```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
```

```
import warnings
warnings.filterwarnings("ignore")
```

```
df=pd.read_csv("C:\\Users\\amitk\\OneDrive\\Desktop\\haberman.csv")
```

```
df.head()
```

```
   age  year  nodes  status
0   30    64      1       1
1   30    62      3       1
2   30    65      0       1
3   31    59      2       1
4   31    65      4       1
```

```
df.tail()
```

```
     age  year  nodes  status
301   75    62      1       1
302   76    67      0       1
303   77    65      3       1
304   78    65      1       2
305   83    58      2       2
```

```
print(df.shape)
```

```
(306, 4)
```

```
print(df.shape[1])
```

```
4
```

```
print(df.columns)
```

```
Index(['age', 'year', 'nodes', 'status'], dtype='object')
```

```
print(df['status'].nunique())
print(df['status'].unique())
```

```
2
[1 2]
```

```
print(df['status'].value_counts())
```

```
1    225
2     81
Name: status, dtype: int64
```

OBSERVATIONS:

1. there are 306 data points are present in the data set.
2. data set consist of 3 input variable(age , year ,nodes) and one output variable(status).
3. ouput variable has 2 class label(1,2).
4. it is a inbalanced data set.
5. the data set consist patients survied for 5 years or more large in number.

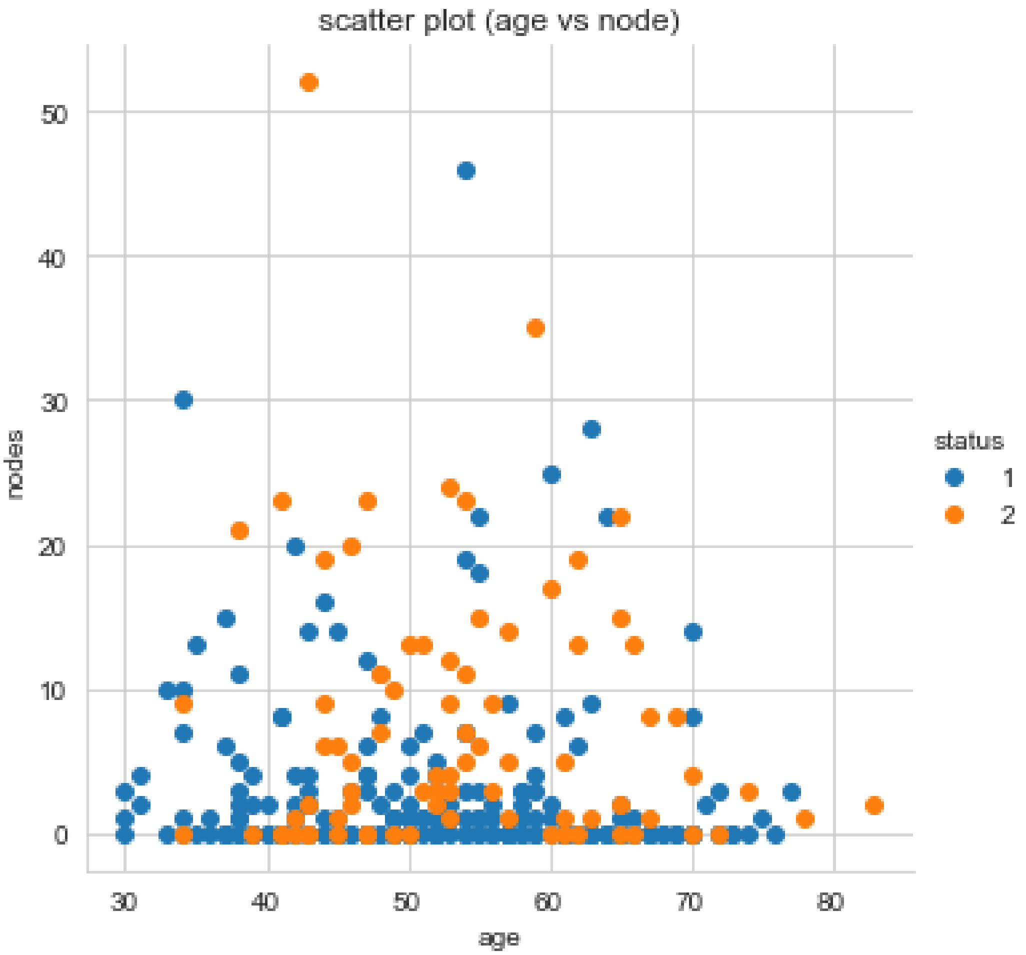
Bi-variate analysis

2D scatter plot

```
plt.figure()
sns.set_style("whitegrid")
g=sns.FacetGrid(df,hue="status",size=5)
g.map(plt.scatter,'age','nodes')
plt.title("scatter plot (age vs node)")
g.add_legend()
```

```
<seaborn.axisgrid.FacetGrid at 0x1cc79d71bb0>
```

