Business Problem Yulu has recently suffered considerable dips in its revenues. They have contracted a consulting company to understand the factors on ... electric cycles depends. Specifically, they want to understand the factors affecting the demand for these ... rket.

Which var... demand for shared electric cycles in the Indian market?

How well ... ycle demands?

- Undo insert cell Ctrl+M Z
- Redo Ctrl+Shift+Y
- Select all cells Ctrl+Shift+A
- Cut cell or selection
- Copy cell or selection
- Paste
- Delete selected cells Ctrl+M D
- Find and replace Ctrl+H
- Find next Ctrl+G
- Find previous Ctrl+Shift+G
- Notebook settings
- Clear all outputs

```
import pa
import nu
import se
import ma
from stat                            est as ztest
```

```
df = pd.r
```

```
df.shape
```

```
(108
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10886 entries, 0 to 10885
Data columns (total 12 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   datetime    10886 non-null  object 
 1   season      10886 non-null  int64  
 2   holiday     10886 non-null  int64  
 3   workingday  10886 non-null  int64  
 4   weather     10886 non-null  int64  
 5   temp        10886 non-null  float64
 6   atemp       10886 non-null  float64
 7   humidity    10886 non-null  int64  
 8   windspeed   10886 non-null  float64
 9   casual      10886 non-null  int64  
 10  registered  10886 non-null  int64  
 11  count       10886 non-null  int64  
dtypes: float64(3), int64(8), object(1)
memory usage: 1020.7+ KB
```

```
df.head(5)
```

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed
0	2011-01-01 00:00:00	1	0	0	1	9.84	14.395	81	0.0
1	2011-01-01 01:00:00	1	0	0	1	9.02	13.635	80	0.0
	2011-01-								

```
##Checking for any null value
df.isnull().sum()
```

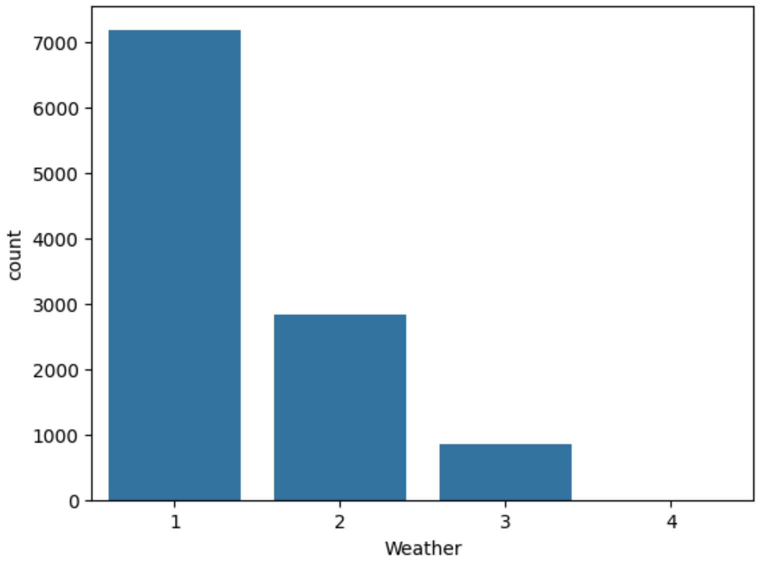
```
datetime      0
season        0
holiday       0
workingday    0
weather       0
temp          0
atemp         0
humidity      0
windspeed     0
casual        0
registered    0
count         0
dtype: int64
```

