In [2]:

```
import warnings
warnings.filterwarnings("ignore")
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np

#Load Habermans.csv into pandas as a dataframe
Haberman = pd.read_csv("D:\TGM\ML\Habermans-Survival-Data-Set\haberman.csv")
Haberman['Surv_Status'] = Haberman['Surv_Status'].map({1:'Yes', 2:'N0'})
Haberman.head()
```

Out[2]:

	Age	Op_Year	Axil_Nodes	Surv_Status
0	30	64	1	Yes
1	30	62	3	Yes
2	30	65	0	Yes
3	31	59	2	Yes
4	31	65	4	Yes

In [128]:

```
print('Data points, Features:',Haberman.shape)
```

```
Data points, Features: (306, 4)
```

In [4]:

```
print(Haberman.columns)
```

```
Index(['Age', 'Op_Year', 'Axil_Nodes', 'Surv_Status'], dtype='object')
```

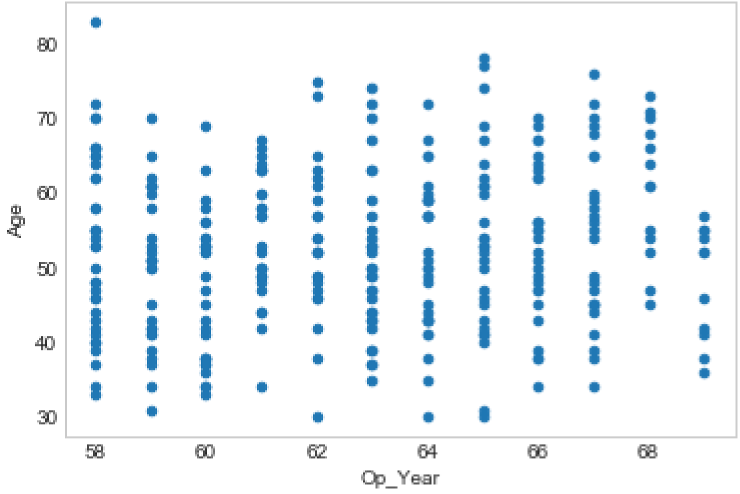
In [ ]:

```
# Q: How many people are survived more than 5 years or more
#Q: How many people were died within 5 years
# 1 or 'Yes' is the indication of survived people 5 or more years; and 2 or 'N
o' is the indication of people were died within 5 years
Haberman['Surv_Status'].value_counts()
```

2D Scatter

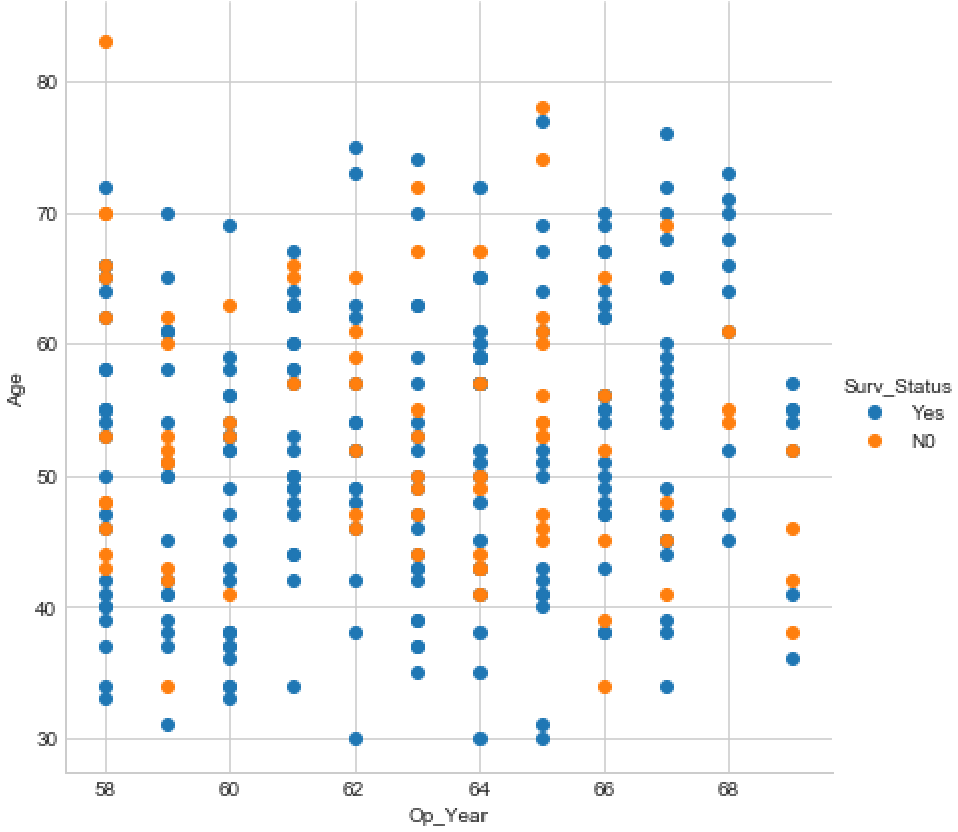
In [136]:

```
Haberman.plot(kind='scatter',x='Op_Year',y='Age')
plt.grid()
plt.show()
#Here we are not able to distinguish between the two featurs or class label.
```