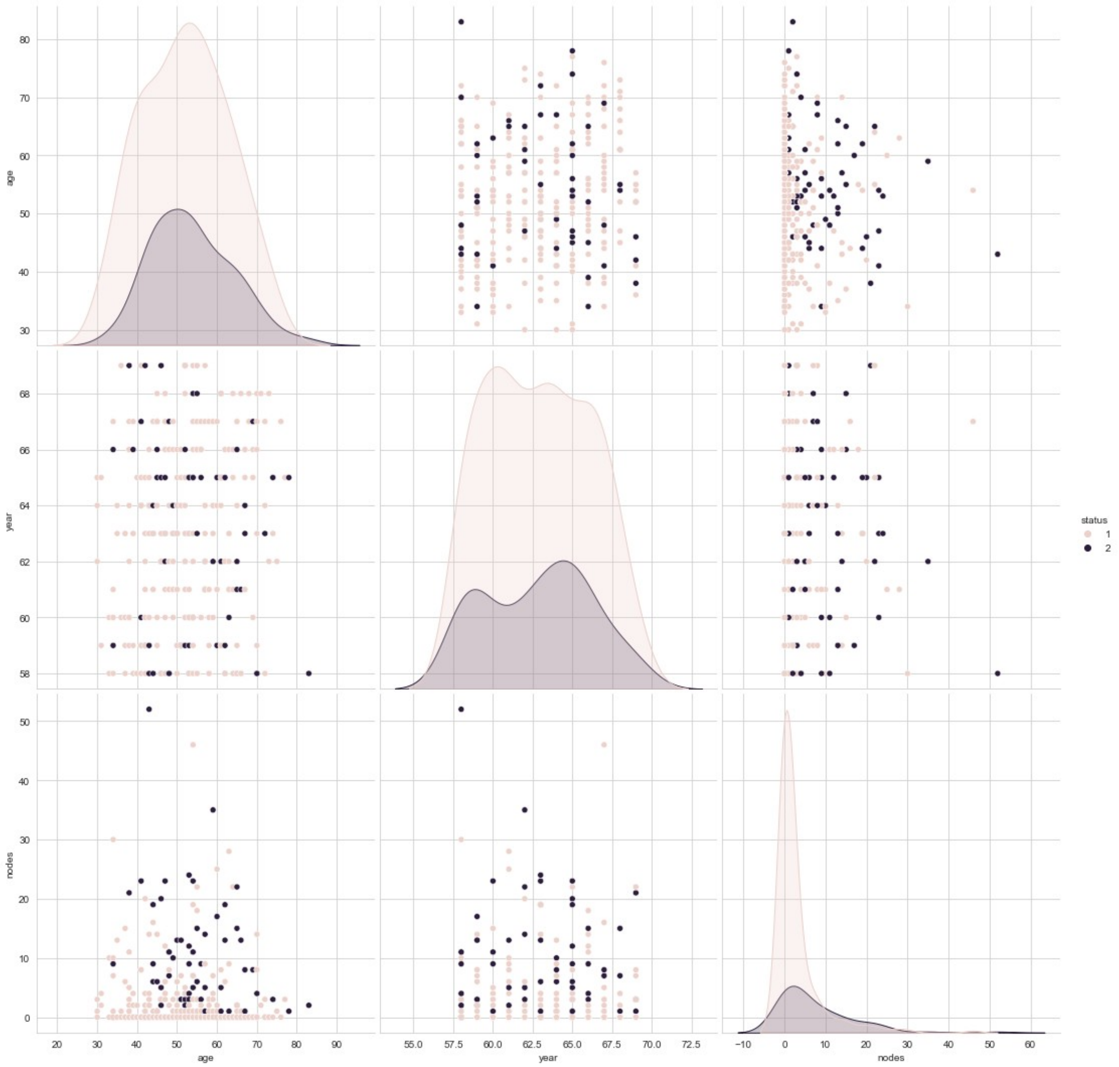
```
<Figure size 432x288 with 0 Axes>
```



Pair Plot

```
sns.pairplot(df,hue="status",vars=["age","year","nodes"],size=5)
```

```
<seaborn.axisgrid.PairGrid at 0x1cc79e1f7c0>
```



OBSERVATIONS:

1.from above plot we not getting any useful information. 2.all data points are spread across in the status labels.

