In [95]:
```python
import numpy as np
import pandas as pd
import seaborn as ssn
import matplotlib.pyplot as plt
import matplotlib.patches as mpatches
```

Objective is by giving input variables , what will be the surv_status , he/she can survive 5 years and longer(1) or died with in 5 years(2)

In [12]:
```python
Hm_DataF = pd.read_csv('haberman.csv')
```

In [13]:
```python
Hm_DataF.head()
Hm_DataF.tail()
```

Out[13]:

| | 30 | 64 | 1 | 1.1 |
|---|---|---|---|---|
| **300** | 75 | 62 | 1 | 1 |
| **301** | 76 | 67 | 0 | 1 |
| **302** | 77 | 65 | 3 | 1 |
| **303** | 78 | 65 | 1 | 2 |
| **304** | 83 | 58 | 2 | 2 |

In [14]:
```python
Hm_DataF.columns = ['Age','Op_Year','axil_nodes','Surv_status']
Hm_DataF.head()
```

Out[14]:

| | Age | Op_Year | axil_nodes | Surv_status |
|---|---|---|---|---|
| **0** | 30 | 62 | 3 | 1 |

| | Age | Op_Year | axil_nodes | Surv_status |
|---|---|---|---|---|
| **1** | 30 | 65 | 0 | 1 |
| **2** | 31 | 59 | 2 | 1 |
| **3** | 31 | 65 | 4 | 1 |
| **4** | 33 | 58 | 10 | 1 |

In [16]:
```
Hm_DataF.columns
Hm_DataF.describe()
```

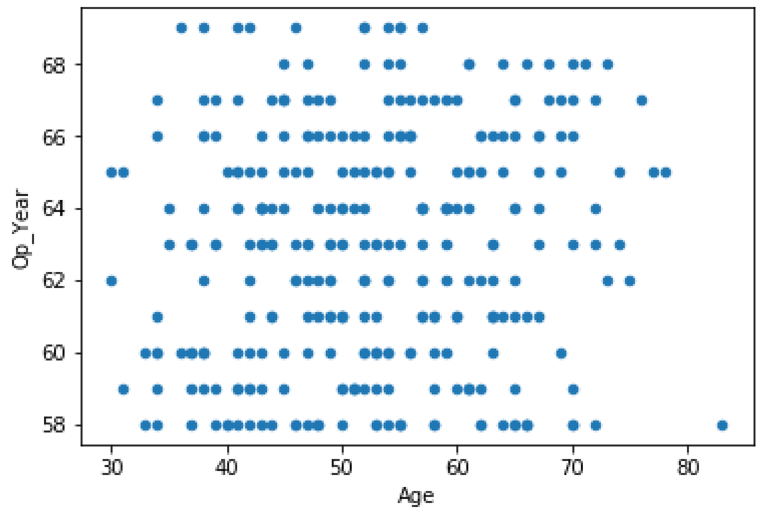
Out[16]:

| | Age | Op_Year | axil_nodes | Surv_status |
|---|---|---|---|---|
| **count** | 305.000000 | 305.000000 | 305.000000 | 305.000000 |
| **mean** | 52.531148 | 62.849180 | 4.036066 | 1.265574 |
| **std** | 10.744024 | 3.254078 | 7.199370 | 0.442364 |
| **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%** | 61.000000 | 66.000000 | 4.000000 | 2.000000 |
| **max** | 83.000000 | 69.000000 | 52.000000 | 2.000000 |