In [137]:

```
sns.set_style("whitegrid")
sns.FacetGrid(Haberman, hue='Surv_Status', size=6).map(plt.scatter, 'Op_Year',
'Age').add_legend()
plt.show()
```

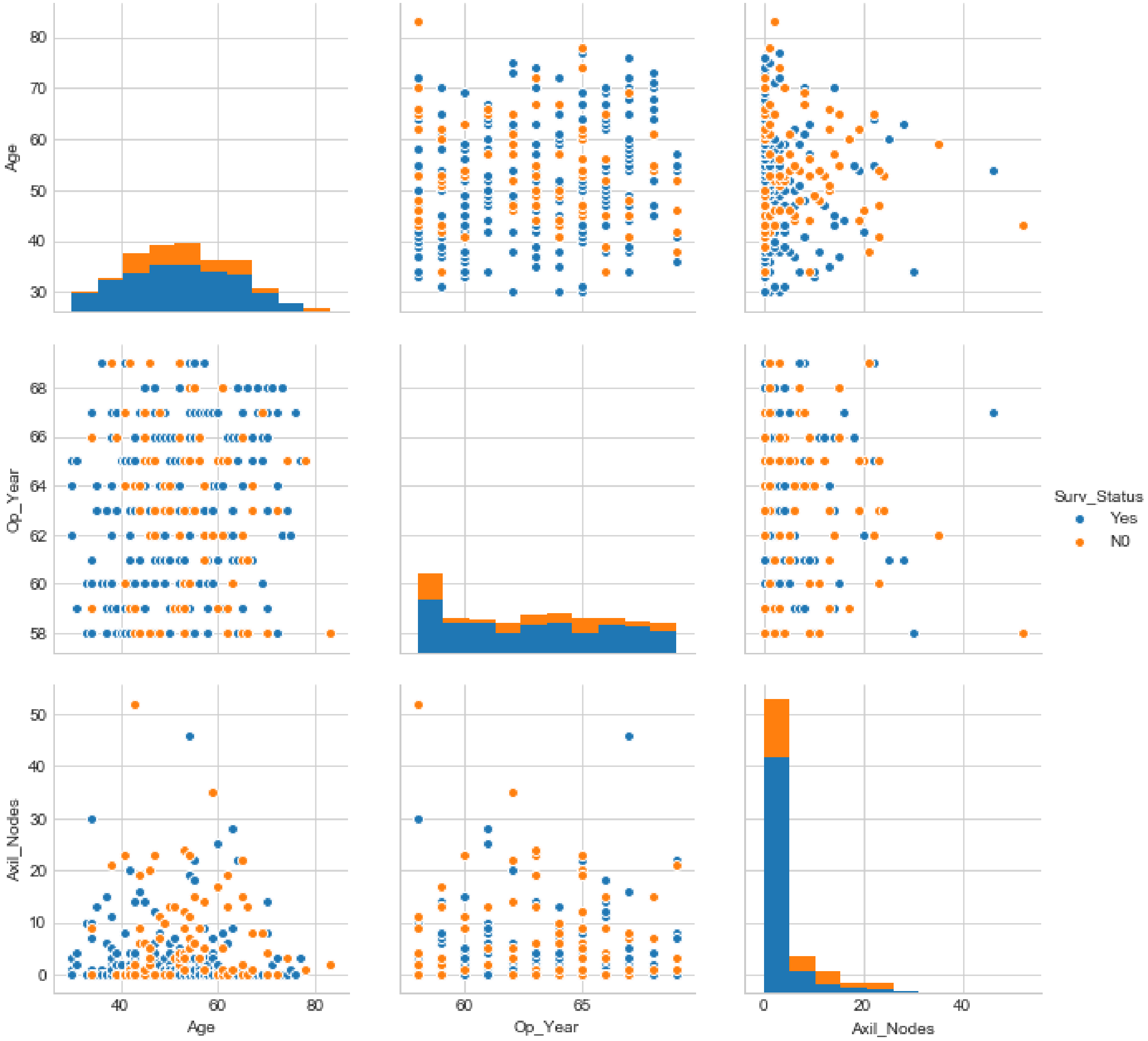


Observations:

```
Here survival staus 'Yes' and 'No' both are overlapped using Op_Year and Age featur
s. So the classification between both is not possible.
```

