In [1]:

```
import numpy as np
import pandas as pd
from scipy.stats import
ttest_ind,norm,f_oneway,chi2_contingency,shapiro,levene
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```
df=pd.read_csv("yulu")
df
```

Out[2]:

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	casual	registered	count
0	2011-01-01 00:00:00	1	0	0	1	9.84	14.395	81	0.0000	3	13	16
1	2011-01-01 01:00:00	1	0	0	1	9.02	13.635	80	0.0000	8	32	40
2	2011-01-01 02:00:00	1	0	0	1	9.02	13.635	80	0.0000	5	27	32
3	2011-01-01 03:00:00	1	0	0	1	9.84	14.395	75	0.0000	3	10	13
4	2011-01-01 04:00:00	1	0	0	1	9.84	14.395	75	0.0000	0	1	1
...	...	...	...	...	...	...	...	...	...	...	...	...
10881	2012-12-19 19:00:00	4	0	1	1	15.58	19.695	50	26.0027	7	329	336
10882	2012-12-19 20:00:00	4	0	1	1	14.76	17.425	57	15.0013	10	231	241
10883	2012-12-19 21:00:00	4	0	1	1	13.94	15.910	61	15.0013	4	164	168
10884	2012-12-19 22:00:00	4	0	1	1	13.94	17.425	61	6.0032	12	117	129

10885	2012-12-19 23:00:00	4	0	1	1	13.12	16.665	66	8.9981	4	84	88

10886 rows × 12 columns

OBSERVATIONS

In [3]:

```
df.shape
```

Out[3]:
```
(10886, 12)
```

In [4]:

```
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
```

From the above data set we can see that there is no missing values present in the data

In [5]:

```
df.describe(include="all")
```

Out[5]:

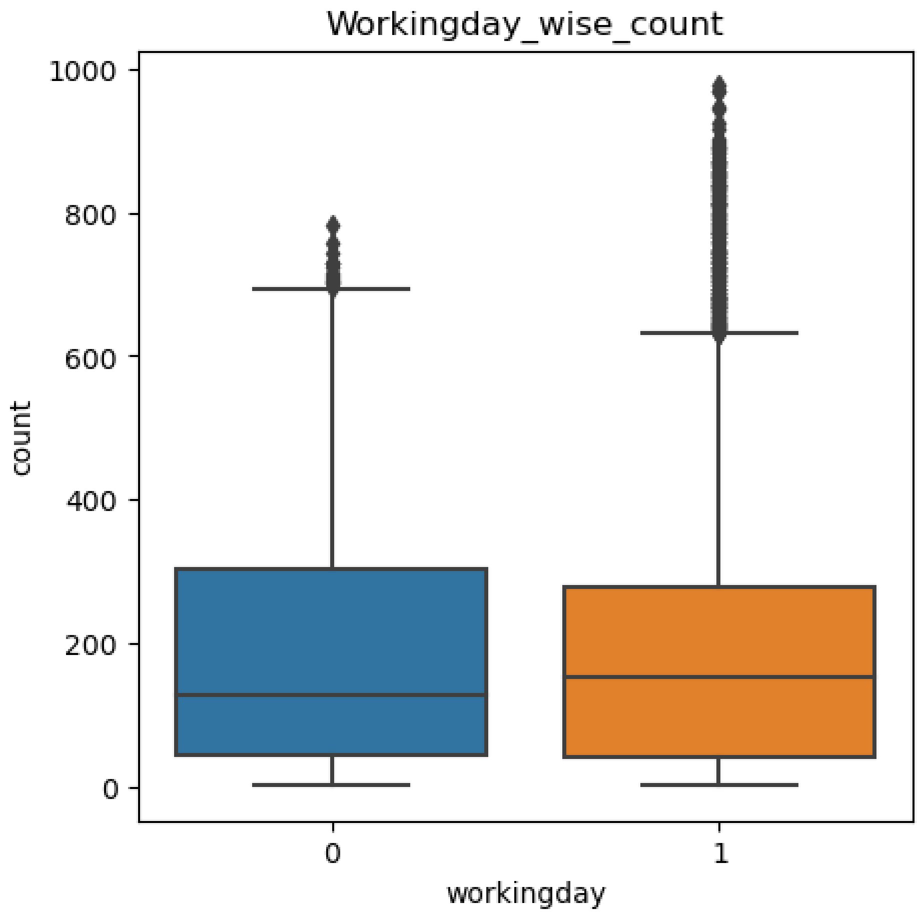
	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	casual	registered	count
count	10886	10886.000000	10886.000000	10886.000000	10886.000000	10886.00000	10886.000000	10886.000000	10886.000000	10886.000000	10886.000000	10886.000000

unique	10886	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
top	2011-01-01 00:00:00	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
freq	1	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
mean	NaN	2.506614	0.028569	0.680875	1.418427	20.23086	23.655084	61.886460	12.799395	36.021955	155.552177	191.574132
std	NaN	1.116174	0.166599	0.466159	0.633839	7.79159	8.474601	19.245033	8.164537	49.960477	151.039033	181.144454
min	NaN	1.000000	0.000000	0.000000	1.000000	0.82000	0.760000	0.000000	0.000000	0.000000	0.000000	1.000000
25%	NaN	2.000000	0.000000	0.000000	1.000000	13.94000	16.665000	47.000000	7.001500	4.000000	36.000000	42.000000
50%	NaN	3.000000	0.000000	1.000000	1.000000	20.50000	24.240000	62.000000	12.998000	17.000000	118.000000	145.000000
75%	NaN	4.000000	0.000000	1.000000	2.000000	26.24000	31.060000	77.000000	16.997900	49.000000	222.000000	284.000000
max	NaN	4.000000	1.000000	1.000000	4.000000	41.00000	45.455000	100.000000	56.996900	367.000000	886.000000	977.000000