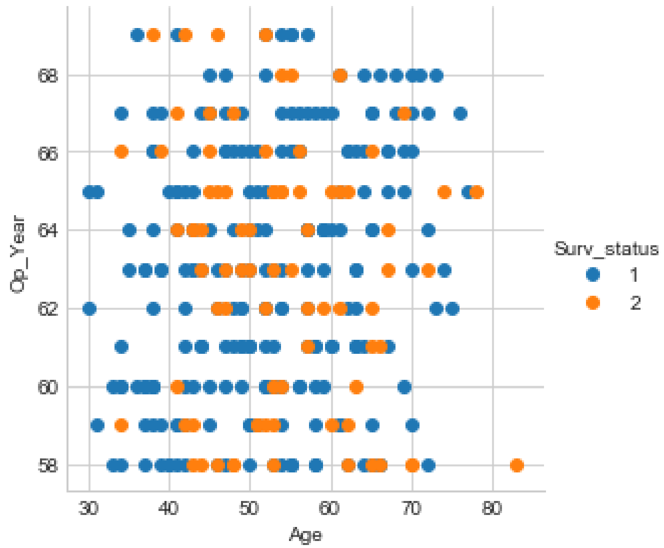
In [18]:
```
Hm_DataF['Surv_status'].value_counts()
```

Out[18]:
```
1    224
2     81
Name: Surv_status, dtype: int64
```

In [20]:
```
Hm_DataF.plot(kind='scatter', x = 'Age' , y = 'Op_Year')
plt.show()
```