Pair Plots

In [61]:
```
plt.close()
sns.set_style('whitegrid')
sns.pairplot(Haberman, hue='Surv_Status',  size=3)
plt.show()
```



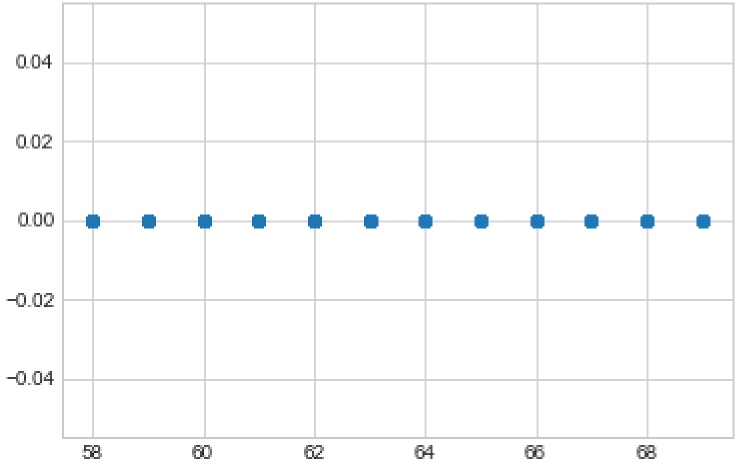
Observation:

Above upper dignoal and lower diagnoal graphs are same, only the x and y axis's are interchanged. The data points are overlapped in each graph.

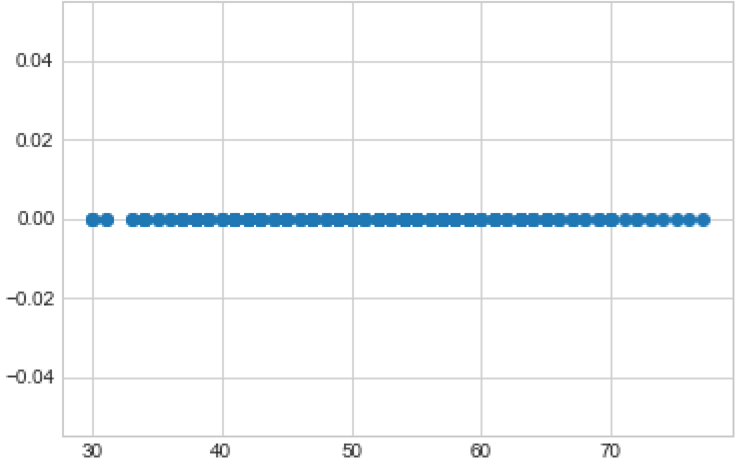
Histogram, PDF, CDF

1-D Scatter Plot

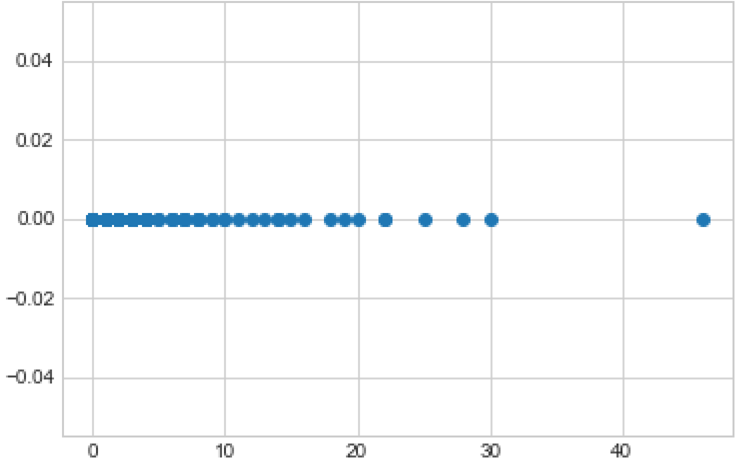
In [44]:
```
Haberman_Yes = Haberman.loc[Haberman['Surv_Status'] == 'Yes']
Haberman_No = Haberman.loc[Haberman['Surv_Status'] == 'No']

plt.plot(Haberman_Yes['Op_Year'], np.zeros_like(Haberman_Yes['Op_Year']),'o')
plt.plot(Haberman_No['Op_Year'], np.zeros_like(Haberman_No['Op_Year']),'o')
plt.show()
```



In [138]:
```
plt.plot(Haberman_Yes['Age'], np.zeros_like(Haberman_Yes['Age']),'o')
plt.plot(Haberman_No['Age'], np.zeros_like(Haberman_No['Age']),'o')
plt.show()
```