Checking Outliers

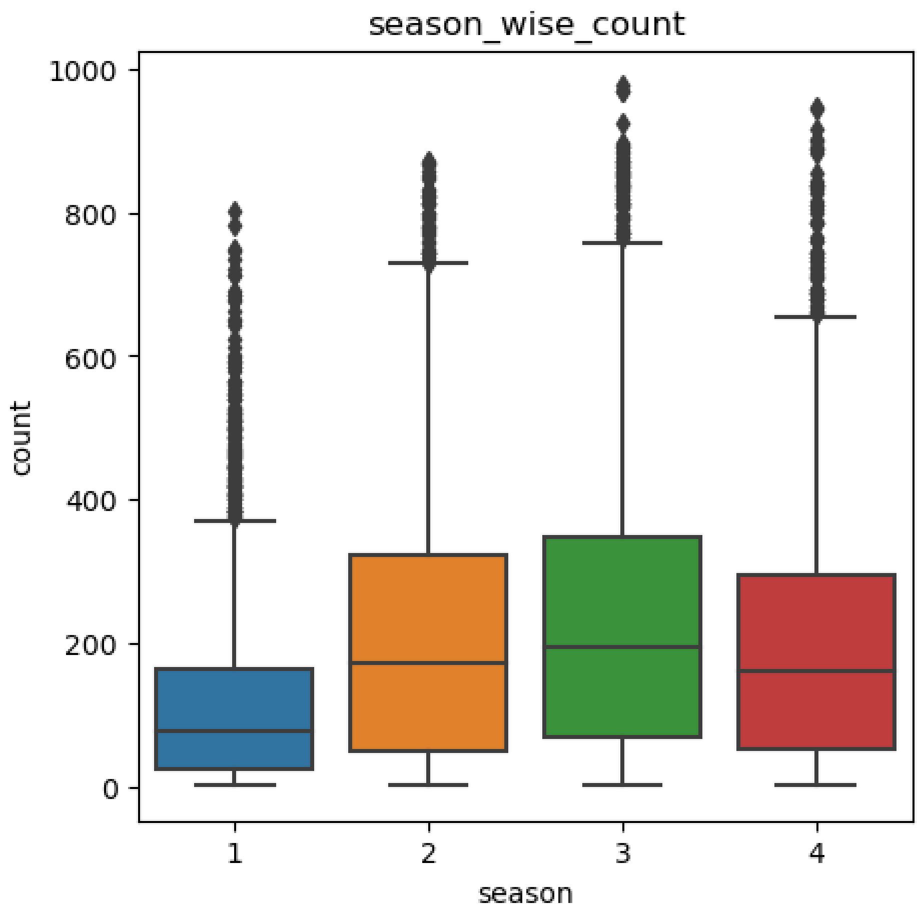
In [6]:

```
plt.figure(figsize=(5,5))
sns.boxplot(y=df["count"],x=df["workingday"])
plt.title("Workingday_wise_count")
plt.show()
```



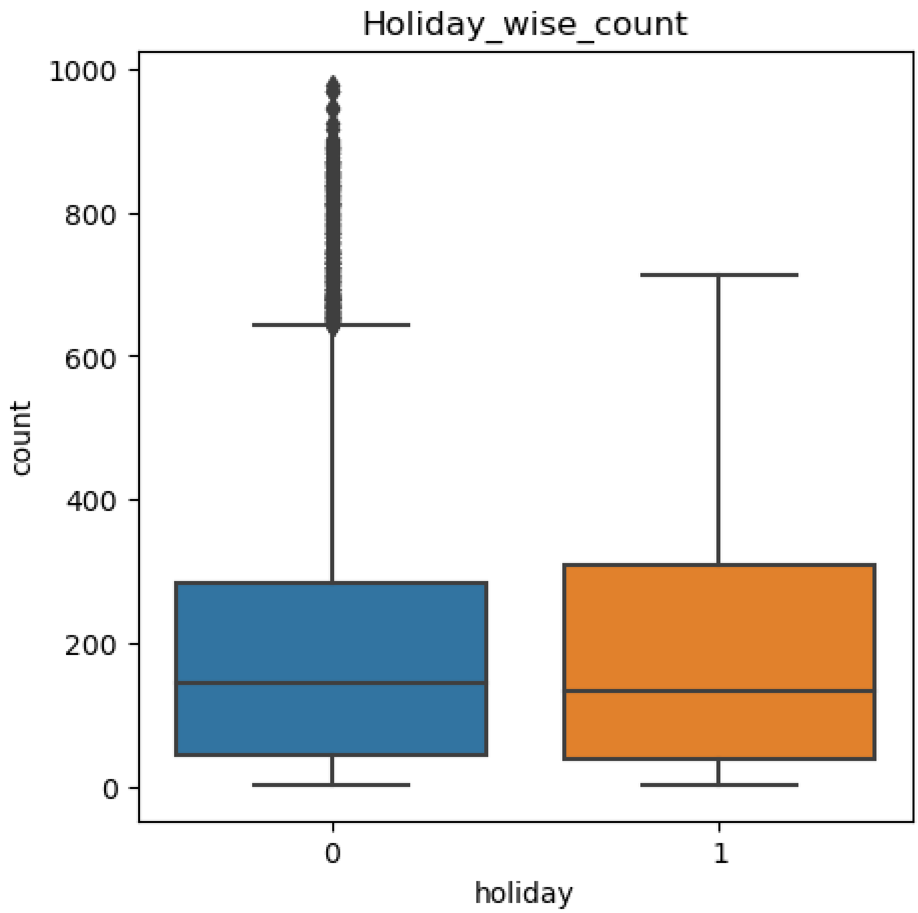
In [7]:

```
plt.figure(figsize=(5,5))
sns.boxplot(y=df["count"],x=df["season"])
plt.title("season_wise_count")
plt.show()
```



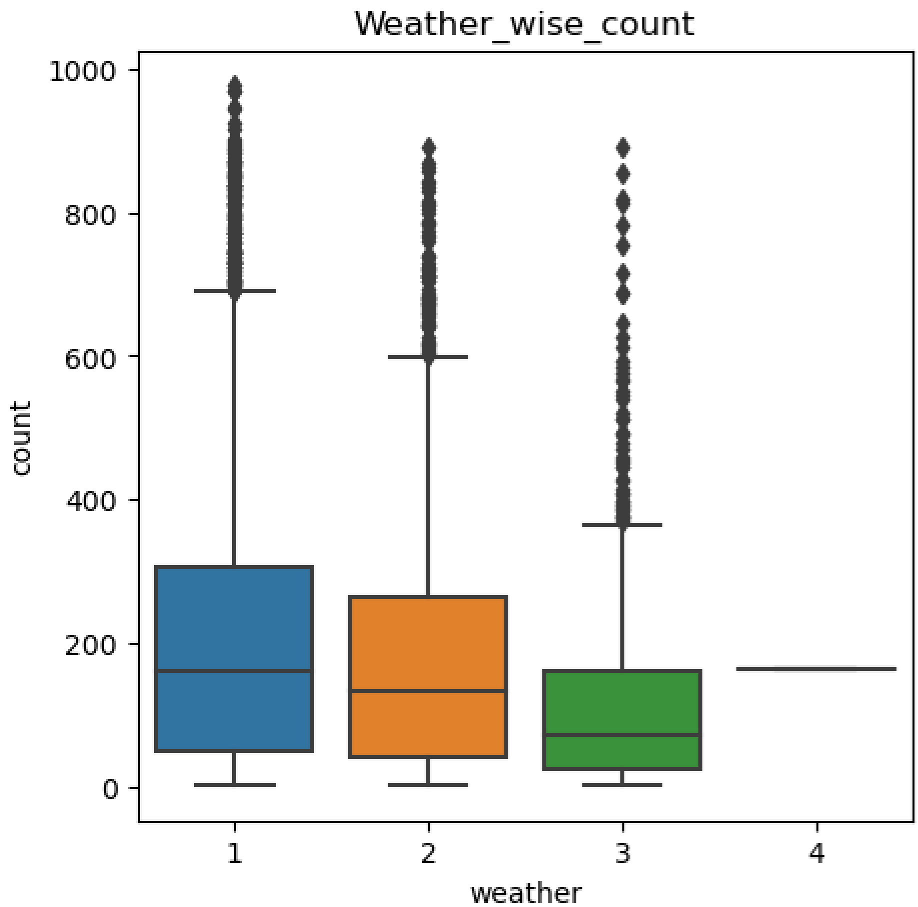
In [8]:

```
plt.figure(figsize=(5,5))
sns.boxplot(y=df["count"],x=df["holiday"])
plt.title("Holiday_wise_count")
plt.show()
```