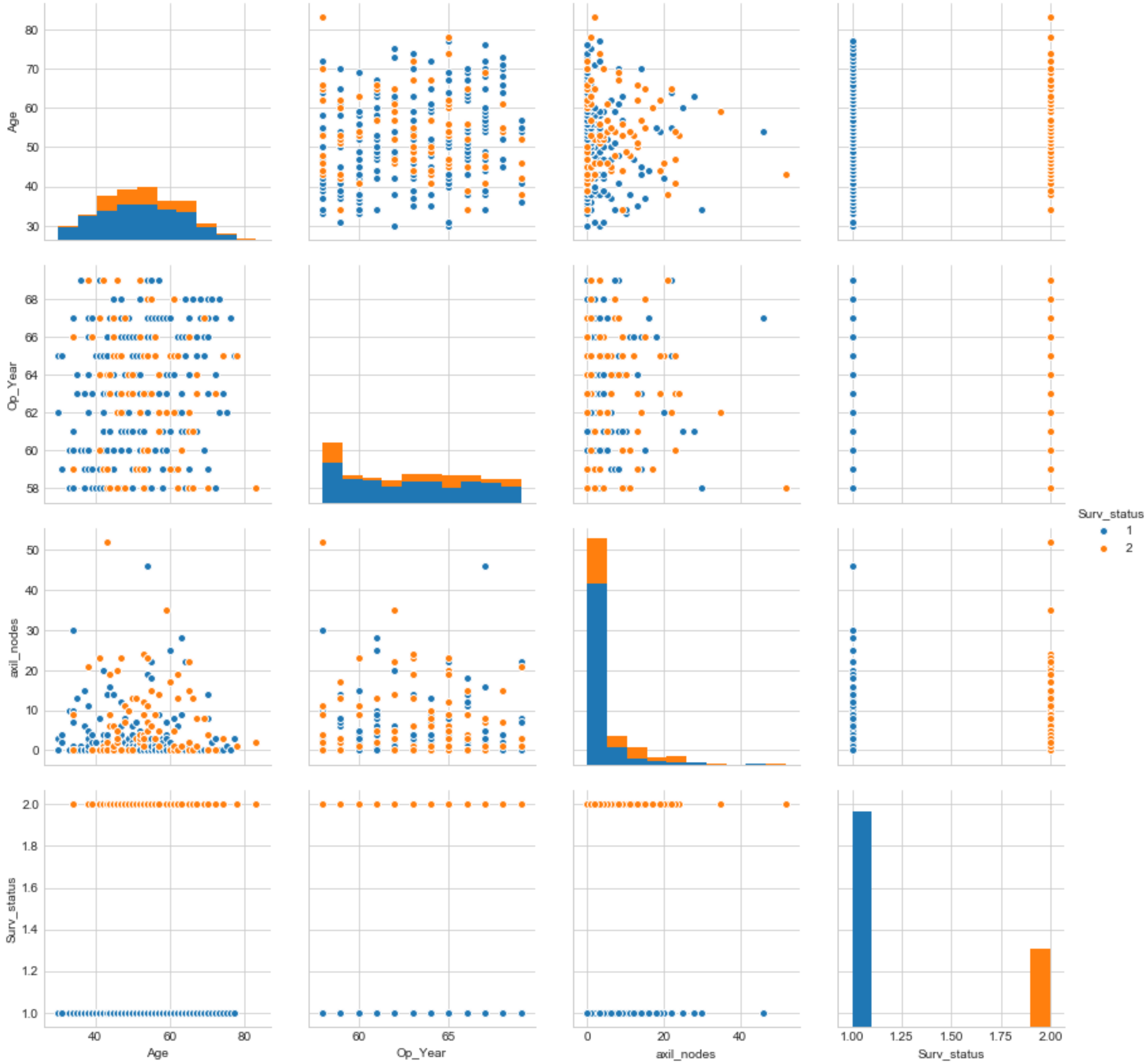



In [58]:
```
ssn.set_style(style='whitegrid')
ssn.FacetGrid(Hm_DataF,hue="Surv_status" ,size=4) \
    .map(plt.scatter, "Age", "Op_Year") \
    .add_legend()
plt.show()
```



here the data is clubed with each other.

In [57]:
```
plt.close();
ssn.set_style("whitegrid");
ssn.pairplot(Hm_DataF, hue="Surv_status", size=3);
plt.show()
```

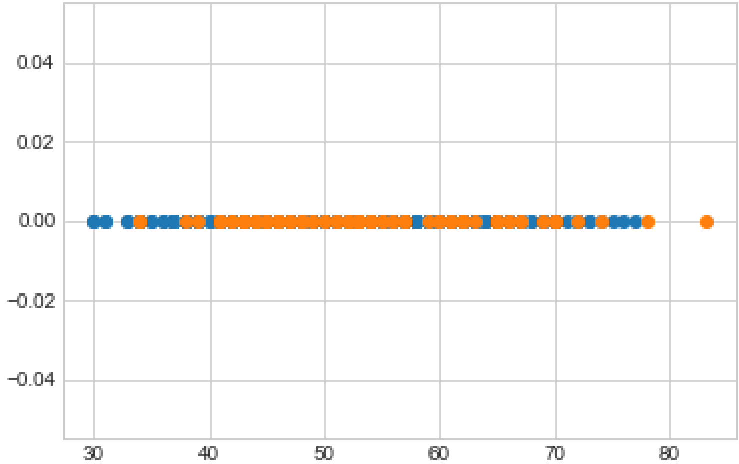


As per my observations

1)what i think is 'Age' with 'axil_nodes' can make some classification for Surv_status as per above pair plots 2)Age from 40 to 60 with axil_nodes with 0 to 20 have more surv_status with 2 i.e who are died with in 5 years

In [79]:

```
#One-D Scatter plot

Hm_DataF_1 = Hm_DataF.loc[Hm_DataF["Surv_status"] == 1];
Hm_DataF_2 = Hm_DataF.loc[Hm_DataF["Surv_status"] == 2];

plt.plot(Hm_DataF_1["Age"], np.zeros_like(Hm_DataF_1["Age"]), 'o')

plt.plot(Hm_DataF_2["Age"], np.zeros_like(Hm_DataF_2["Age"]), 'o')

plt.show()
```