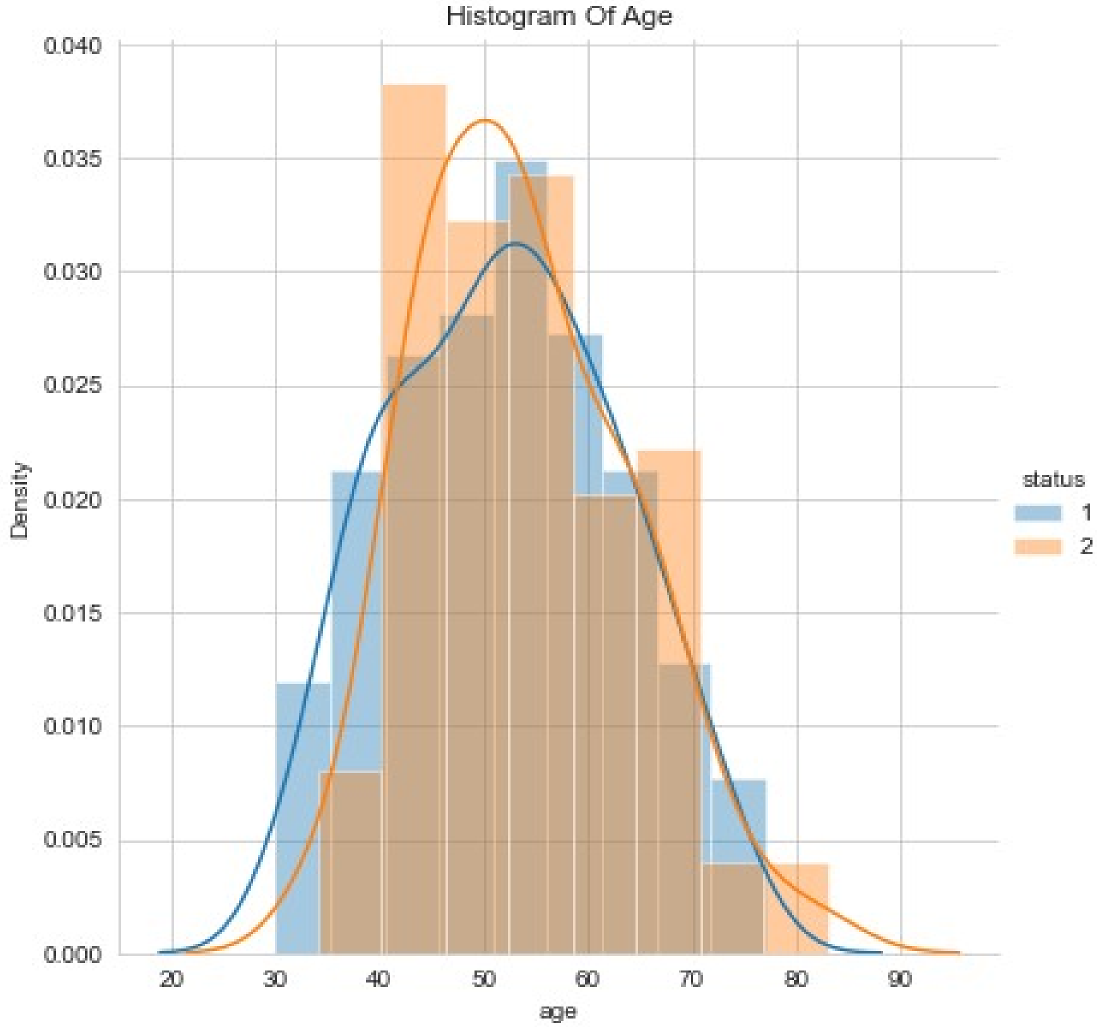
Uni-variate

Histogram

```
plt.figure()
g=sns.FacetGrid(df,hue="status",size=6)
g.map(sns.distplot,"age")
g.add_legend()
plt.title("Histogram Of Age")
```

```
Text(0.5, 1.0, 'Histogram Of Age')
```

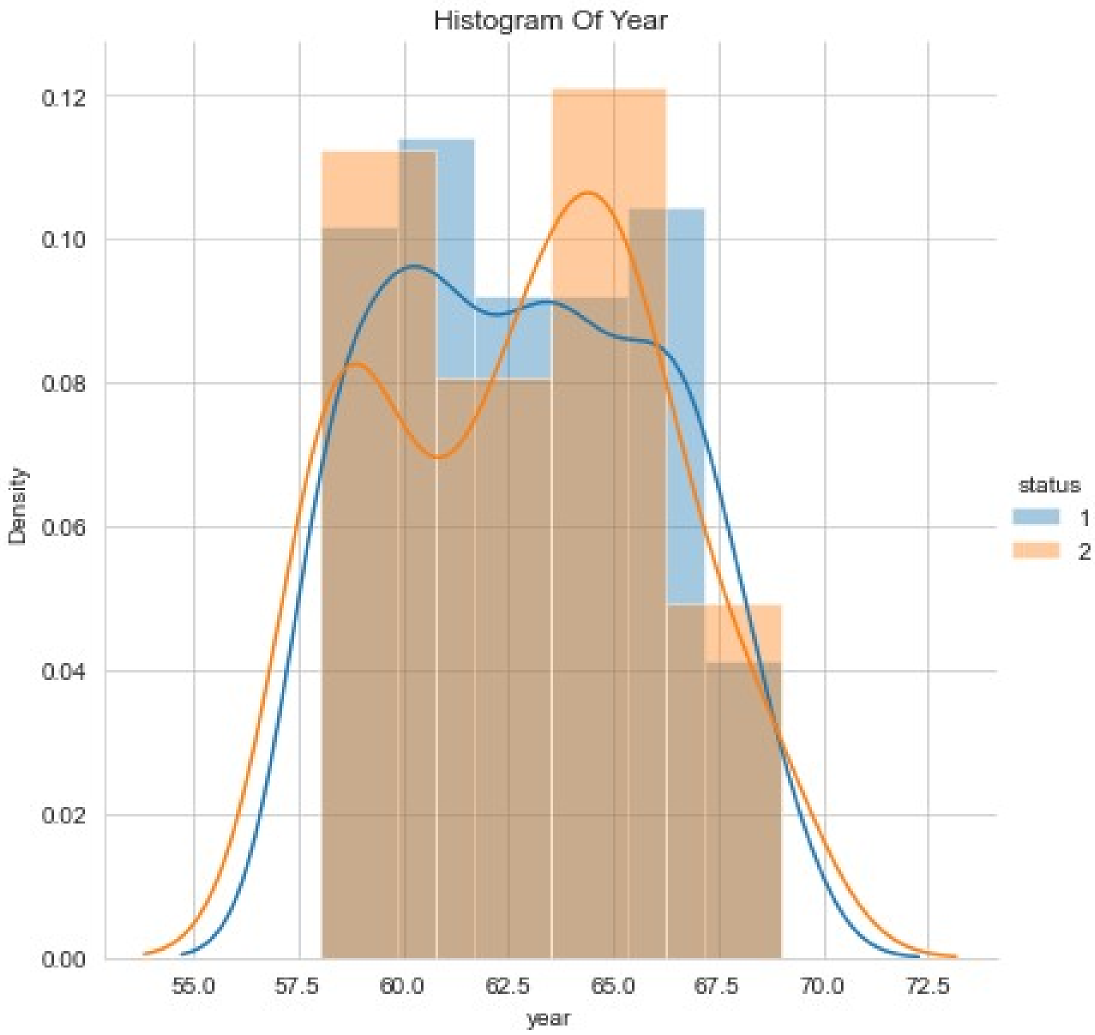
```
<Figure size 432x288 with 0 Axes>
```



```
plt.figure()
g=sns.FacetGrid(df,hue="status",size=6)
g.map(sns.distplot,"year")
plt.title("Histogram Of Year")
g.add_legend()
```

```
<seaborn.axisgrid.FacetGrid at 0x1cc7a889160>
```