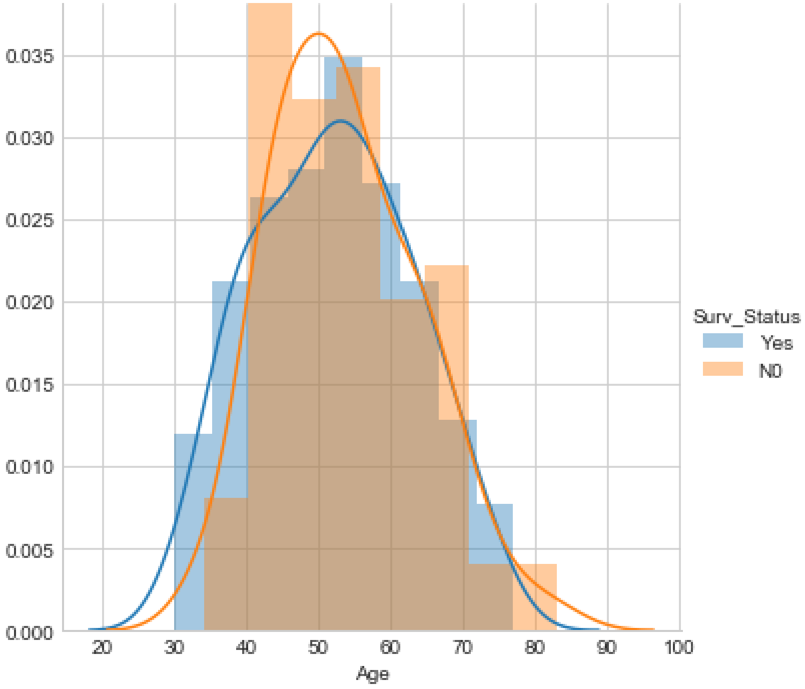
In [139]:
```
plt.plot(Haberman_Yes['Axil_Nodes'], np.zeros_like(Haberman_Yes['Axil_Nodes'
]),'o')
plt.plot(Haberman_No['Axil_Nodes'], np.zeros_like(Haberman_No['Axil_Nodes']),
'o')
plt.show()
```



In [11]:

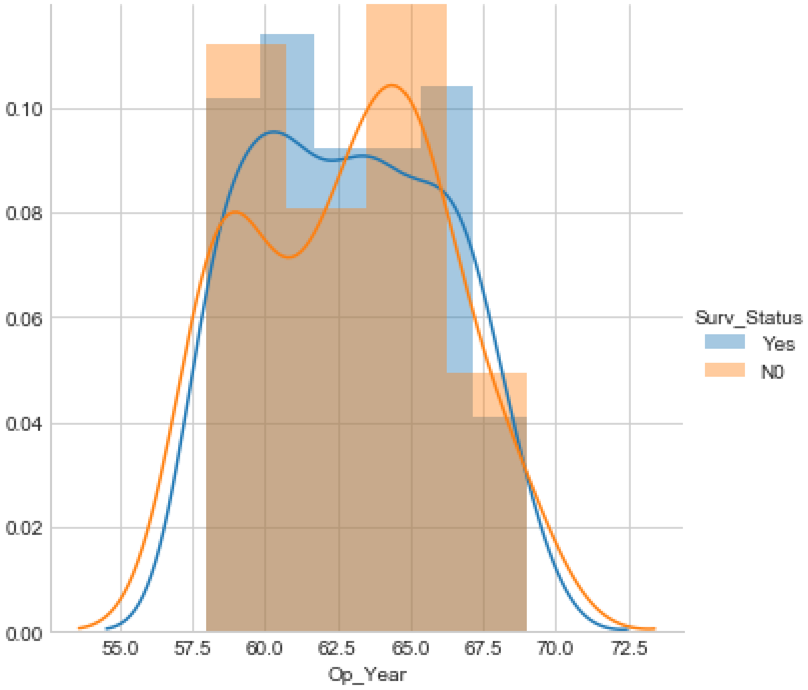
```
sns.FacetGrid(Haberman, hue='Surv_Status', size=5).map(sns.distplot, 'Age').ad
d_legend();
plt.show()
```

```
D:\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: Th
e 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
D:\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: Th
e 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```



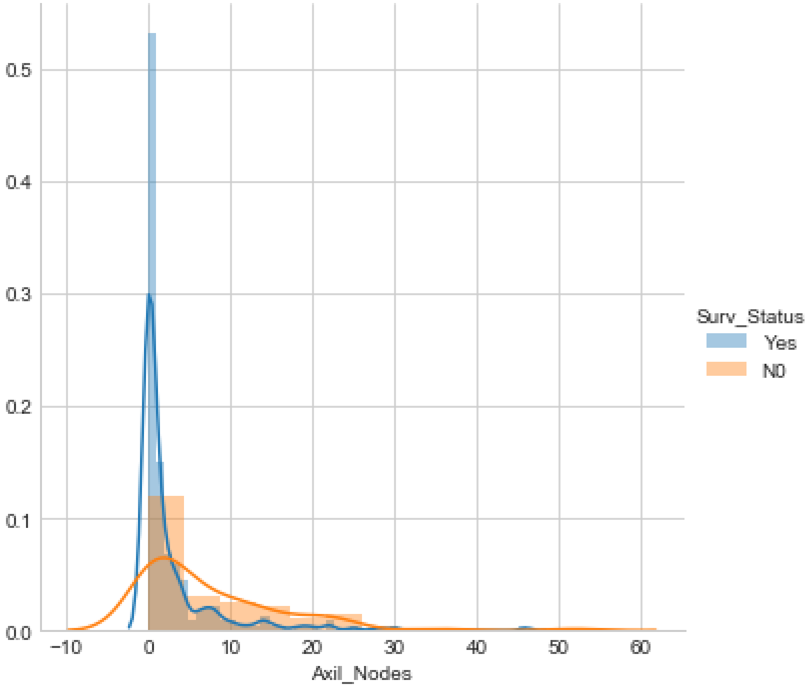
```
In [12]: sns.FacetGrid(Haberman, hue='Surv_Status', size=5).map(sns.distplot, 'Op_Year'
         ).add_legend();
         plt.show()
```