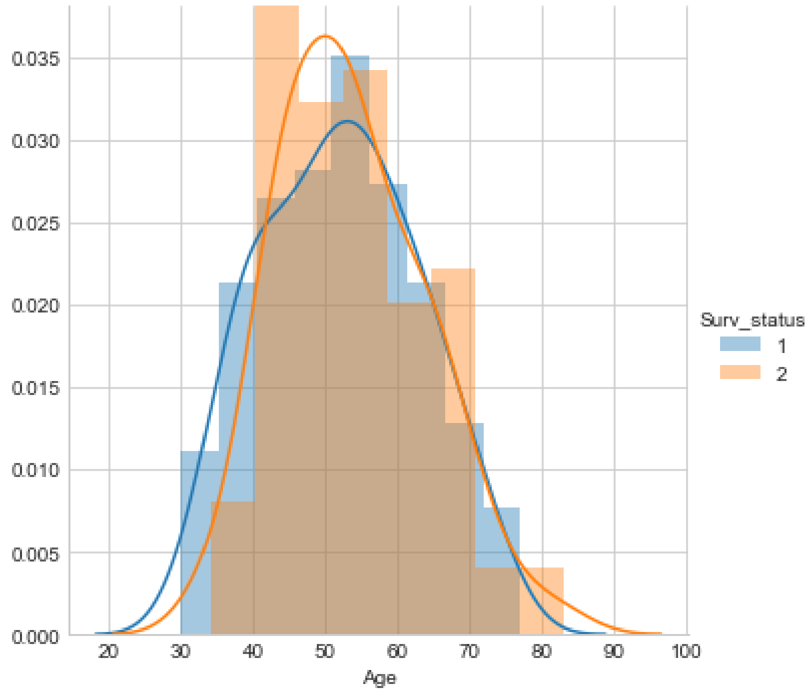

There are overlapping with each other to see the data

In [78]:

```
#using Histogram's to better understand the data,
#for Age
```

```
ssn.FacetGrid(Hm_DataF, hue="Surv_status", size=5) \
   .map(ssn.distplot, "Age") \
   .add_legend();
plt.show();
```

```
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:646
2: UserWarning: The 'normed' kwarg is deprecated, and has been replaced
by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:646
2: UserWarning: The 'normed' kwarg is deprecated, and has been replaced
by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```




In [ ]:

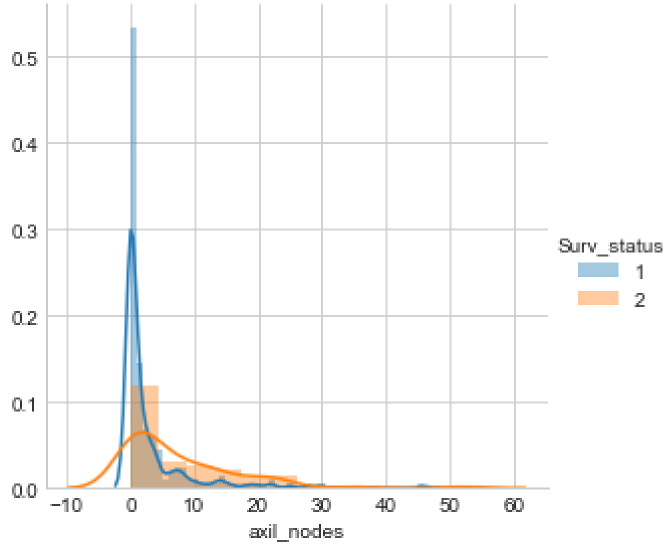
```
Here as we see that Surv_status 1 and 2 are overlapping with each other
1)the height represents the maximum number, as per histogram 40 - 46 ag
```

```
e are under surv_status with 2
and for surv_status 1 maximum ages are from 51-55.
```

In [83]:

```
#For axil_nodes
ssn.FacetGrid(Hm_DataF,hue="Surv_status",size=4) \
    .map(ssn.distplot , "axil_nodes") \
    .add_legend();
plt.show();
```

```
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:646
2: UserWarning: The 'normed' kwarg is deprecated, and has been replaced
by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:646
2: UserWarning: The 'normed' kwarg is deprecated, and has been replaced
by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```