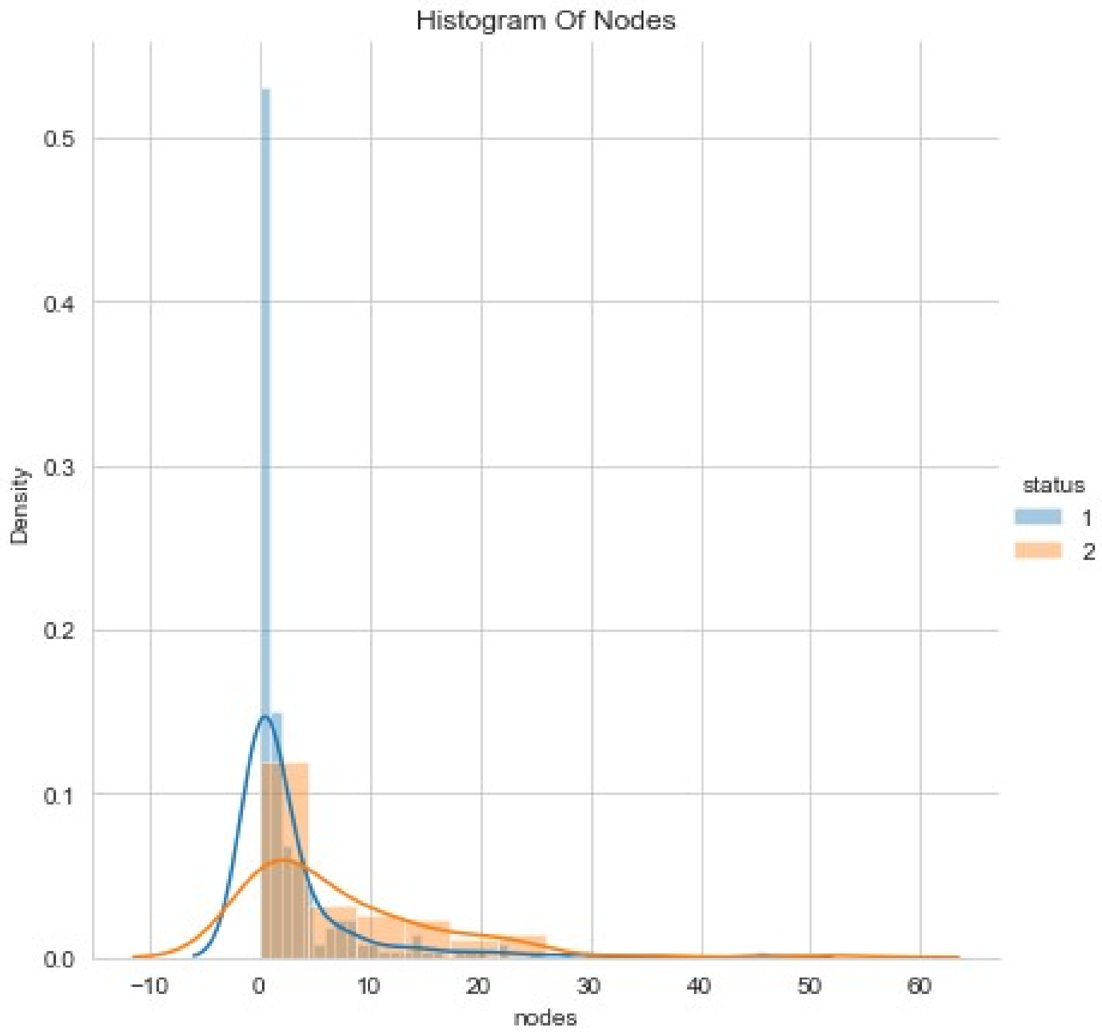
```
<Figure size 432x288 with 0 Axes>
```



```
plt.figure()
g=sns.FacetGrid(df,hue="status",size=6)
g.map(sns.distplot,"nodes")
plt.title("Histogram Of Nodes")
g.add_legend()
```

```
<seaborn.axisgrid.FacetGrid at 0x1cc7b1e4e50>
```

