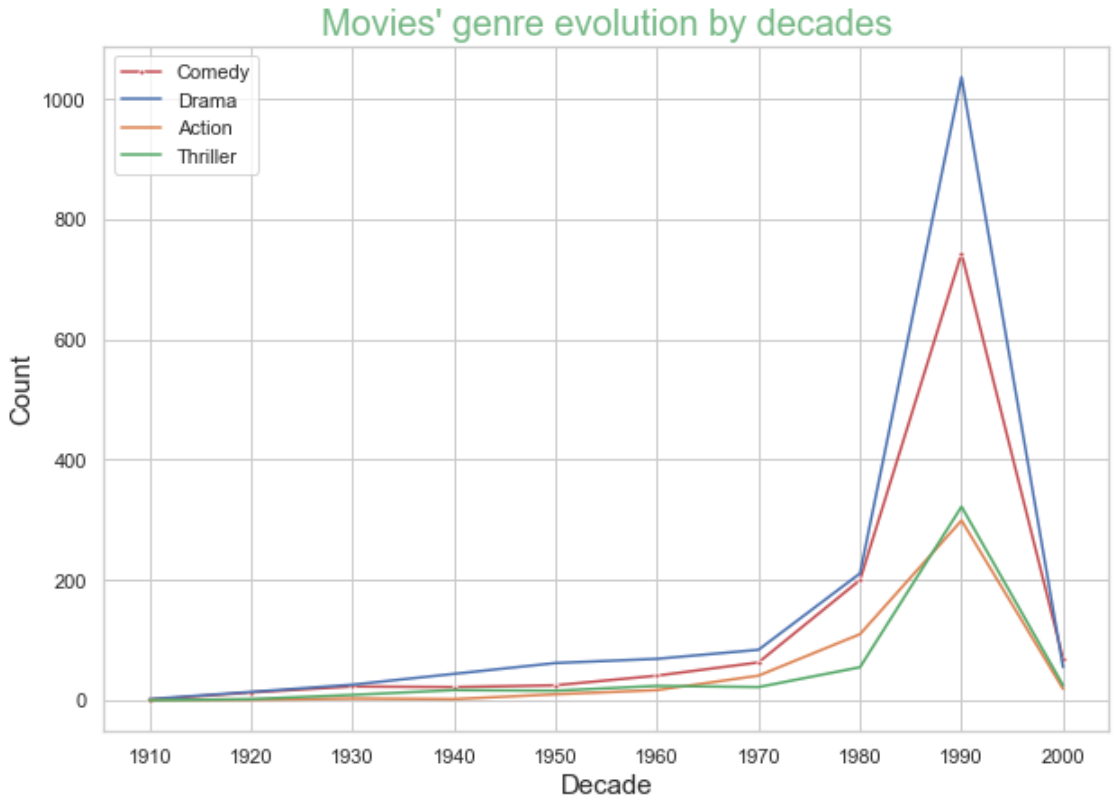
DECADE	Action	Adventure	Animation	Children's	Comedy	Crime	Documentary
1910	1	1	0	0	1	0	0
1920	1	1	0	0	13	1	0
1930	3	6	2	4	23	4	1
1940	2	6	11	13	22	8	0
1950	10	13	5	10	25	7	1
1960	17	16	5	20	41	6	1
1970	41	26	8	25	63	17	2
1980	110	78	14	31	200	21	9
1990	299	130	52	139	743	139	105
2000	19	6	8	9	69	8	8

DECADE	Drama	Fantasy	Film-Noir	Horror	Musical	Mystery	Romance	Sci-Fi
1910	2	0	0	0	0	0	0	0
1920	14	0	0	1	1	0	2	1
1930	26	0	1	7	11	5	15	1
1940	44	0	17	14	14	9	14	1
1950	62	4	9	20	17	7	18	32
1960	69	2	2	26	19	5	10	13
1970	84	4	1	35	9	6	8	31
1980	211	24	4	112	12	12	54	66
1990	1036	33	10	120	30	61	333	121
2000	55	1	0	8	1	1	17	10