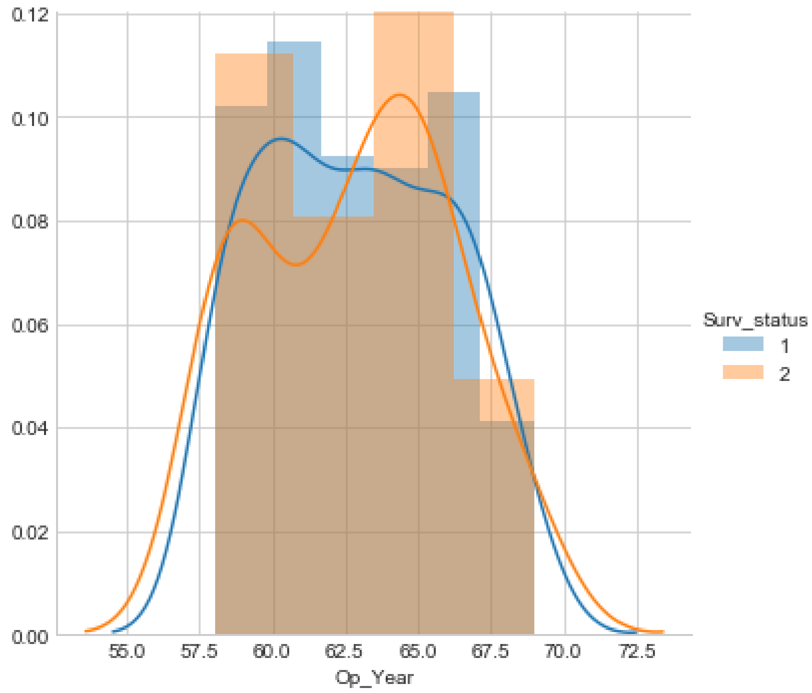



In [69]:

```
#for Op_Year
ssn.FacetGrid(Hm_DataF, hue="Surv_status", size=5) \
   .map(ssn.distplot, "Op_Year") \
```

```
    .add_legend();
plt.show();
```

```
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:646
2: UserWarning: The 'normed' kwarg is deprecated, and has been replaced
by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:646
2: UserWarning: The 'normed' kwarg is deprecated, and has been replaced
by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```

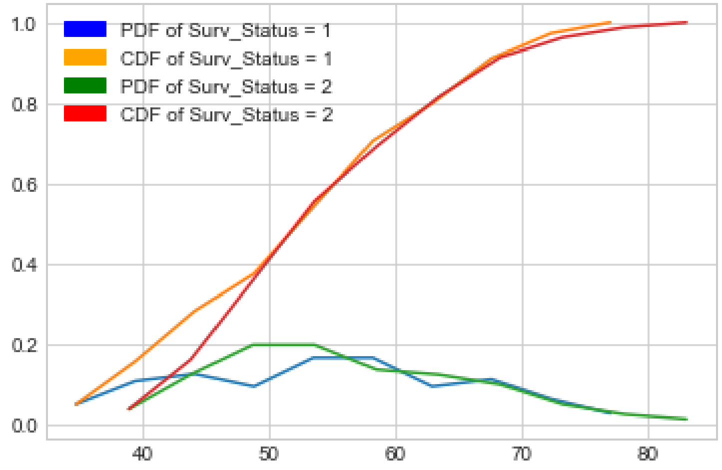



By using univariant analysis , i decided to take variables of axil_nodes and Age and here axil_nodes will some what better then Age.

In [102]:
```
#Cumulative Distribution Function (CDF)
# for Age
```

```
counts , bin_edges = np.histogram(Hm_DataF_1["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)

blue_patch = mpatches.Patch(color='blue', label='PDF of Surv_Status = 1')
org_patch = mpatches.Patch(color='orange', label='CDF of Surv_Status = 1')
green_patch = mpatches.Patch(color='green', label='PDF of Surv_Status = 2')
red_patch = mpatches.Patch(color='red', label='CDF of Surv_Status = 2')
plt.legend(handles=[blue_patch,org_patch,green_patch,red_patch])
#blue_patch = mpatches.Patch(color='blue', label='PDF class 1')
#plt.legend(handles=[blue_patch])

counts , bin_edges = np.histogram(Hm_DataF_2["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)
plt.show();
```