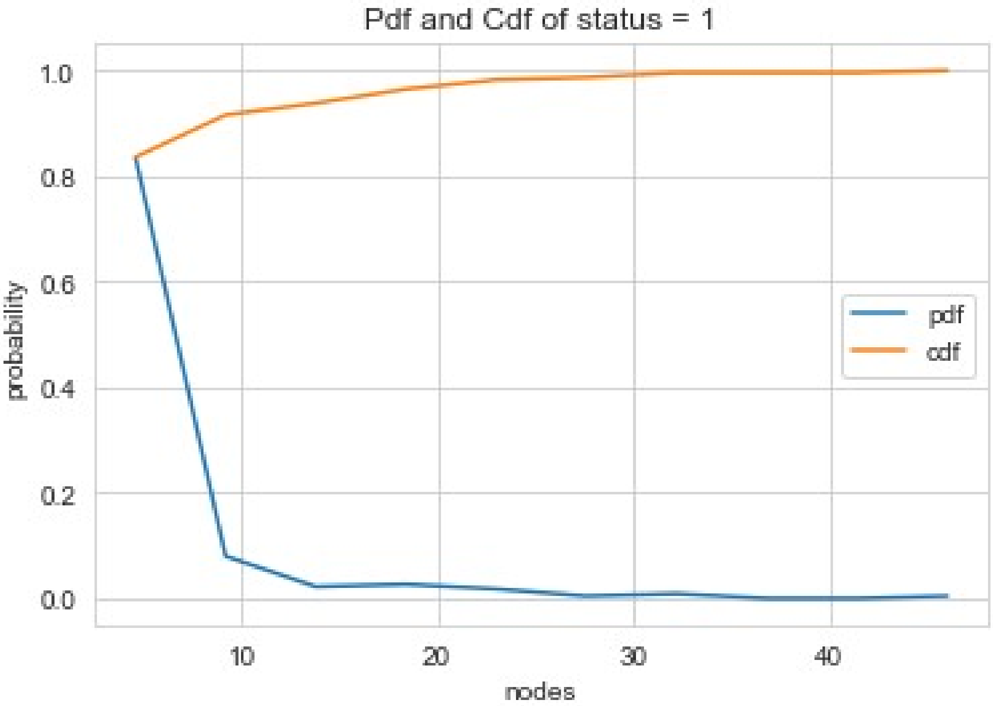
```
<Figure size 432x288 with 0 Axes>
```



PDF & CDF

```
df_1 = df.loc[df["status"] == 1]
df_2 = df.loc[df["status"] == 2]

from statsmodels import robust

count,edges=np.histogram(df_1['nodes'],bins=10,density=True)
pdf=count/sum(count)
cdf=np.cumsum(pdf)
print("bin edges",edges[1:])
print(" ")
print("probability density function")
print(" ")
print(pdf)
print(" ")
print("Cumulative distribution function")
print(" ")
print(cdf)
plt.plot(edges[1:],pdf,label="pdf")
plt.plot(edges[1:],cdf,label="cdf")
plt.ylabel("probability")
plt.xlabel("nodes")
plt.title("Pdf and Cdf of status = 1")
plt.legend()
```