```
D:\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: Th
e 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
D:\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: Th
e 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```



In [13]:
```
sns.FacetGrid(Haberman, hue='Surv_Status', size=5).map(sns.distplot, 'Axil_Nod
es').add_legend();
plt.show()
```

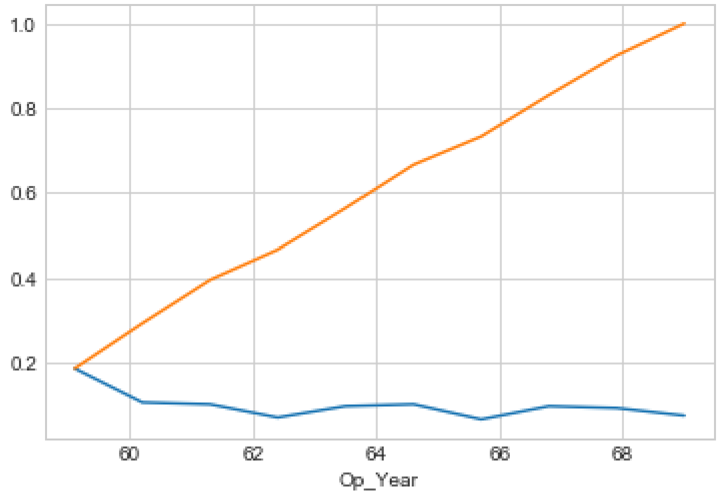
```
D:\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: Th
e 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
D:\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: Th
e 'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```



In [64]:
```
counts, bin_edges = np.histogram(Haberman_Yes['Op_Year'], bins=10, density=True)
pdf=counts/(sum(counts))
print('pdf:',pdf)
print('bin_edges:',bin_edges)
cdf=np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('Op_Year')

#counts, bin_edges = np.histogram(Haberman_Yes['Op_Year'], bins=20, density=True)
#pdf=counts/(sum(counts))
#plt.plot(bin_edges[1:],pdf)
#plt.show()
```

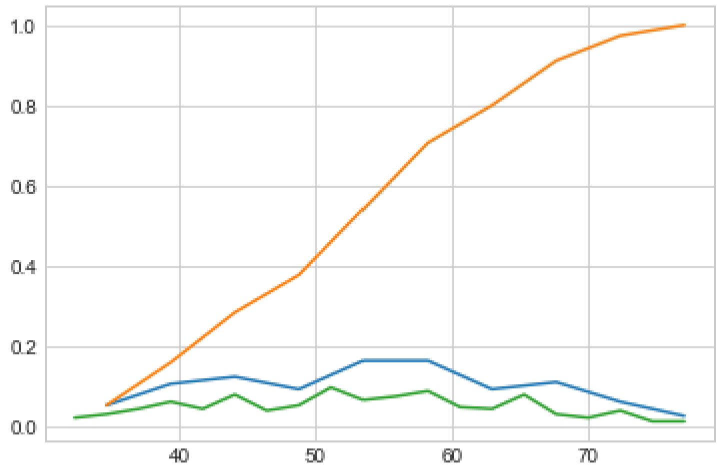
```
pdf: [0.18666667 0.10666667 0.10222222 0.07111111 0.09777778 0.10222222
 0.06666667 0.09777778 0.09333333 0.07555556]
bin_edges: [58.  59.1 60.2 61.3 62.4 63.5 64.6 65.7 66.8 67.9 69. ]
```

Out[64]:
```
Text(0.5,0,'Op_Year')
```