```
[0.04910714 0.10714286 0.125      0.09375    0.16517857 0.16517857
 0.09375    0.11160714 0.0625     0.02678571]
[30.  34.7 39.4 44.1 48.8 53.5 58.2 62.9 67.6 72.3 77. ]
[0.03703704 0.12345679 0.19753086 0.19753086 0.13580247 0.12345679
 0.09876543 0.04938272 0.02469136 0.01234568]
[34.  38.9 43.8 48.7 53.6 58.5 63.4 68.3 73.2 78.1 83. ]
```

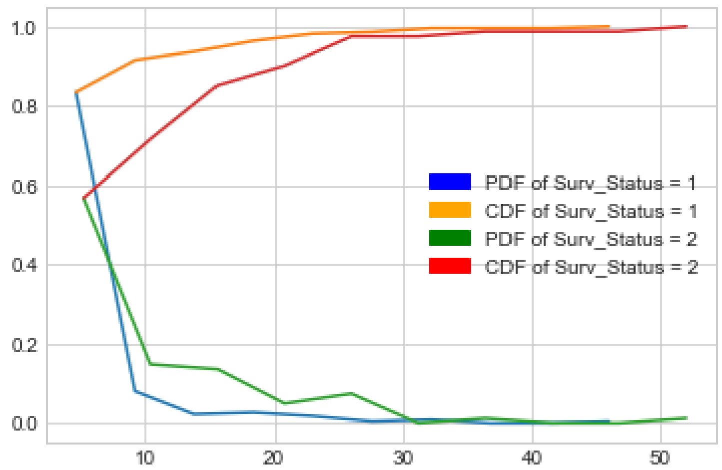



Here the observations are : -> there is intersecting of both pdfs at age of 44 , in which the survival is 30% chance and 18% with no chance of survival. -> next interscting point is at 56 in which , 62% of probability chance for both.

In [107]:
```
#for Op_Year

counts , bin_edges = np.histogram(Hm_DataF_1["axil_nodes"],bins=10,dens
ity=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)

blue_patch = mpatches.Patch(color='blue', label='PDF of Surv_Status =
 1')
org_patch = mpatches.Patch(color='orange', label='CDF of Surv_Status =
 1')
green_patch = mpatches.Patch(color='green', label='PDF of Surv_Status =
 2')
red_patch = mpatches.Patch(color='red', label='CDF of Surv_Status = 2')
```

```
plt.legend(handles=[blue_patch,org_patch,green_patch,red_patch])
#blue_patch = mpatches.Patch(color='blue', label='PDF class 1')
#plt.legend(handles=[blue_patch])

counts , bin_edges = np.histogram(Hm_DataF_2["axil_nodes"],bins=10,dens
ity=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)
plt.show();
```

```
[0.83482143 0.08035714 0.02232143 0.02678571 0.01785714 0.00446429
 0.00892857 0.         0.         0.00446429]
[ 0.   4.6  9.2 13.8 18.4 23.  27.6 32.2 36.8 41.4 46. ]
[0.56790123 0.14814815 0.13580247 0.04938272 0.07407407 0.
 0.01234568 0.         0.         0.01234568]
[ 0.   5.2 10.4 15.6 20.8 26.  31.2 36.4 41.6 46.8 52. ]
```




Observations : as per the first intersecting point the axil_nodes with 7 and less has 90% chance of survival

In [113]:

```
#Mean, Variance, Std-deviation,
print("Means:")
print(np.mean(Hm_DataF_1["Age"]))
print(np.mean(Hm_DataF_2["Age"]))
print(np.mean(np.append(Hm_DataF_2["Age"],500)));


print("\nStd-dev:");
print(np.std(Hm_DataF_1["Age"]))
print(np.std(Hm_DataF_2["Age"]))
```

```
Means:
52.11607142857143
53.67901234567901
59.1219512195122

Std-dev:
10.913004640364269
10.10418219303131
```

Observation : the average age of persons who are survived 5 years or more than is 52 the average age of persons who are not survived 5 years is 53 mean will affect when there is outliers.

In [111]:

```
#Median, Quantiles, Percentiles, IQR.
print("\nMedians:")
print(np.median(Hm_DataF_1["Age"]))
print(np.median(Hm_DataF_2["Age"]))
#Median with an outlier
print(np.median(np.append(Hm_DataF_2["Age"],500)));


print("\nQuantiles:")
print(np.percentile(Hm_DataF_1["Age"] , np.arange(0,100,25)))
print(np.percentile(Hm_DataF_2["Age"] , np.arange(0,100,25)))
```