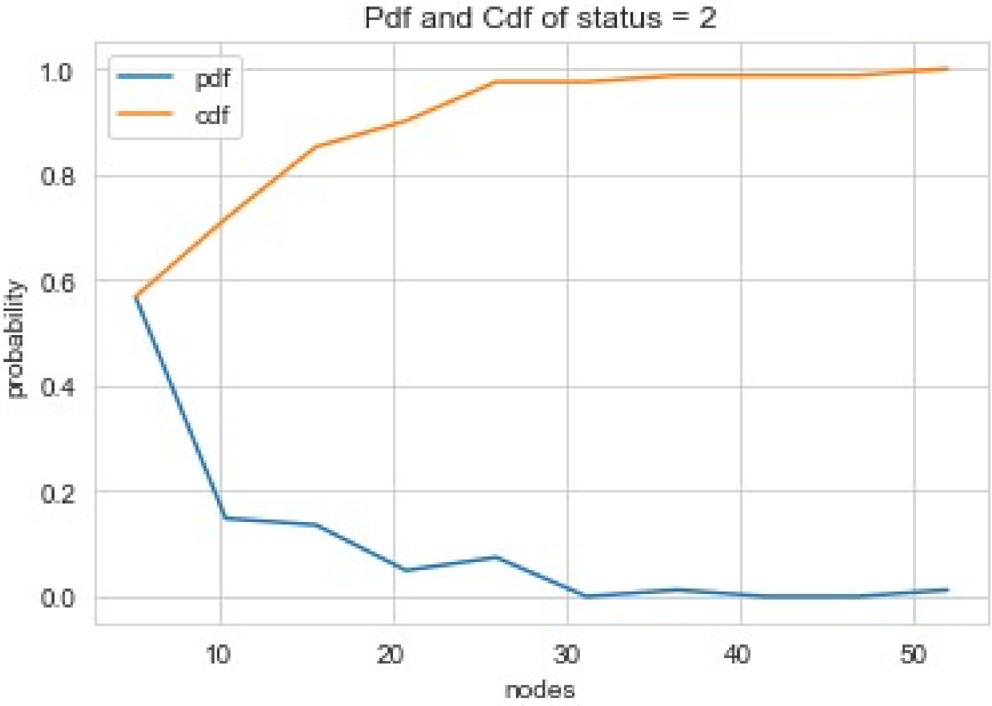
```
bin edges [ 4.6  9.2 13.8 18.4 23.  27.6 32.2 36.8 41.4 46. ]

probability density function

[0.83555556 0.08       0.02222222 0.02666667 0.01777778 0.00444444
 0.00888889 0.         0.         0.00444444]

Cumulative distribution function

[0.83555556 0.91555556 0.93777778 0.96444444 0.98222222 0.98666667
 0.99555556 0.99555556 0.99555556 1.        ]

<matplotlib.legend.Legend at 0x1cc7c3e9c10>
```



```
count,edges=np.histogram(df_2['nodes'],bins=10,density=True)
pdf=count/sum(count)
cdf=np.cumsum(pdf)
print("bin edges",edges[1:])
print(" ")
print("probability density function")
print(" ")
print(pdf)
print(" ")
print("Cumulative distribution function")
print(" ")
print(cdf)
plt.plot(edges[1:],pdf,label="pdf")
plt.plot(edges[1:],cdf,label="cdf")
plt.xlabel("nodes")
plt.ylabel("probability")
plt.title("Pdf and Cdf of status = 2")
plt.legend()
```

```
bin edges [ 5.2 10.4 15.6 20.8 26.  31.2 36.4 41.6 46.8 52. ]

probability density function

[0.56790123 0.14814815 0.13580247 0.04938272 0.07407407 0.
 0.01234568 0.         0.         0.01234568]

Cumulative distribution function

[0.56790123 0.71604938 0.85185185 0.90123457 0.97530864 0.97530864
 0.98765432 0.98765432 0.98765432 1.        ]
```

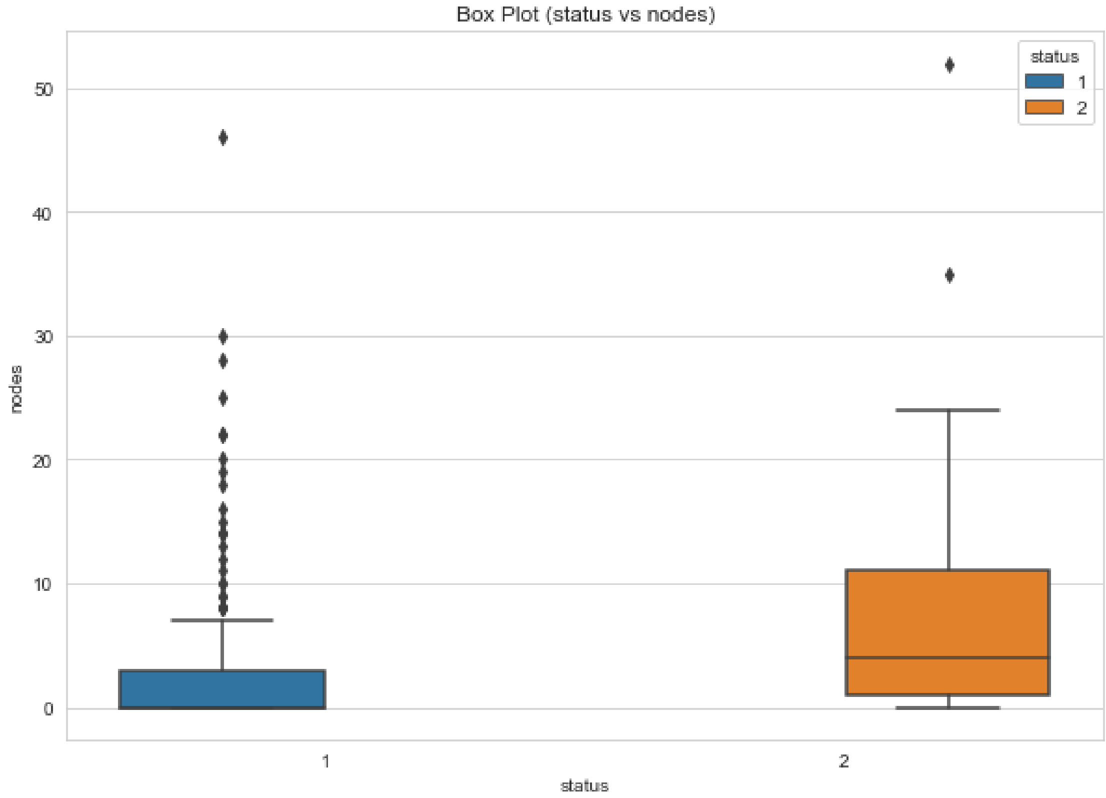
```
<matplotlib.legend.Legend at 0x1cc7c4648e0>
```