== **Univariate Analysis** =====================================

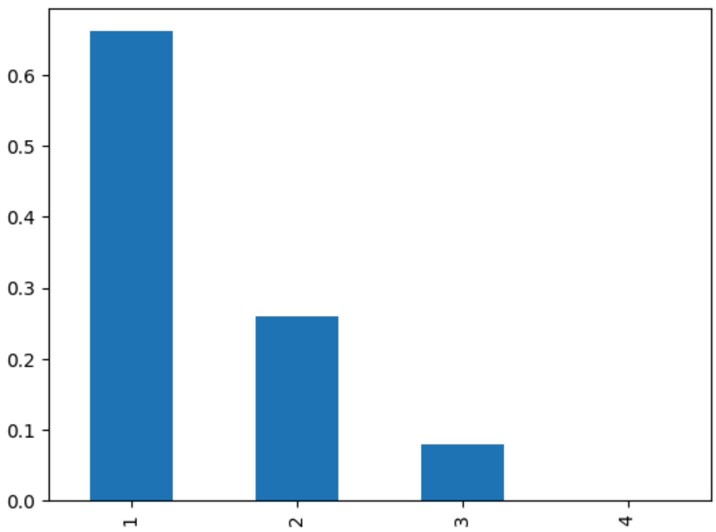
```
df.describe()
```

	season	holiday	workingday	weather	temp	ater
count	10886.000000	10886.000000	10886.000000	10886.000000	10886.00000	10886.0000(
mean	2.506614	0.028569	0.680875	1.418427	20.23086	23.6550{
std	1.116174	0.166599	0.466159	0.633839	7.79159	8.4746(
min	1.000000	0.000000	0.000000	1.000000	0.82000	0.7600(
25%	2.000000	0.000000	0.000000	1.000000	13.94000	16.6650(
50%	3.000000	0.000000	1.000000	1.000000	20.50000	24.2400(
75%	4.000000	0.000000	1.000000	2.000000	26.24000	31.0600(
max	4.000000	1.000000	1.000000	4.000000	41.00000	45.4550(

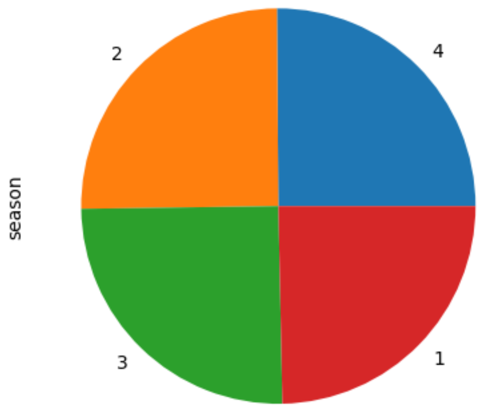
```
sns.countplot(x=df["weather"])
plt.xlabel("Weather")
plt.show()
```




```
df['weather'].value_counts(normalize=True).round(3).plot(kind = "bar")
plt.show()
```




```
df["season"].value_counts().plot(kind="pie")
plt.show()
```



Observation of Univariate Analysis

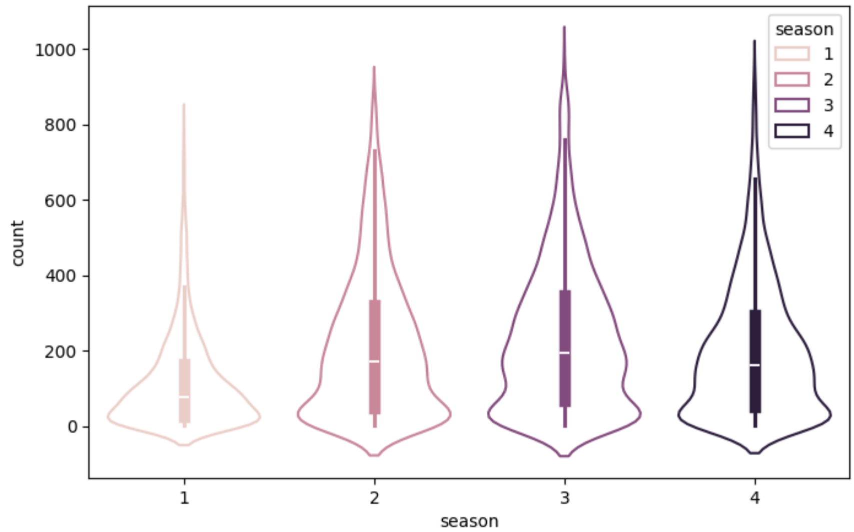
- weather category 1 has most number of values around 70 percent values