```python
print("\n90th Percentiles:")
print(np.percentile(Hm_DataF_1["Age"],90))
print(np.percentile(Hm_DataF_2["Age"],90))


from statsmodels import robust
print ("\nMedian Absolute Deviation")
print(robust.mad(Hm_DataF_1["Age"]))
print(robust.mad(Hm_DataF_2["Age"]))
```

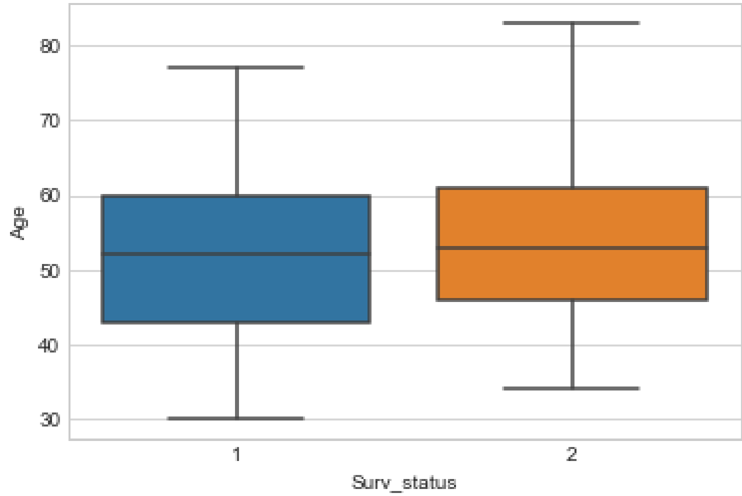
```
Medians:
52.0
53.0
53.0

Quantiles:
[30. 43. 52. 60.]
[34. 46. 53. 61.]

90th Percentiles:
67.0
67.0

Median Absolute Deviation
13.343419966550417
11.860817748044816
10.913004640364269
10.10418219303131
```

In [ ]:

```
there is not much impact on adding the outliners of age
```

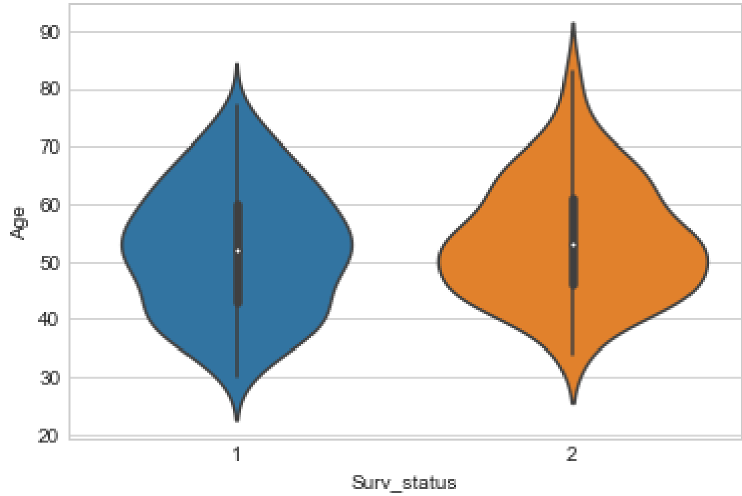
In [116]:

```python
ssn.boxplot(x='Surv_status',y='Age', data=Hm_DataF)
plt.show()
```




In [ ]:
```
medians for surv_status 1 is 52 and surv_status 2 is 53
most of the persons with age 43 to 60  are survived above 5 years
```

In [119]:
```
ssn.violinplot(x="Surv_status", y="Age", data=Hm_DataF, size=5)
plt.show()
```



In [ ]:

```
Summary :
    from the starting pair plots i have observed that Age and axil_node
s are used in determining the output
    people with 40 to 66 years are are survived for more than 5 years
```

In [124]:

```
  File "<ipython-input-124-4451821cc3ca>", line 1
    ipython nbconvert to latex Haberman_EDA.pdf
                    ^
SyntaxError: invalid syntax
```