Box plot

```
plt.figure(figsize=(10,7))
plt.title("Box Plot (status vs nodes)")
sns.boxplot(data=df,x='status',y='nodes',hue='status')
```

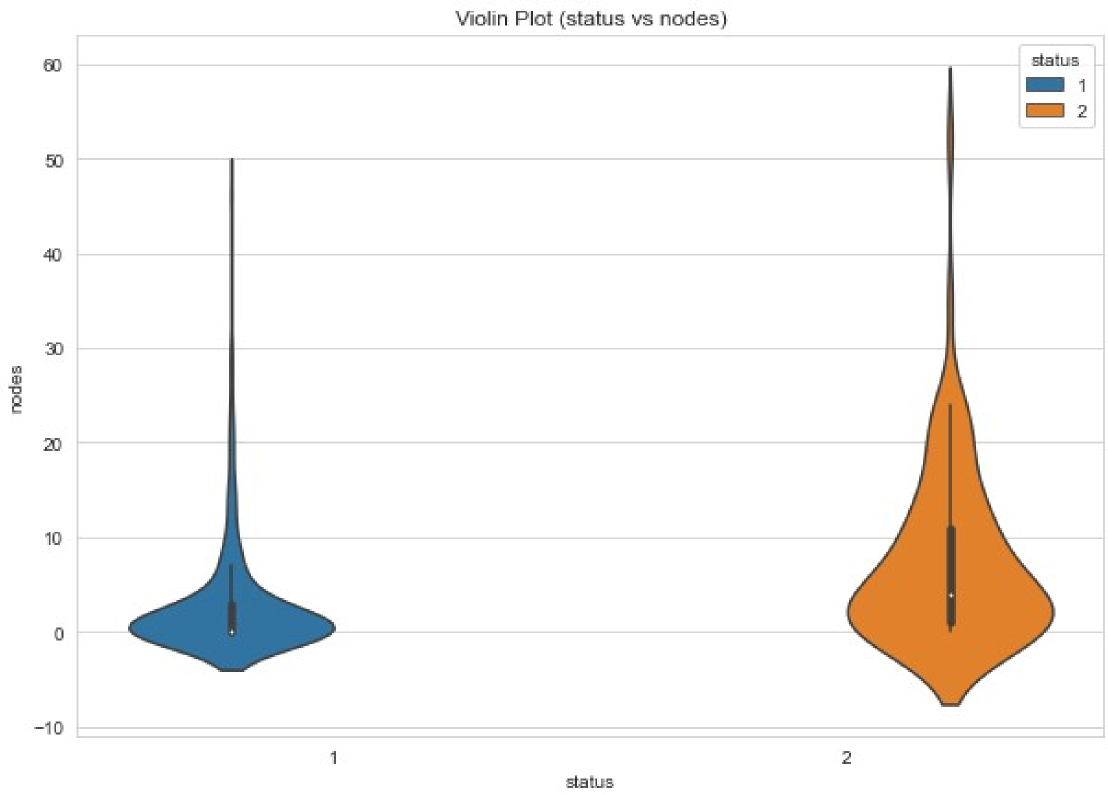
```
<AxesSubplot:title={'center':'Box Plot (status vs nodes)'}, 
xlabel='status', ylabel='nodes'>
```



Violin Plot

```
plt.figure(figsize=(10,7))
plt.title("Violin Plot (status vs nodes)")
sns.violinplot(data=df,x='status',y='nodes',hue='status')
```

```
<AxesSubplot:title={'center':'Violin Plot (status vs nodes)'}, 
xlabel='status', ylabel='nodes'>
```



Mean , Std , Median , Percentile , Quantiles and Mad

```
from statsmodels import robust

print("************************STATUS 1****************************")
print(" ")
print("mean =",np.mean(df_1['nodes']))
print(" ")
print("standard deviation =",np.std(df_1['nodes']))
print(" ")
print("median =",np.median(df_1['nodes']))
print(" ")
print("90th percentile =",np.percentile(df_1['nodes'],90))
print(" ")
print("quantiles (25%, 50% and 75%)
=",np.percentile(df_1['nodes'],np.arange(25,100,25)))
print(" ")
print("median absolute deviation",robust.mad(df_1["nodes"]))
```

```
************************STATUS 1****************************

mean = 2.7911111111111113

standard deviation = 5.857258449412131

median = 0.0
```

```
90th percentile = 8.0

quantiles (25%, 50% and 75%) = [0. 0. 3.]

median absolute deviation 0.0
```

```
print("************************STATUS 2****************************")
print(" ")
print("mean =",np.mean(df_2['nodes']))
print(" ")
print("standard deviation =",np.std(df_2['nodes']))
print(" ")
print("median =",np.median(df_2['nodes']))
print(" ")
print("90th percentile =",np.percentile(df_2['nodes'],90))
print(" ")
print("quantiles (25%, 50% and 75%)
=",np.percentile(df_2['nodes'],np.arange(25,100,25)))
print(" ")
print("median absolute deviation",robust.mad(df_2["nodes"]))
```

```
************************STATUS 2****************************

mean = 7.45679012345679

standard deviation = 9.128776076761632

median = 4.0

90th percentile = 20.0

quantiles (25%, 50% and 75%) = [ 1.  4. 11.]

median absolute deviation 5.930408874022408
```

```
df.describe()
```

```
              age        year       nodes      status
count  306.000000  306.000000  306.000000  306.000000
mean    52.457516   62.852941    4.026144    1.264706
std     10.803452    3.249405    7.189654    0.441899
min     30.000000   58.000000    0.000000    1.000000
25%     44.000000   60.000000    0.000000    1.000000
50%     52.000000   63.000000    1.000000    1.000000
75%     60.750000   65.750000    4.000000    2.000000
max     83.000000   69.000000   52.000000    2.000000
```

```
df_0=df.loc[df['nodes']<=0]
```

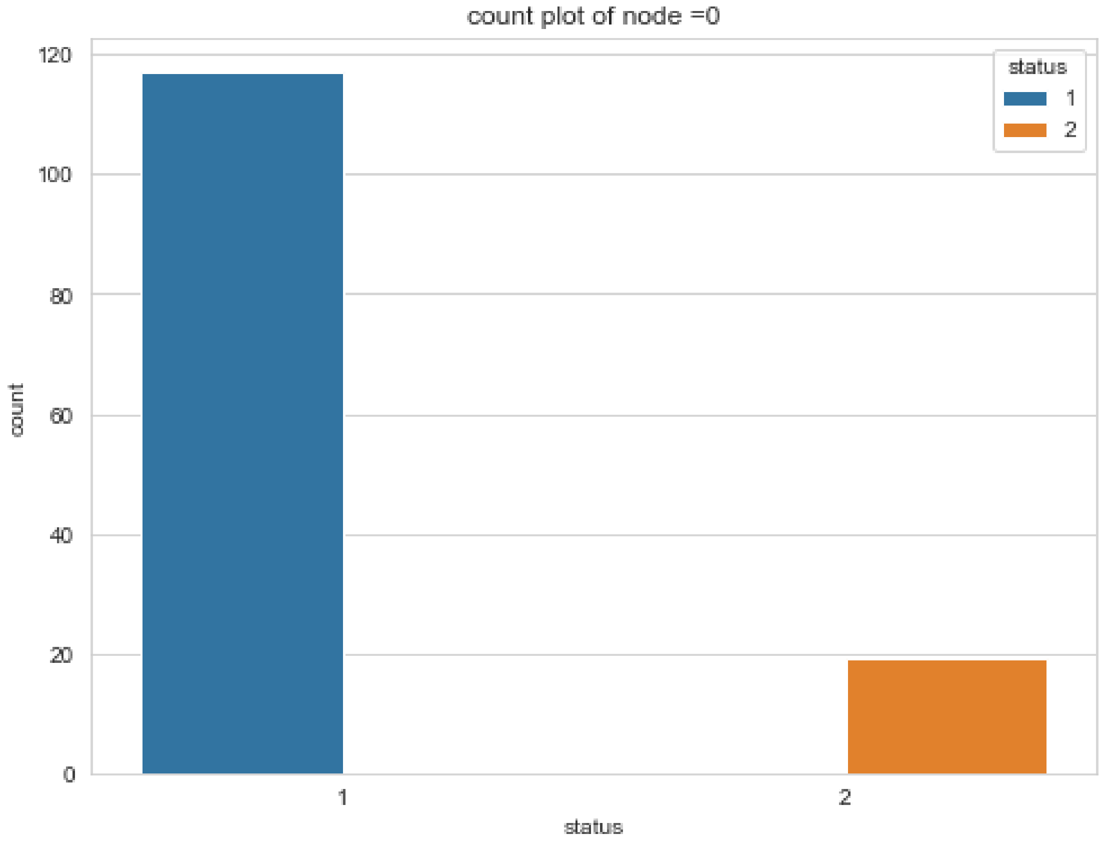
```
df_0.shape
```

```
(136, 4)
```

Count Plot

```
plt.figure(figsize=(8,6))
sns.countplot(x="status",data=df_0,hue="status")
plt.title("count plot of node =0")
```

```
Text(0.5, 1.0, 'count plot of node =0')
```


count plot of node =0
status
count
status