In [9]:

```
plt.figure(figsize=(5,5))
sns.boxplot(y=df["count"],x=df["weather"])
plt.title("Weather_wise_count")
plt.show()
```



In [ ]:

BIVARIATE ANALYSIS

In [ ]:

ttest to check "Working Day has effect on number of electric cycles rented"

H0:Mean of working day and mean of non working day are equal. Ha:Mean of working day and mean of non working day are not same. alpha value=0.5

In [10]:

```
alpha_value=0.5
```

In [11]:

```
df_notworkingday=df[df["workingday"]==0]["count"]
```

```python
df_notworkingday
```

Out[11]:
```
0         16
1         40
2         32
3         13
4          1
        ...
10809    109
10810    122
10811    106
10812     89
10813     33
Name: count, Length: 3474, dtype: int64
```

In [12]:
```python
df_workingday=df[df["workingday"]==1]["count"]
df_workingday
```

Out[12]:
```
47         5
48         2
49         1
50         3
51        30
        ...
10881    336
10882    241
10883    168
10884    129
10885     88
Name: count, Length: 7412, dtype: int64
```

In [13]:
```python
tstatistic,P_value=ttest_ind(df_notworkingday,df_workingday)
```

In [14]:
```python
P_value
```

Out[14]:
```
0.22644804226361348
```

In [ ]:

In [15]:
```python
if P_value < alpha_value:
    print("reject the null hypothesis")
else:
    print("Don't reject the null hypothesis")
```

```
reject the null hypothesis
```

Hence no of casual users and registered user are more compare to non working day

Visual Analysis "Working Day has effect on number of electric cycles rented"

In [16]:

```
df_notworkingday.mean()
```

Out[16]:188.50662061024755

In [17]:

```
df_workingday.mean()
```

Out[17]:193.01187263896384

df_notworkingday.mean() < df_workingday.mean()

Normality test for working and non working day

H0:working and non working day will come under normality Ha:working and non working will not come under normality

In [21]:

```
statistic_value,p_value=shapiro(df_workingday)
```

In [22]:

```
p_value
```

Out[22]:0.0

In [23]:

```
statistic_value,p_value=shapiro(df_notworkingday)
```

In [24]:

```
p_value
```

Out[24]:4.203895392974451e-45

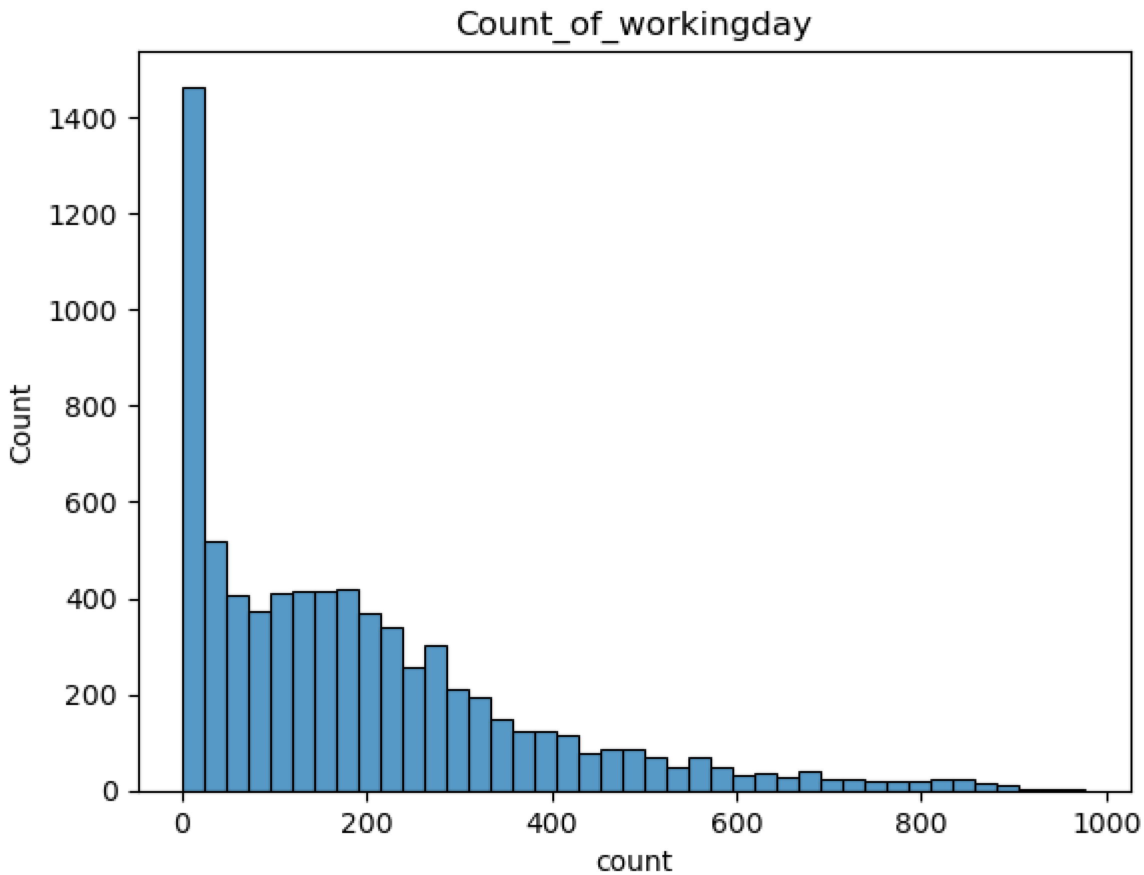
In [25]:

```
if p_value < alpha_value:
    print("working and non working will not come under normality")
else:
    print("working and non working day will come under normality ")
```

```
working and non working will not come under normality
```