```
In [25]: counts, bin_edges = np.histogram(Haberman_Yes['Age'], bins=10, density=True)
         pdf=counts/(sum(counts))
         print(pdf)
         print(bin_edges)
         cdf=np.cumsum(pdf)
         plt.plot(bin_edges[1:],pdf)
         plt.plot(bin_edges[1:],cdf)

         counts, bin_edges = np.histogram(Haberman_Yes['Age'], bins=20, density=True)
         pdf=counts/(sum(counts))
         plt.plot(bin_edges[1:],pdf)
         plt.show()
```

```
[0.05333333 0.10666667 0.12444444 0.09333333 0.16444444 0.16444444
 0.09333333 0.11111111 0.06222222 0.02666667]
[30.  34.7 39.4 44.1 48.8 53.5 58.2 62.9 67.6 72.3 77. ]
```



Mean, Variance and Std-dev

In [143]:

```
print('Means:')
print('Mean of Survived people of the Year:',np.mean(Haberman_Yes['Op_Year']))
print('Mean with outlier of survived of the Year :',np.mean(np.append(Haberman_Yes['Op_Year'],50)))
print('**********************************************')

print('Means:')
print('Mean of Survived people of the Age:',np.mean(Haberman_Yes['Age']))
print('Mean with outlier Survived people of the Age:', np.mean(np.append(Haberman_Yes['Age'],50)))


print('\nStd-dev:')
print('Std dev of Survived people of the Year:',np.std(Haberman_Yes['Op_Year']))

print('Std dev of Survived people of the Age:',np.std(Haberman_Yes['Age']))
```

```
Means:
Mean of Survived people of the Year: 62.86222222222222
Mean with outlier of survived of the Year : 62.80530973451327
**********************************************
Means:
Mean of Survived people of the Age: 52.01777777777778
Mean with outlier Survived people of the Age: 52.008849557522126

Std-dev:
Std dev of Survived people of the Year: 3.2157452144021956
Std dev of Survived people of the Age: 10.98765547510051
```

Median, Percentile, Quantile, IQR, MAD

In [144]:

```
print('Medians')
print('Median of Survived people of the Year:',np.median(Haberman_Yes['Op_Year']))
print('Median with outlier of Survived people of the Year:',np.median(np.append(Haberman_Yes['Op_Year'],50)))

print('Median of Survived people of the Age:',np.median(Haberman_Yes['Age']))
print('Median with outlier of Survived people of the Year:',np.median(np.append(Haberman_Yes['Age'],50)))
```

```
Medians
Median of Survived people of the Year: 63.0
Median with outlier of Survived people of the Year: 63.0
Median of Survived people of the Age: 52.0
Median with outlier of Survived people of the Year: 52.0
```

In [146]:

```
print('Quantiles')
print('Year of Operation:', np.percentile(Haberman_Yes['Op_Year'],np.arange(0,
100,25)))
print('Age:',np.percentile(Haberman_Yes['Age'],np.arange(0,100,25)))
```

```
Quantiles
Year of Operation: [58. 60. 63. 66.]
Age: [30. 43. 52. 60.]
```

In [145]:

```
print('90th Percentiles')
print('90th Percentile of the Year:',np.percentile(Haberman_Yes['Op_Year'],90
))
print('90th Percentile of the Age:',np.percentile(Haberman_Yes['Age'],90))
```

```
90th Percentiles
90th Percentile of the Year: 67.0
90th Percentile of the Age: 67.0
```

In [148]:

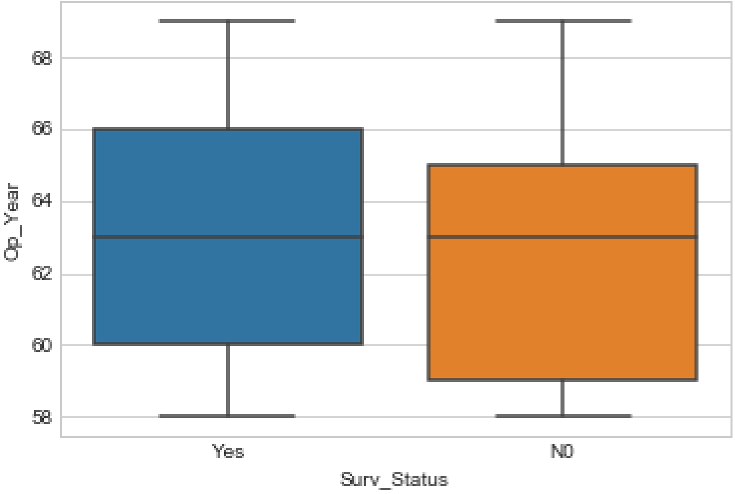
```
from statsmodels import robust
print('Median Absolute Deviation')
print('MAD of the Year:',robust.mad(Haberman_Yes['Op_Year']))
print('MAD of the Age',robust.mad(Haberman_Yes['Age']))
```