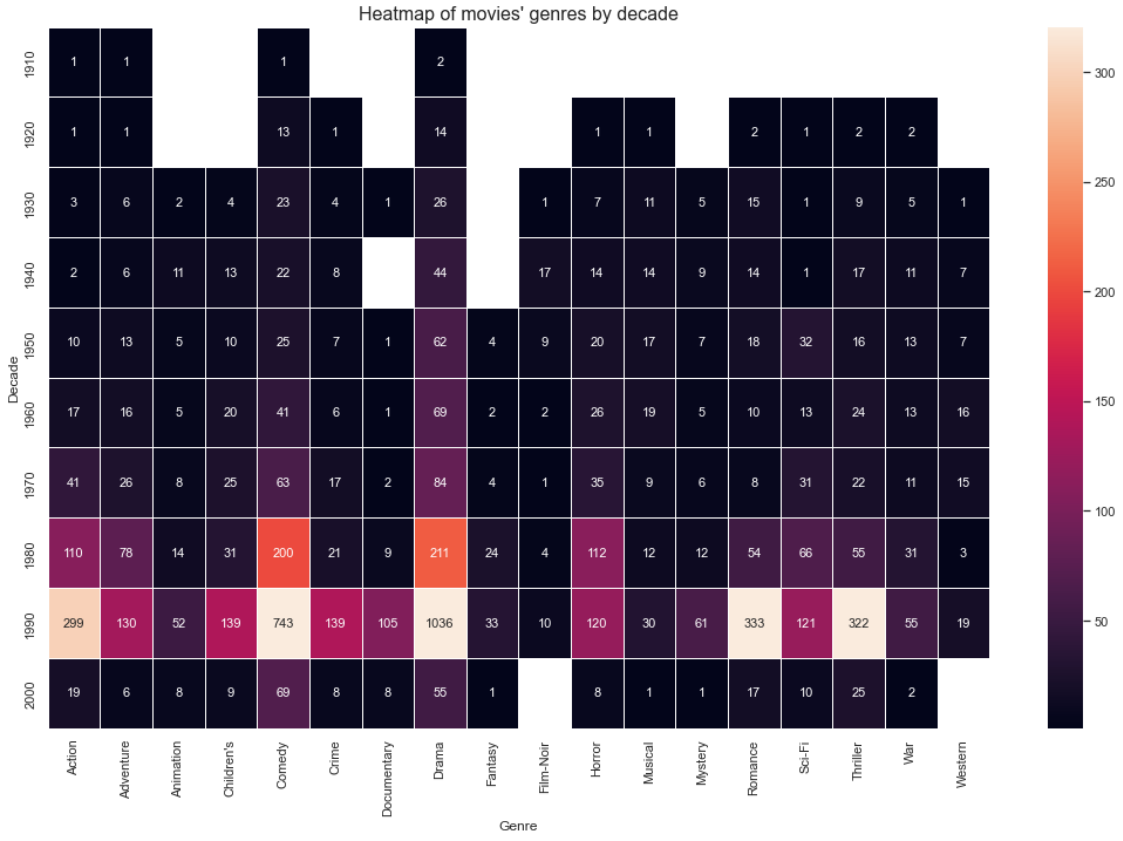
DECADE	Thriller	War	Western
1910	0	0	0
1920	2	2	0
1930	9	5	1
1940	17	11	7
1950	16	13	7
1960	24	13	16
1970	22	11	15
1980	55	31	3
1990	322	55	19
2000	25	2	0

[22]:
```
# show evolution of movies' releases by top four genres
plt.figure(figsize =(10, 7))
sns.set_style("whitegrid")
sns.lineplot(x="DECADE", y="Comedy", marker='.', color='r', data=data2)
sns.lineplot(x="DECADE", y="Drama", data=data2)
sns.lineplot(x="DECADE", y="Action", data=data2)
sns.lineplot(x="DECADE", y="Thriller", data=data2)
```

```
plt.title('Movies\' genre evolution by decades', fontsize=20, color='g',␣
 ↪alpha=0.8)
plt.xlabel("Decade", fontsize=15)
plt.ylabel("Count", fontsize=15)
plt.legend(["Comedy", "Drama", "Action", "Thriller"])
plt.show()
```



[23]:
```
#plot heatmap without zero values
plt.figure(figsize =(18, 11))
mask = data2 == 0
sns.heatmap(data2, annot=True, annot_kws={"size": 11}, robust=True, fmt='.0f',
            mask=mask, linewidth=1, linecolor="w")
plt.title("Heatmap of movies' genres by decade", fontdict={'fontsize':16})
plt.xlabel("Genre")
plt.ylabel("Decade")
plt.show()
```


Heatmap of movies' genres by decade
Decade
1910 1 1 1 2
1920 1 1 13 1 14 1 1 2 1 2 2
1930 3 6 2 4 23 4 1 26 1 7 11 5 15 1 9 5 1
1940 2 6 11 13 22 8 44 17 14 14 9 14 1 17 11 7
1950 10 13 5 10 25 7 1 62 4 9 20 17 7 18 32 16 13 7
1960 17 16 5 20 41 6 1 69 2 2 26 19 5 10 13 24 13 16
1970 41 26 8 25 63 17 2 84 4 1 35 9 6 8 31 22 11 15
1980 110 78 14 31 200 21 9 211 24 4 112 12 12 54 66 55 31 3
1990 299 130 52 139 743 139 105 1036 33 10 120 30 61 333 121 322 55 19
2000 19 6 8 9 69 8 8 55 1 8 1 1 17 10 25 2
Action
Adventure
Animation
Children's
Comedy
Crime
Documentary
Drama
Fantasy
Film-Noir
Horror
Musical
Mystery
Romance
Sci-Fi
Thriller
War
Western
Genre
300
250
200
150
100
50