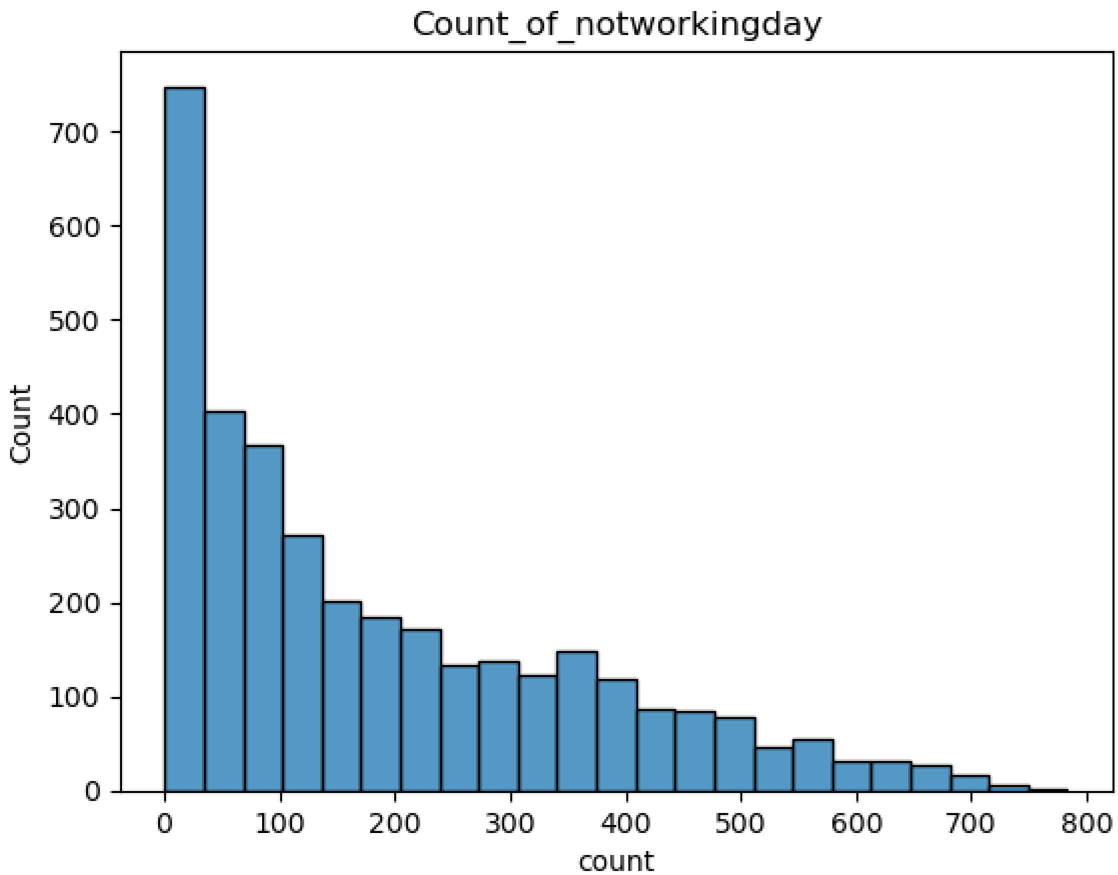
In [26]:

```
sns.histplot(df_workingday)
plt.title("Count_of_workingday")
plt.show()
```



In [27]:

```
sns.histplot(df_notworkingday)
plt.title("Count_of_notworkingday")
plt.show()
```



Variance Test for Working and non working day

H0:Both Working and non working variance are equal Ha:Both Working and non working variance not are equal

In [29]:

```
statistic_value,p_value=levene(df_workingday,df_notworkingday)
```

In [30]:

```
p_value
```

Out[30]:0.9437823280916695

In [31]:

```
if P_value < alpha_value:
    print('Both Working and non working variance not are equal')
else:
    print("Both Working and non working variance are equal")
```

```
Both Working and non working variance not are equal
```

In [ ]:

In [ ]:

No. of cycles rented similar or different in different seasons

In [ ]:

H0:the null hypothesis is that there is no difference among group means(mu1=mu2=mu3=mu=4)
Ha:The alternative hypothesis is that at least one group differs significantly from the overall mean of the dependent variable

In [32]:

```
season1=df[df["season"]==1]["count"]
season2=df[df["season"]==2]["count"]
season3=df[df["season"]==3]['count']
season4=df[df["season"]==4]["count"]
```

In [33]:

```
fstatistic,p_value=f_oneway(season1,season2,season3,season4)
```

In [34]:

```
p_value
```

Out[34]:

```
6.164843386499654e-149
```

In [ ]:

In [35]:

```
if p_value > alpha_value:
    print("the null hypothesis is that there is no difference among group means")
else:
    print("The alternative hypothesis is that at least one group differs significantly from the overall mean of the dependent variable")
```

```
The alternative hypothesis is that at least one group differs
significantly from the overall mean of the dependent variable
```

Visual Analysis " No. of cycles rented similar or different in different seasons"

season1.mean()

In [36]:

```
season2.mean()
```

Out[36]:

```
215.25137211855105
```

In [37]:

```
season3.mean()
```

Out[37]:

```
234.417124039517
```

In [38]:

```
season4.mean()
```

Out[38]: 198.98829553767374

In [39]:

```
season1.mean()
```

Out[39]: 116.34326135517499

From the above means we can conclude that at least one group differs significantly from the overall mean of the dependent variable

Normality test for working and non working day

H0:season1,season2,season3,season4 will are normally distributed
Ha:season1,season2,season3,season4 will are not normally distributed

In [40]:

```
shapiro(season1)
```

Out[40]: ShapiroResult(statistic=0.8087388873100281, pvalue=0.0)

In [41]:

```
shapiro(season2)
```

Out[41]: ShapiroResult(statistic=0.900481641292572, pvalue=6.039093315091269e-39)

In [42]:

```
shapiro(season3)
```

Out[42]: ShapiroResult(statistic=0.9148160815238953, pvalue=1.043458045587339e-36)

In [43]:

```
shapiro(season4)
```

Out[43]: ShapiroResult(statistic=0.8954644799232483, pvalue=1.1301682309549298e-39)