```
Median Absolute Deviation
MAD of the Year: 4.447806655516806
MAD of the Age 13.343419966550417
```

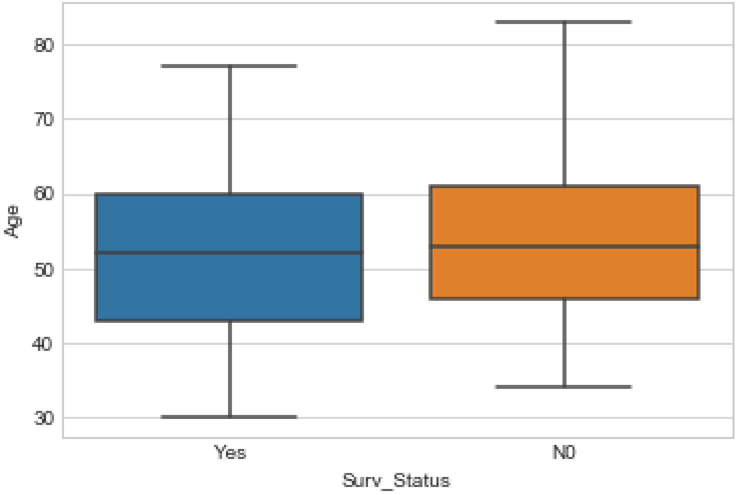
Box Plot and Whiskers

In [103]:

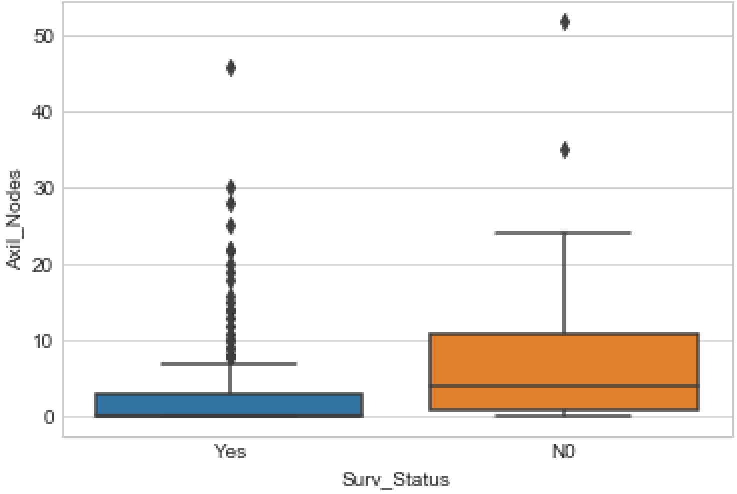
```
sns.boxplot(x='Surv_Status', y='Op_Year', data=Haberman)
plt.show()
```



In [117]:
```
sns.boxplot(x='Surv_Status', y='Age', data=Haberman)
plt.show()
```



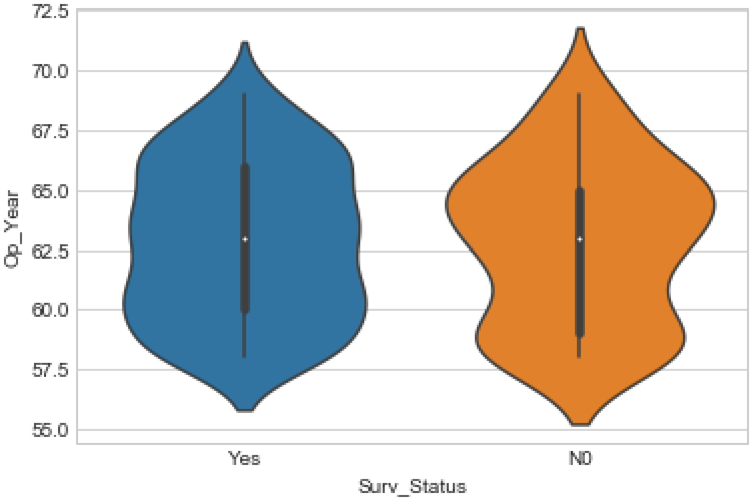
In [118]:
```
sns.boxplot(x='Surv_Status', y='Axil_Nodes', data=Haberman)
plt.show()
```



Violin Plots

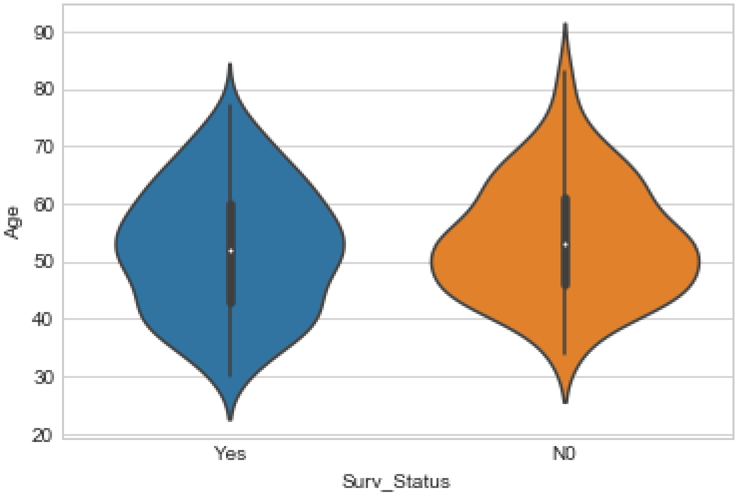
In [105]:

```
sns.violinplot(x='Surv_Status', y='Op_Year', data=Haberman, size=8)
plt.show()
```



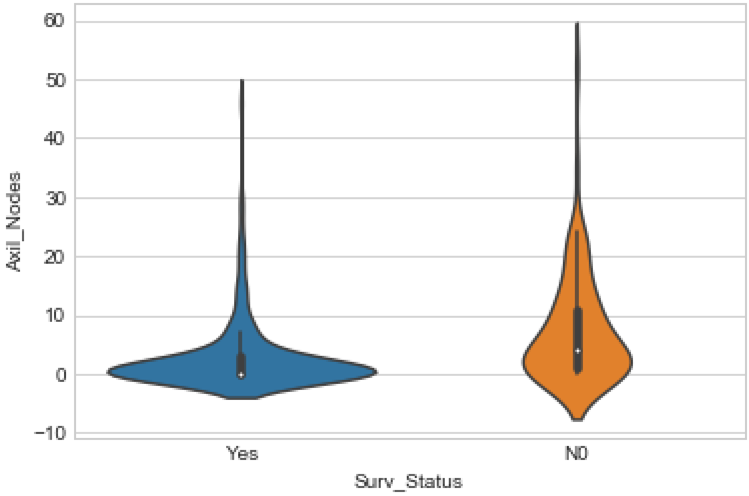
In [106]:

```
sns.violinplot(x='Surv_Status', y='Age', data=Haberman, size=8)
plt.show()
```



In [119]:

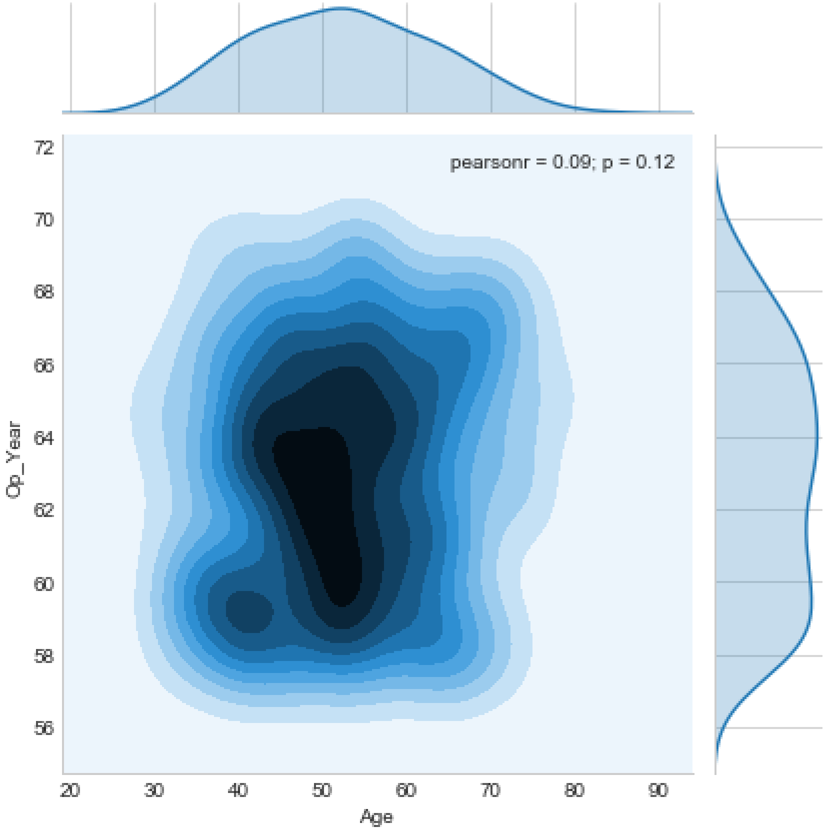
```
sns.violinplot(x='Surv_Status', y='Axil_Nodes', data=Haberman, size=8)
plt.show()
```



Contour Plot

In [127]:

```
sns.jointplot(x='Age', y='Op_Year', data=Haberman, kind='kde')
plt.show()
```


pearsonr = 0.09; p = 0.12
Op_Year
Age