1. Clear, Few clouds, partly cloudy, partly cloudy

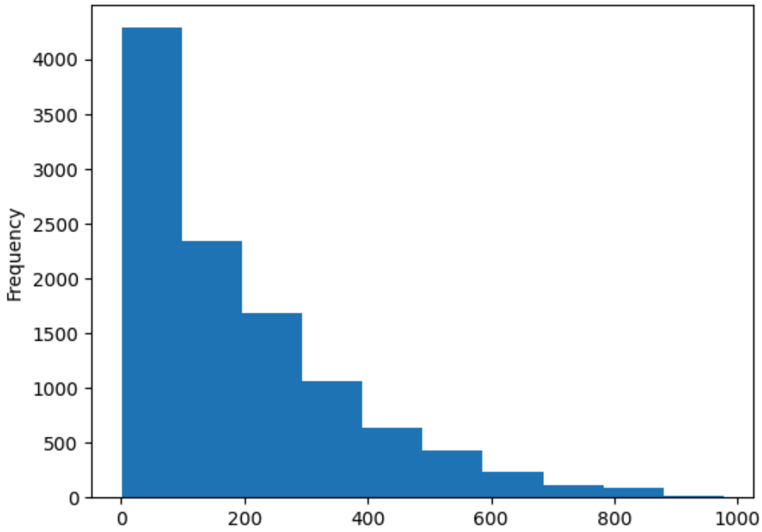
- season values are nearly equal for all seasons

+++++++++++++++++Bivariate Analysis+++++++++++++++++++++++

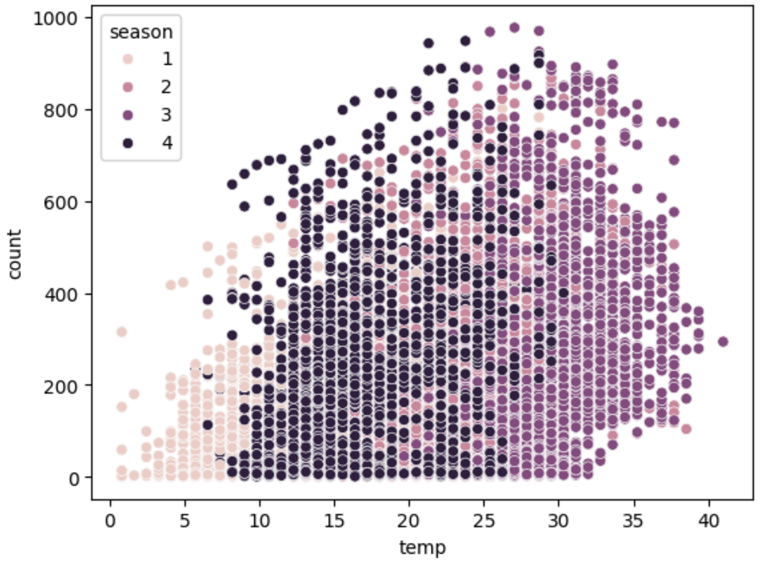
```
plt.figure(figsize=(8,5))
sns.violinplot(x = 'season', y = 'count', data = df,hue='season',fill=False)
plt.show()
```



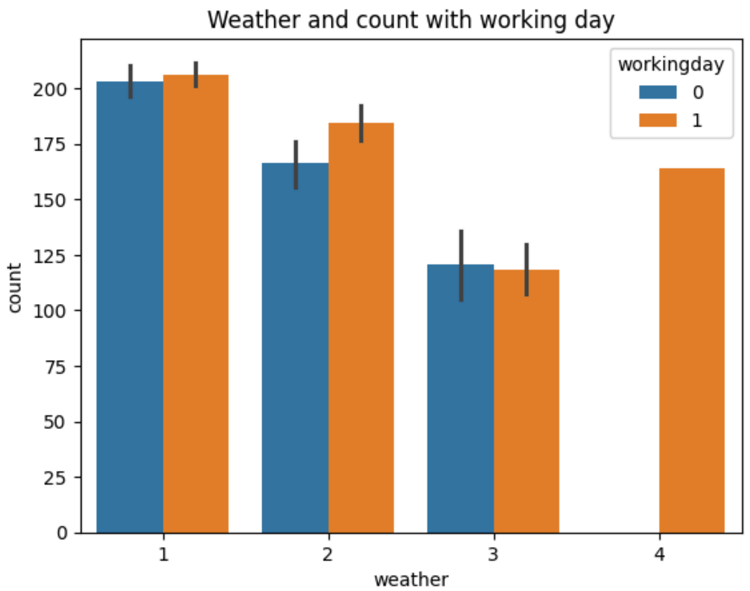

```
df["count"].plot(kind = "hist")
plt.show()
```



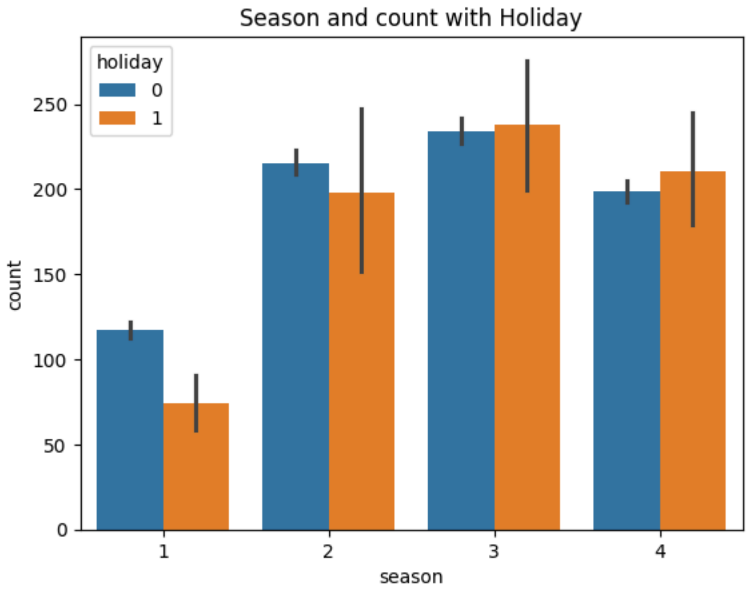

```
sns.scatterplot(data = df, x = "temp", y = "count", hue = "season")
plt.show()
```




```
sns.barplot(x="weather", y="count",data=df, hue="workingday")
plt.title("Weather and count with working day")
plt.show()
```

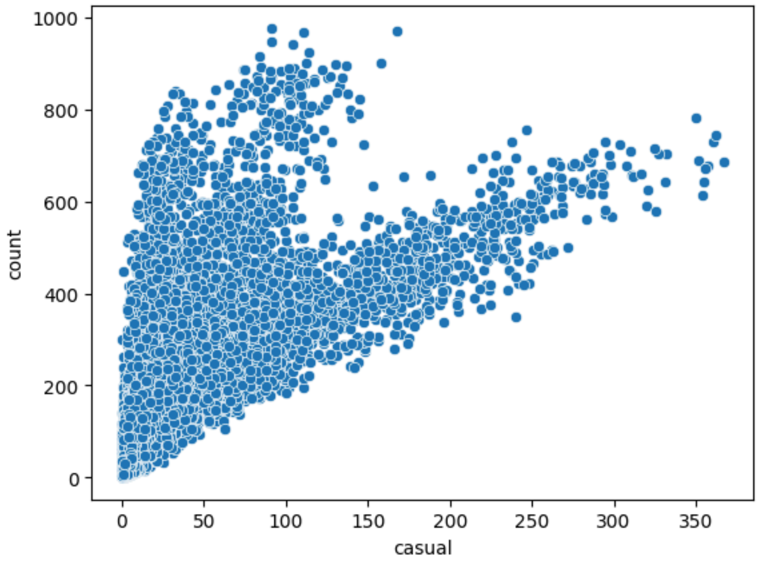


```
sns.barplot(x="season", y="count",data=df, hue="holiday")
plt.title("Season and count with Holiday")
plt.show()
```




```
sns.scatterplot(x="casual", y="count",data=df)
```

```
<Axes: xlabel='casual', ylabel='count'>
```

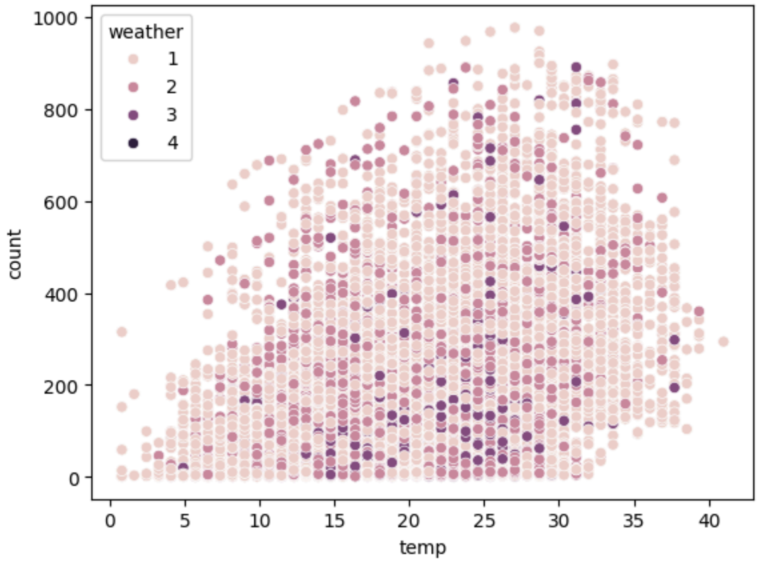


Observation

1. Weather day 1 has most bikes rented (1: Clear, Few clouds, partly cloudy, partly cloudy)
2. Season Fall has most number of counts and spring has least
3. No users on holidays in Heavy Rain + Ice Pallets + Thunderstorm + Mist, Snow + Fog weather conditions
4. weather category 1 has equal users on holidays and workdays

Getting a bird eye view of some data

```
sns.scatterplot(data = df, x = "temp", y = "count", hue = "weather")
plt.show()
```



* Objectve 1

2 sample Test

To determine whether holiday and working day has any effect on number of bikes rented

```
df['workingday'].value_counts()
```

```
1    7412
0    3474
Name: workingday, dtype: int64
```

```
workinday_rent_count = df["count"].loc[df["workingday"] == 0]
holiday_rent_count = df["count"].loc[df["workingday"] == 1]
```

Null Hypothesis Ho is working day and holiday has no effect on number of bikes rented

Ho = holiday and working day are same

i.e. Ho => number of bikes rented on holiday are same as number of bikes rented on working day

Alternate Hypothesis Ha => number of bikes rented on holiday are not same as number of bikes rented on working day

using 2 sample test

Keeping full sample size as is as larger sample size assures us a near normal distribution

```
samp1=workinday_rent_count
samp2=holiday_rent_count
alpha=0.05
```

```
zscore,p_value= ztest(samp1,samp2,alternative='two-sided')
print(p_value)
if p_value < alpha:
  print("Reject Ho:there is no similarity in count of bikes rented in different weathers")
else:
  print("Failed to reject H0/Accept Ho:Working day and holiday has no effect on number of bikes rented ")
```

```
0.22642176970306893
Failed to reject H0/Accept Ho:Working day and holiday has no effect on number of bikes rented
```

Observation We accept number of bikes rented on holiday are same as number of bikes rented on working day, i.e null hypothesis

note: There is a risk in considering the values of this test as very correct as we have not taken the normal sample distribution for 2 sample test and not cross checked with assumptions of the test (Normality, Equal Variance).

Objectve 2

Chi-square

Test to check if Weather is dependent on the season

Weather:

1. Clear, Few clouds, partly cloudy, partly cloudy
2. Mist + Cloudy, Mist + Broken clouds, Mist + Few clouds, Mist
3. Light Snow, Light Rain + Thunderstorm + Scattered clouds, Light Rain + Scattered clouds
4. Heavy Rain + Ice Pallets + Thunderstorm + Mist, Snow + Fog

season:

1. spring
2. summer
3. fall
4. winter

Hypothesis

Null Hypothesis "Ho"

Weather and season are independent or No relation

Alternate hypothesis "Ha"

variables weather and season are dependent or significant relationship

Ho is variables are independent

Ha is variables are dependent

```
df["weather"].value_counts()
```

```
1    7192
2    2834
3     859
4       1
Name: weather, dtype: int64
```

```
df["season"].value_counts()
```

```
4    2734
2    2733
3    2733
1    2686
Name: season, dtype: int64
```

Contingency table

```
pd.crosstab(index=df['weather'],columns=df["season"],margins=True)
```

season	1	2	3	4	All
weather					
1	1759	1801	1930	1702	7192
2	715	708	604	807	2834
3	211	224	199	225	859
4	1	0	0	0	1
All	2686	2733	2733	2734	10886

```
from scipy.stats import chi2_contingency
```

```
# defining the table
data = [[1759, 715, 211, 1], [1801, 708, 224, 0], [1930, 604, 199, 0], [1702, 807, 225, 0]]
stat, p, dof, expected = chi2_contingency(data)
print(p)
print(expected)
```

```
1.549925073686492e-07
[[1.77454639e+03 6.99258130e+02 2.11948742e+02 2.46738931e-01]
 [1.80559765e+03 7.11493845e+02 2.15657450e+02 2.51056403e-01]
 [1.80559765e+03 7.11493845e+02 2.15657450e+02 2.51056403e-01]
 [1.80625831e+03 7.11754180e+02 2.15736359e+02 2.51148264e-01]]
```

```
alpha = 0.05
p

if p < alpha:
    print("Reject Ho. Accept Ha")
else:
    print("Accept Ho,  fail to reject he null hypothesis")
```

```
Reject Ho. Accept Ha
```

Observation We have Rejected null hypothesis and accepted Alternate hypothesis

Variables weather and season are **dependent** and will affect the each other values resulting changes in count in rented bikes

===
=

- Objectve 3

1. ANNOVA to check if No. of cycles rented is similar or different in different weathers To check whether "Weather" has any effect on nu,ber of bikes rented

Hypothesis Null Hypothesis "Ho" :-Bikes rented in all weather are similar

Alternate hypothesis "Ha":-Number of Bikes rented in all weather are different

```
## stats model library
from scipy.stats import f_oneway
```

Weather

1. Clear, Few clouds, partly cloudy, partly cloudy
2. Mist + Cloudy, Mist + Broken clouds, Mist + Few clouds, Mist
3. Light Snow, Light Rain + Thunderstorm + Scattered clouds, Light Rain + Scattered clouds
4. Heavy Rain + Ice Pallets + Thunderstorm + Mist, Snow + Fog

```
df.weather.value_counts()
```

```
1    7192
2    2834
3     859
4       1
Name: weather, dtype: int64
```

```
cat_1 = df.loc[df['weather'] == 1]['count'].values
cat_2 = df.loc[df['weather'] == 2]['count'].values
cat_3 = df.loc[df['weather'] == 3]['count'].values
cat_4 = df.loc[df['weather'] == 4]['count'].values

# f_oneway(cat_1, cat_2, cat_3, cat_4)
```

```
statistic,p_value=f_oneway(cat_1, cat_2, cat_3, cat_4)
print(statistic)
print(p_value)
```

```
65.53024112793271
5.482069475935669e-42
```

```
alpha=0.05
if p_value < alpha:
   print("Reject Ho:- Number of Bikes rented in all weather are different")
else:
    print("Accept Ho:-Bikes rented in all weather are similar")
```

```
Reject Ho:- Number of Bikes rented in all weather are different
```

Observation

As we **reject the NUll Hypothesis**: Means yulu need to have different policies for different weather conditions as these are not working. same policies for all weather won't work.

##

2. **ANNOVA to check if No. of cycles rented is similar or different in different seasons**

To check whether "seasons" has any effect on number of bikes rented

Hypothesis Null Hypothesis "Ho" :-Bikes rented in all seasons are similar

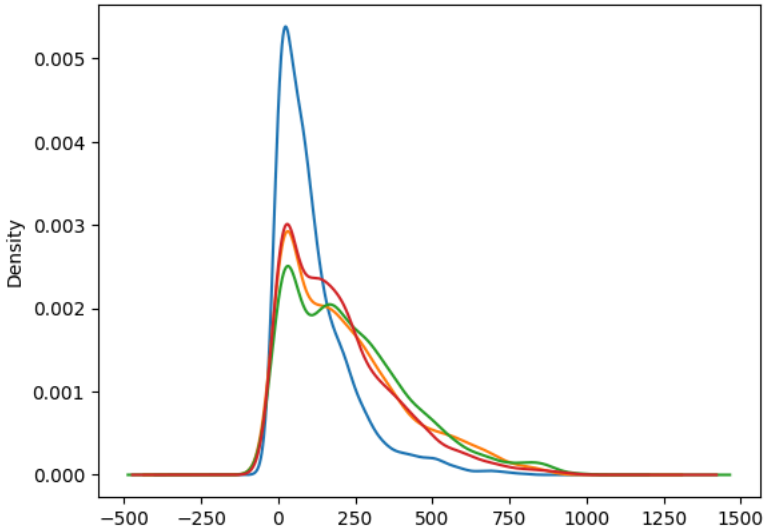
Alternate hypoothesis "Ha":-number of Bikes rented in all seasons are different

```
df["season"].value_counts()
```

```
4    2734
2    2733
3    2733
1    2686
Name: season, dtype: int64
```

```
df.groupby('season')['count'].plot(kind='kde')
```

```
season
1    Axes(0.125,0.11;0.775x0.77)
2    Axes(0.125,0.11;0.775x0.77)
3    Axes(0.125,0.11;0.775x0.77)
4    Axes(0.125,0.11;0.775x0.77)
Name: count, dtype: object
```




```
sea_cat_1=df.loc[df['season']==1]['count'].values
sea_cat_2=df.loc[df['season']==2]['count'].values
sea_cat_3=df.loc[df['season']==3]['count'].values
sea_cat_4=df.loc[df['season']==4]['count'].values
```

```
statistic,p_value=f_oneway(sea_cat_1, sea_cat_2, sea_cat_3, sea_cat_4)
print(statistic)
print(p_value)
```

```
236.94671081032106
6.164843386499654e-149
```

```
alpha=0.05
if p_value < alpha:
   print("Reject Ho:- Number of Bikes rented in all season are different")
else:
    print("Accept Ho:-Bikes rented in all season are similar")
```

```
Reject Ho:- Number of Bikes rented in all season are different
```

Observation

As we reject the NUll Hypothesis :This means we need to have different policies for different seasons. same policies for al seasons won't work

Insights and Recommendations

Insights

- working day and holiday has no effect on number of bikes rented Note: There is a risk in considering the values of this test as very correct as we have not taken the normal sample distribution for 2 sample test and not cross checked with assumptions of the test (Normality, Equal Variance).

Variables like weather and seasons are dependent variables

- Variables like weather and seasons are **dependent** variables
- Anova test on weather has given us insight of weather has effect on number of bikes rented, number of Bikes rented in all seasons are different.