P_values are less than 0.5(alpha_value) So we are rejecting the null hypothesis

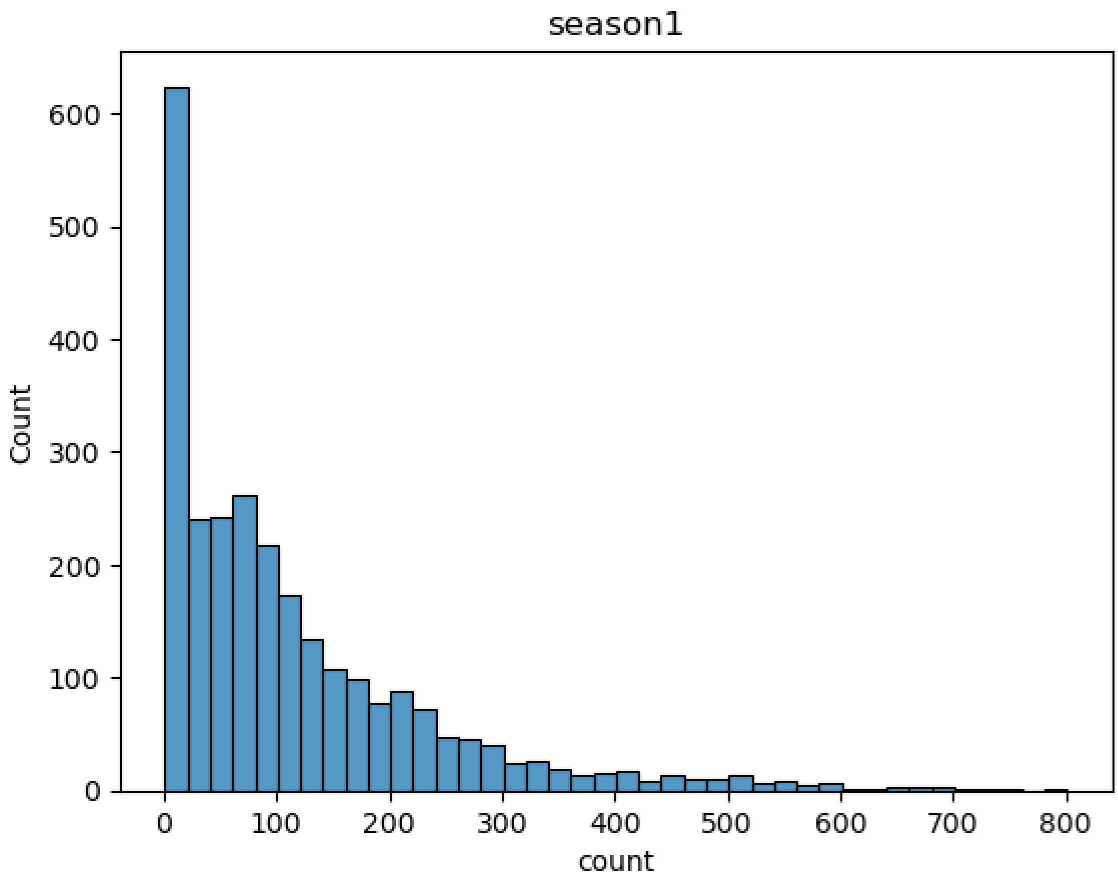
In [ ]:

Graphical analysis for "season vs count"

In [ ]:

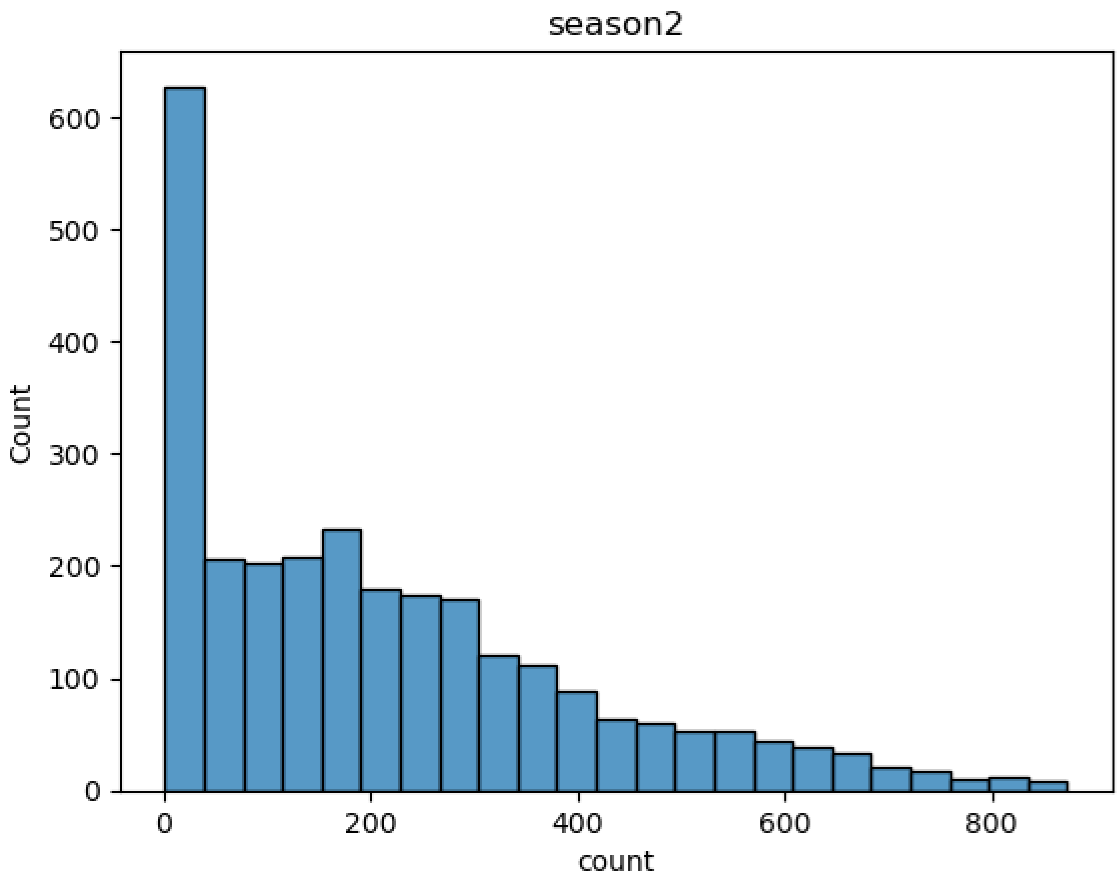
In [44]:

```
sns.histplot(x=season1)
plt.title("season1")
plt.show()
```



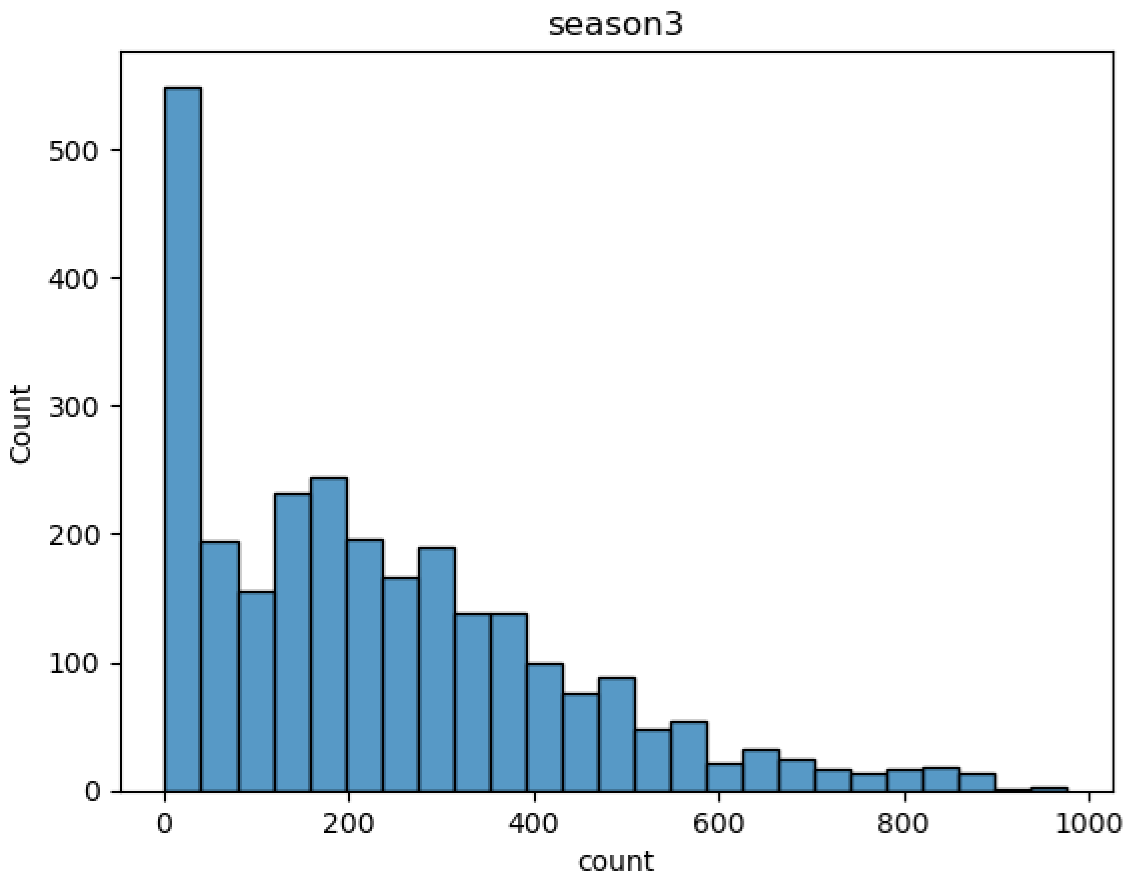
In [45]:

```
sns.histplot(x=season2)
plt.title("season2")
plt.show()
```



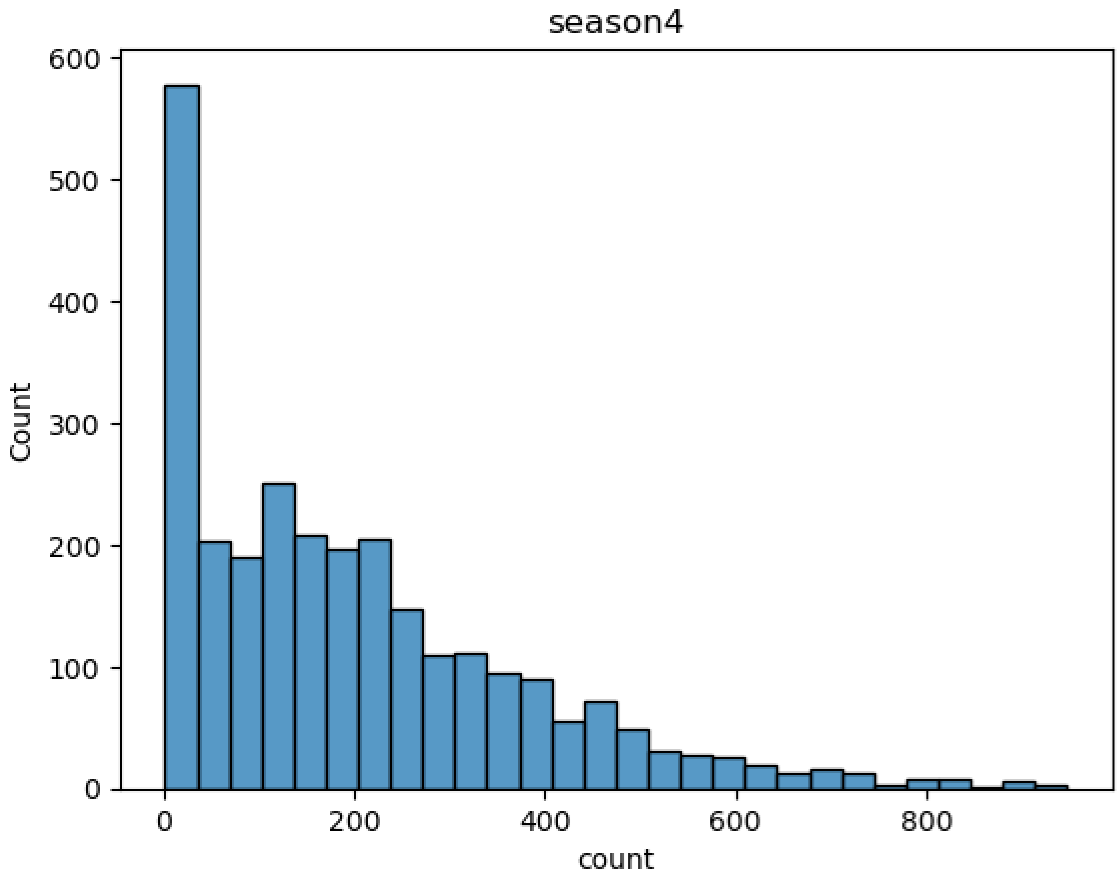
In [46]:

```
sns.histplot(x=season3)
plt.title("season3")
plt.show()
```



In [47]:

```
sns.histplot(x=season4)
plt.title("season4")
plt.show()
```



Variance Test for "season vs count"

H0:season1,season2,season3,season4 are having equal variance.
Ha:season1,season2,season3,season4 are not having equal variance.

In [48]:

```
statistic_value,p_value=levene(season1,season2,season3,season4)
```

In [49]:

```
p_value
```

Out[49]:1.0147116860043298e-118

In [50]:

```
if p_value < alpha_value:
    print("reject null hypothesis")
else:
    print("we don't reject null hypothesis")
```

```
reject null hypothesis
```

In [ ]:

In [ ]:

In [ ]:

"No. of cycles rented similar or different in different weather"

H0:No of cycles is similar in different weather or mu1=mu2=mu3 Ha:No of cycles is different in different weather

In [ ]:

In [59]:

```
df_weather1=df[df["weather"]==1]["count"]
```

In [60]:

```
df_weather2=df[df["weather"]==2]["count"]
```

In [61]:

```
df_weather3=df[df["weather"]==3]["count"]
```

In [62]:

```
df_weather4=df[df["weather"]==4]["count"]
```

In [63]:

```
statistic,P_value=f_oneway(df_weather1,df_weather2,df_weather3,df_weathe
r4)
```

In [ ]:

In [64]:

```
P_value
```

Out[64]:5.482069475935669e-42

In [65]:

```
if P_value < alpha_value:
    print("Reject null hypothesis and We conclude that No of cycles is
different in different weather ")
else:
    print("we don't reject the null hypothesis and we conclude that No
of cycles is similar in different weather ")
```

```
Reject null hypothesis and We conclude that No of cycles is different in
different weather
```

Visual analysis for "No. of cycles rented similar or different in different weather"

In [66]:

```
df_weather1.mean()
```

Out[66]:205.23679087875416

In [67]:

```
df_weather2.mean()
```

Out[67]:178.95553987297106

In [68]:

```
df_weather3.mean()
```

Out[68]:118.84633294528521

In [69]:

```
df_weather4.mean()
```

Out[69]:164.0

From the above analysis we conclude that "No of cycles rented similar or different in different weather"

In [ ]:

Normality Test for Weather vs count

H0:df_weather1,df_weather2,df_weather3,df_weather4 are normally distributed.
Ha:df_weather1,df_weather2,df_weather3,df_weather4 are not normally distributed.

In [72]:

```
statistic_value,P_value=shapiro(df_weather1)
```

In [73]:

```
p_value
```

Out[73]:1.0147116860043298e-118

In [74]:

```
statistic_value,P_value=shapiro(df_weather2)
```

In [75]:

```
p_value
```

Out[75]:1.0147116860043298e-118

In [76]:

```
statistic_value,P_value=shapiro(df_weather3)
```

In [77]:

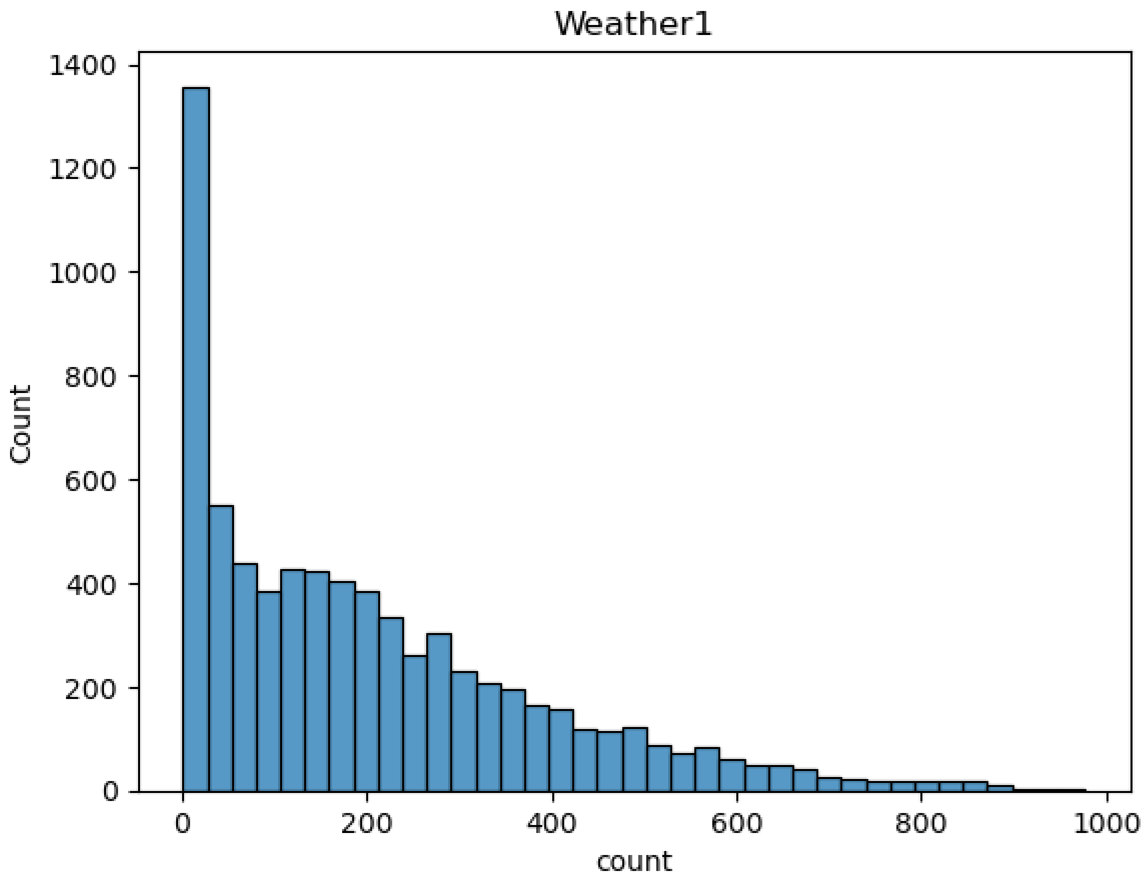
```
P_value
```

Out[77]:3.876090133422781e-33

We cannot able to find the shapiro test for df_weather4 as there is only one value so all the p_values are less than we reject null hypothesis and conclude that df_weather1,df_weather2,df_weather3,df_weather4 are not normally distributed.
Grahical analysis

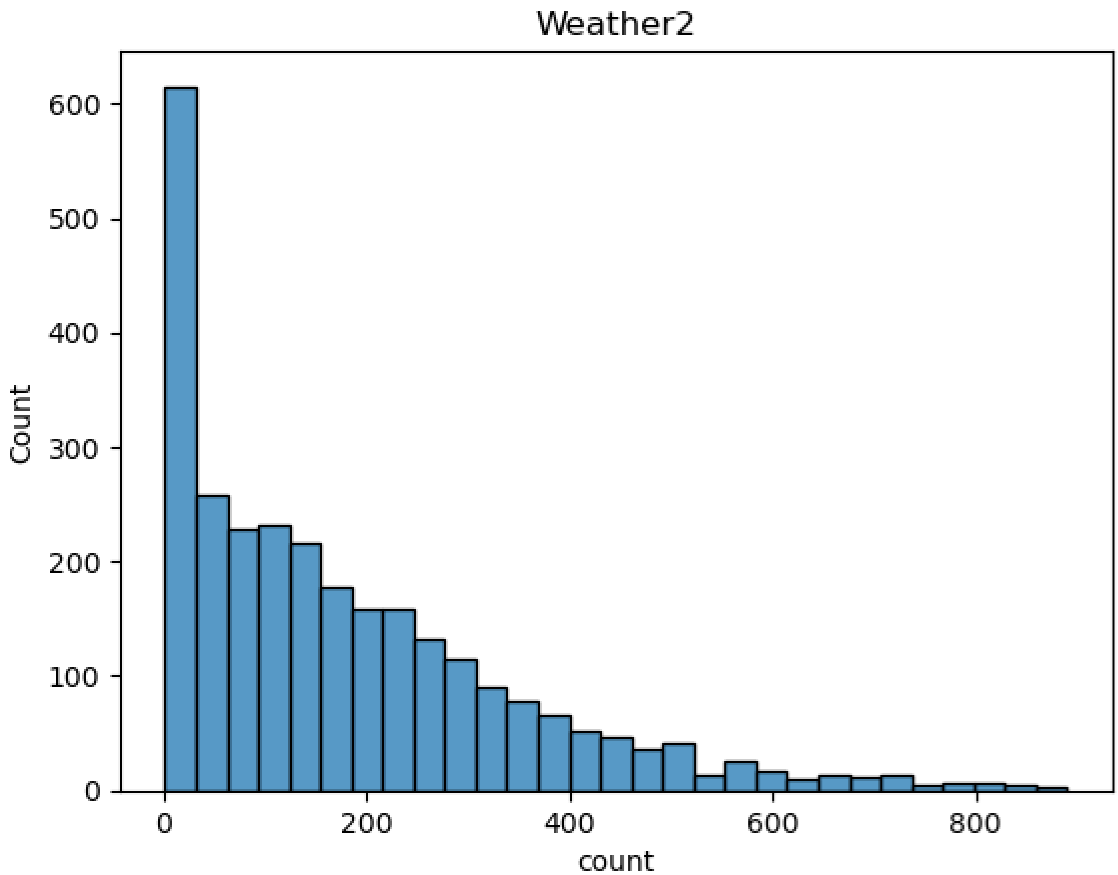
In [78]:

```
sns.histplot(x=df_weather1)
plt.title("Weather1")
plt.show()
```



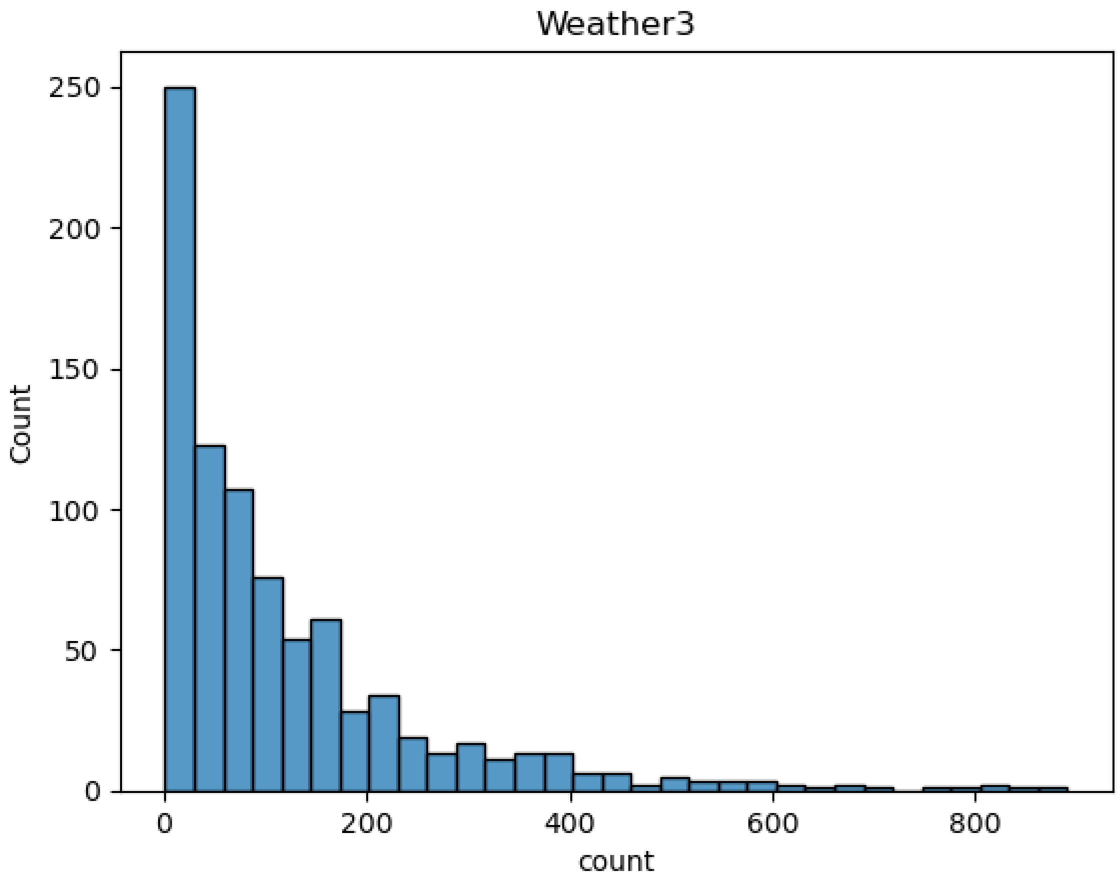
In [79]:

```
sns.histplot(x=df_weather2)
plt.title("Weather2")
plt.show()
```



In [80]:

```
sns.histplot(x=df_weather3)
plt.title("Weather3")
plt.show()
```



Variance test for Weather vs count

H0:Variance for all the weather are equal Ha:Variance for all the weather are not equal

In [81]:

```
levene(df_weather1,df_weather2,df_weather3,df_weather4)
```

Out[81]:
```
LeveneResult(statistic=54.85106195954556, pvalue=3.504937946833238e-
35)
```

P_value is less than alpha value so we reject null hypothesis and we conclude that "Variance for all the weather are not equal".

In [ ]:

Weather is dependent on season

Null hypothesis (H0): Weather is not dependent on season. Alternative hypothesis (Ha): Weather is dependent on season.

In [82]:

```
df["weather"]
```

Out[82]:
```
0        1
1        1
```

```
2        1
3        1
4        1
        ..
10881    1
10882    1
10883    1
10884    1
10885    1
Name: weather, Length: 10886, dtype: int64
```

In [83]:

```
df["season"]
```

Out[83]:

```
0        1
1        1
2        1
3        1
4        1
        ..
10881    4
10882    4
10883    4
10884    4
10885    4
Name: season, Length: 10886, dtype: int64
```

In [84]:

```
pd.crosstab(df["weather"],df["season"])
```

Out[84]:

season	1	2	3	4
weather				
1	1759	1801	1930	1702
2	715	708	604	807
3	211	224	199	225
4	1	0	0	0

In [85]:

```
statistic_value,P_value,Dof,exp_value=chi2_contingency(pd.crosstab(df["w
eather"],df["season"]))
```

In [86]:

```
P_value
```

Out[86]:

```
1.5499250736864862e-07
```

In [87]:

```
if p_value < alpha_value:
    print("We reject null hypothesis and we can conclude Weather is dependent on season.")
else:
    print("Weather is not dependent on season.")
```

```
We reject null hypothesis and we can conclude Weather is dependent on season.
```

In [88]:

```
df
```

Out[88]:

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	casual	registered	count
0	2011-01-01 00:00:00	1	0	0	1	9.84	14.395	81	0.0000	3	13	16
1	2011-01-01 01:00:00	1	0	0	1	9.02	13.635	80	0.0000	8	32	40
2	2011-01-01 02:00:00	1	0	0	1	9.02	13.635	80	0.0000	5	27	32
3	2011-01-01 03:00:00	1	0	0	1	9.84	14.395	75	0.0000	3	10	13
4	2011-01-01 04:00:00	1	0	0	1	9.84	14.395	75	0.0000	0	1	1
...	...	...	...	...	...	...	...	...	...	...	...	...
10881	2012-12-19 19:00:00	4	0	1	1	15.58	19.695	50	26.0027	7	329	336
10882	2012-12-19 20:00:00	4	0	1	1	14.76	17.425	57	15.0013	10	231	241
10883	2012-12-19 21:00:00	4	0	1	1	13.94	15.910	61	15.0013	4	164	168
10884	2012-12-19 22:00:00	4	0	1	1	13.94	17.425	61	6.0032	12	117	129

10885	2012-12-19 23:00:00	4	0	1	1	13.12	16.665	66	8.9981	4	84	88

10886 rows × 12 columns

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: