WHAT IS THIS DATASET ABOUT??

The dataset contains cases from a study that was conducted between 1958 and 1970 at the University of Chicago's Billings Hospital on the survival of patients who had undergone surgery for breast cancer.

Attribute Information:

1. Age of patient at time of operation (numerical)

2. Patient's year of operation (year - 1958, numerical)

3. Number of positive axillary nodes detected (numerical)

4. Survival status (class attribute)

1 = the patient survived 5 years or longer

2 = the patient died within 5 year

In [63]:
```
import warnings
warnings.filterwarnings("ignore")

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

In [64]:
```
haberman = pd.read_csv("haberman.csv")
```

Data Points- No of Rows and Features - Total columns

In [65]:
```
print (haberman.shape)
```

```
(306, 4)
```

In [66]:
```
print(haberman.columns)
```

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

How many Data points for each class are present?

ANSWER- 2

Python Code Below

In [67]:
```
haberman['status'] = haberman['status'].map({1: "Survived", 2: "Not Survived"})
haberman["status"].value_counts()
```

Out[67]:
```
Survived        225
Not Survived     81
Name: status, dtype: int64
```

OBJECTIVE

We need to check whether a particular patient survived for less or more than 5 years based on their AGE, YEAR and no of NODES they operated during the surgery

VARIABLES NEED TO CONSIDER for Comparision- AGE, YEAR and NODES-------- TOTAL- 3 To determine the status 1 or 2

Mathametical point- 3C2= 3

1. (AGE,YEAR)
2. (AGE,NODES)
3. (YEAR,NODES)

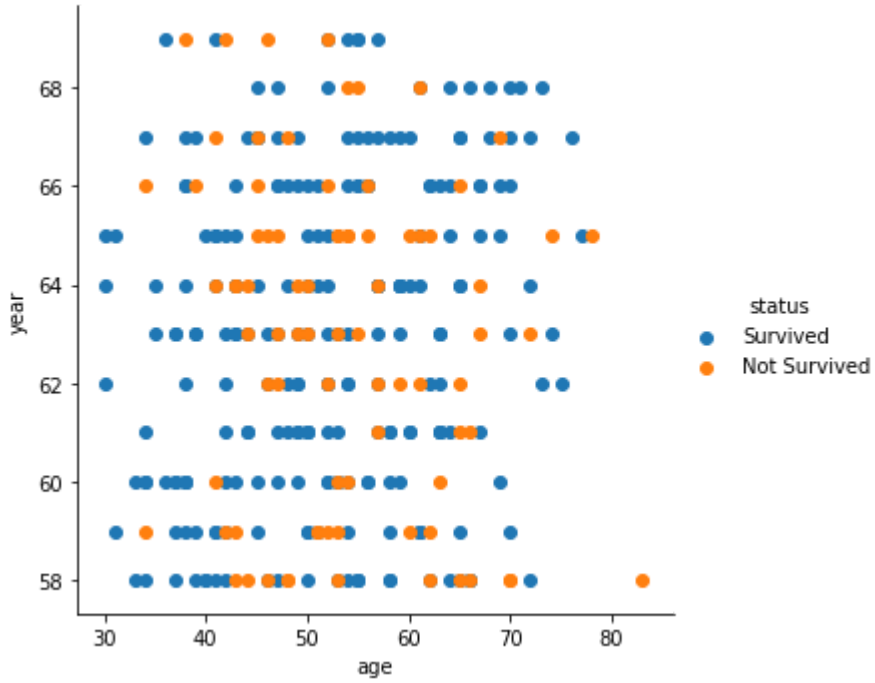
Bi-variate analysis (scatter plots, pair-plots)

SCATTER PLOT

1. SCATTER PLOT BETWEEN AGE AND YEAR

In [68]:

```
g = sns.FacetGrid(haberman, hue='status',height=5)  # Defining Axis
g = g.map(plt.scatter, "age", "year").add_legend() # Plotting

plt.show()
```



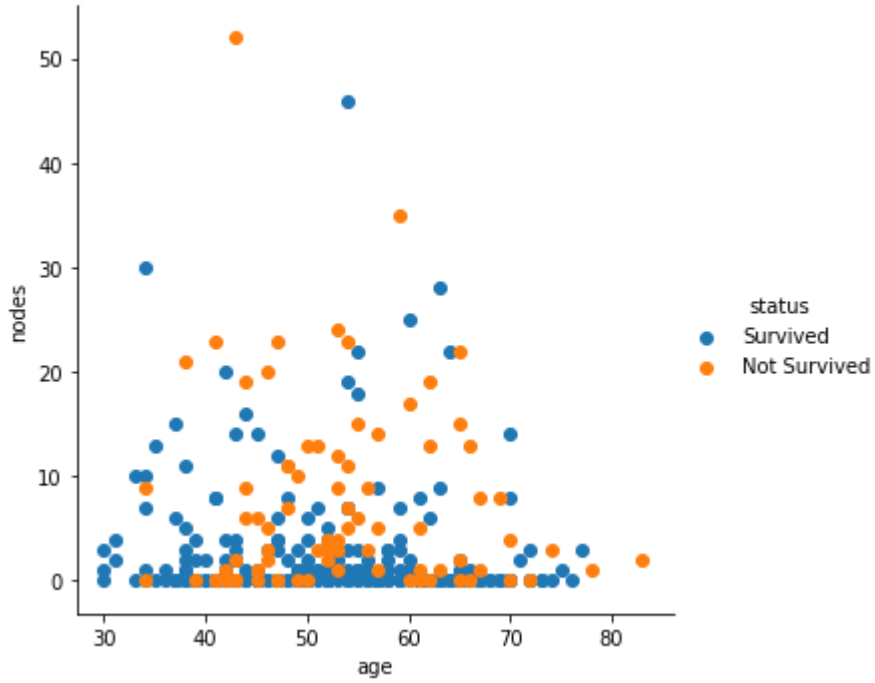
OBSERVATIONS FOR THE ABOVE PLOT

UNABLE TO DETERMINE AS POINTS ARE SCATTERED EVERYWHERE AND OVERLAPPING E ACH OTHER

2. SCATTER PLOT BETWEEN AGE AND NODES

In [69]:

```
g = sns.FacetGrid(haberman, hue='status',height=5)  # Defining Axis
g = g.map(plt.scatter, "age", "nodes").add_legend() # Plotting

plt.show()
```



OBSERVATIONS FOR THE ABOVE PLOT

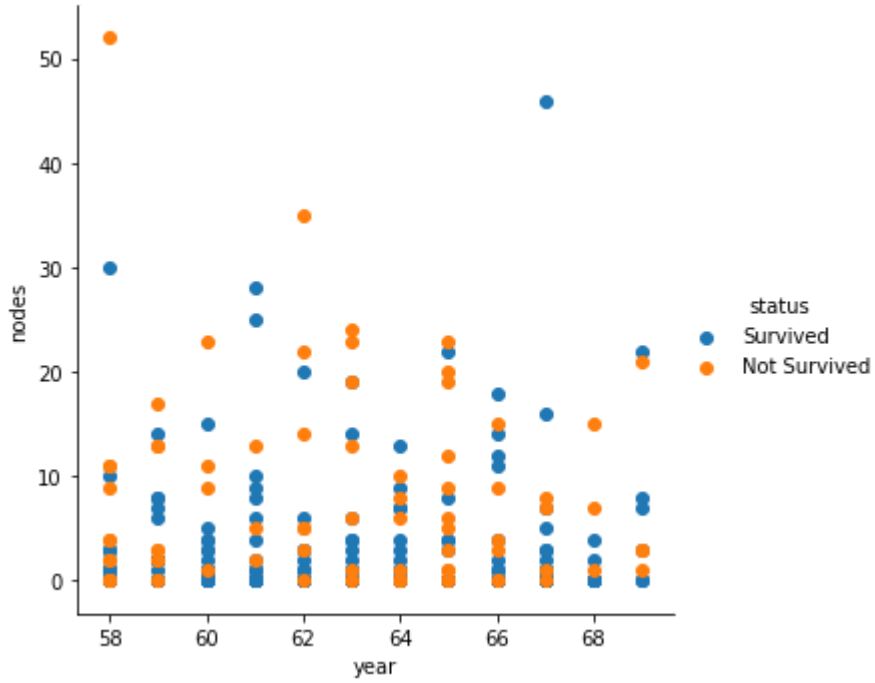
UNABLE TO DETERMINE AS POINTS ARE SCATTERED EVERYWHERE AND OVERLAPPING E ACH OTHER.

THERE ARE MANY OUTLIERS FROM THE ABIVE PLOT, HENCE THE DATA POINTS COLLL ECTED ARE NOT ACCURATE.

3. SCATTER PLOT BETWEEN YEAR AND NODES

In [70]:

```
g = sns.FacetGrid(haberman, hue='status',height=5)  # Defining Axis
g = g.map(plt.scatter, "year", "nodes").add_legend() # Plotting

plt.show()
```

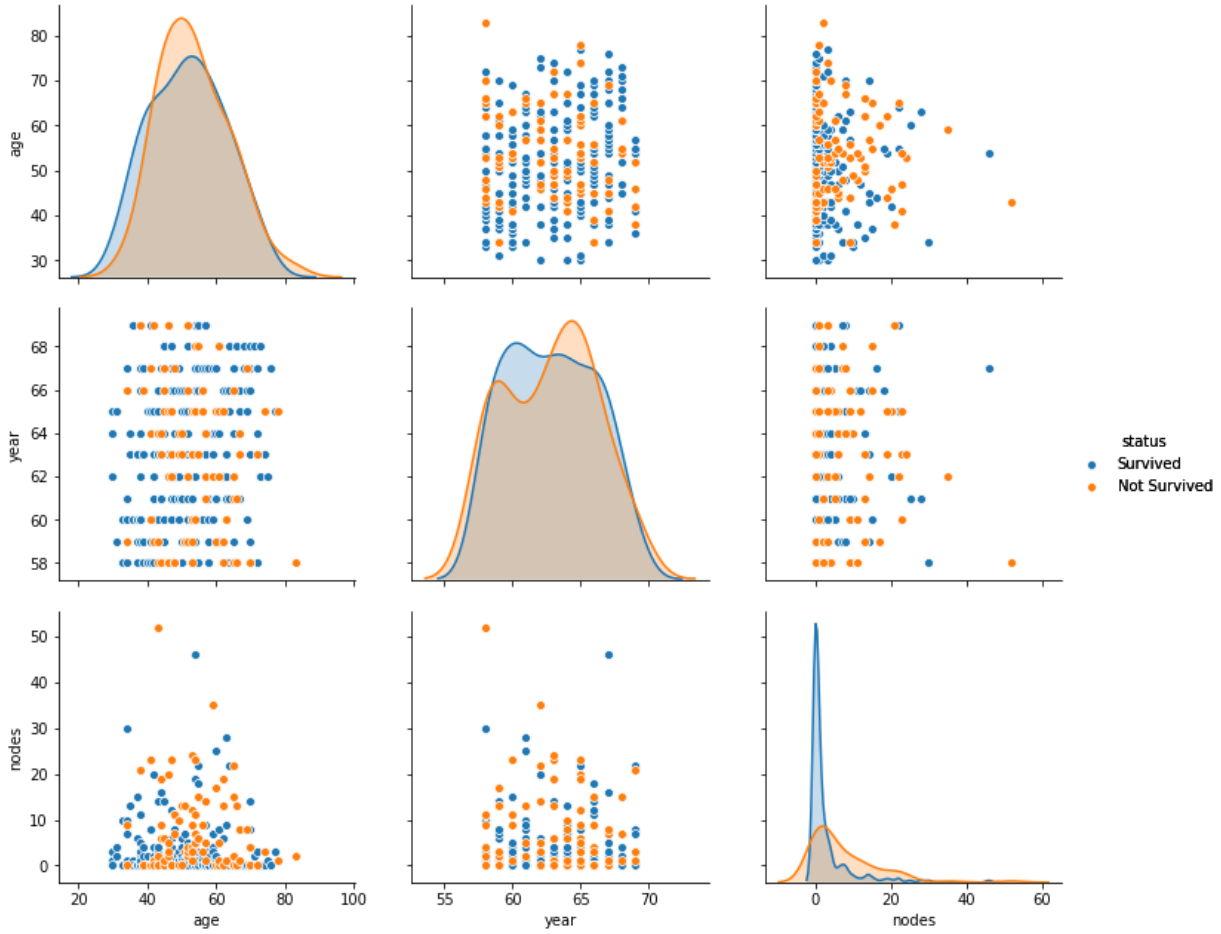


OBSERVATIONS FOR THE ABOVE PLOT

UNABLE TO DETERMINE AS POINTS ARE SCATTERED EVERYWHERE AND OVERLAPPING E ACH OTHER

PAIR PLOT

In [71]:
```
sns.pairplot(haberman, hue="status", height=3).add_legend()
plt.show()
```



OBSERVATIONS FOR THE ABOVE PLOT

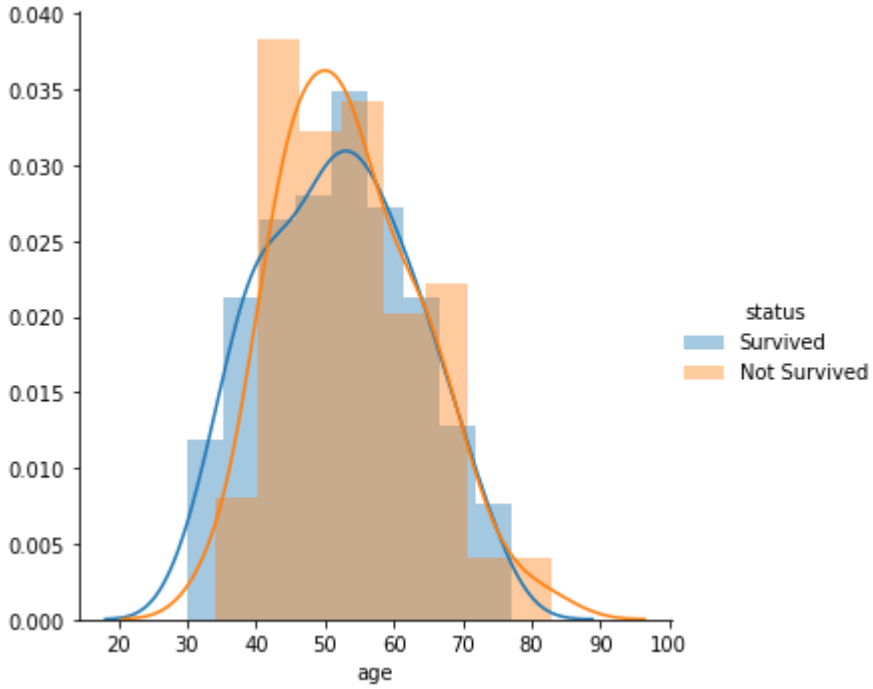
UNABLE TO DETERMINE AS POINTS ARE SCATTERED EVERYWHERE AND OVERLAPPING E ACH OTHER

Univaraite analysis(PDF, CDF, Boxplot, Voilin plots)

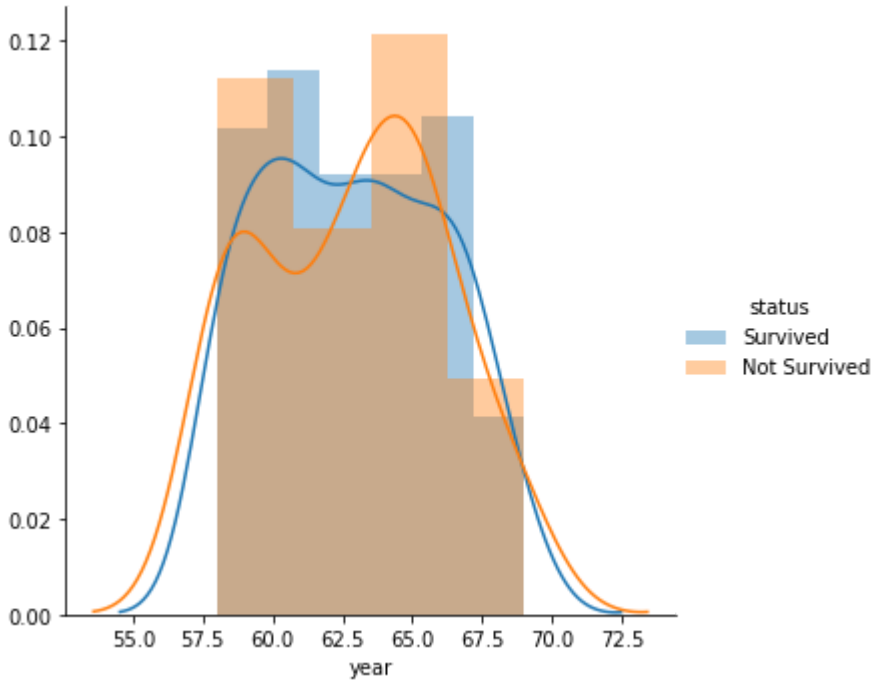
1. PDF

HERE THE HEIGHT OF THE BAR DENOTES THE PERCENTAGE OF DATA POINTS UNDER THE CORRESPONDING GROUP

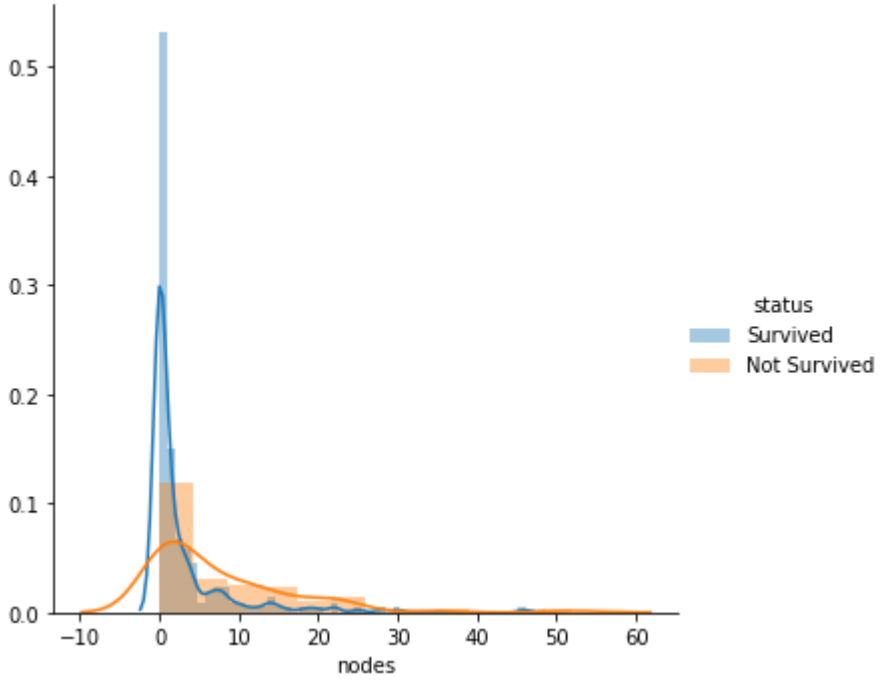
In [72]:
```
#PDF FOR AGE
sns.FacetGrid(haberman, hue="status", height=5).map(sns.distplot, "age").add_lege
plt.show();
```



In [73]:
```
#PDF FOR YEAR

sns.FacetGrid(haberman, hue="status", height=5).map(sns.distplot, "year").add_leg
plt.show();
```



In [74]:
```
#PDF FOR NODES

sns.FacetGrid(haberman, hue="status", height=5).map(sns.distplot, "nodes").add_le
plt.show();
```



OBSERVATIONS FOR PDF

FROM THE PDF PLOT OF NODES IT IS CLEAR THAT PDF OF SURVIVAL IS HIGH MORE THAN 5 YRS.

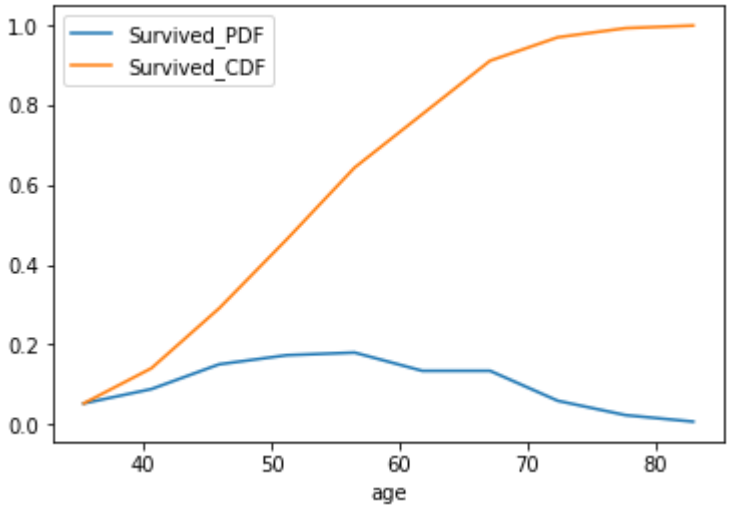
IF 'NODES' <= 3 THEN THE PERSON IS SURVIVED ELSE DIED LESS THAN 5 YRS.

2. CDF

In [75]:

```
#AGE
counts, bin_edges = np.histogram(haberman['age'], bins=10, density = True)

pdf = counts/(sum(counts))
print(pdf);
print(bin_edges)

#compute CDF
cdf = np.cumsum(pdf)


plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)

plt.legend(['Survived_PDF', 'Survived_CDF'])
plt.xlabel("age")
plt.ylabel("P(X)")

plt.show();
```

```
[0.05228758 0.08823529 0.1503268  0.17320261 0.17973856 0.13398693
 0.13398693 0.05882353 0.02287582 0.00653595]
[30.  35.3 40.6 45.9 51.2 56.5 61.8 67.1 72.4 77.7 83. ]
```

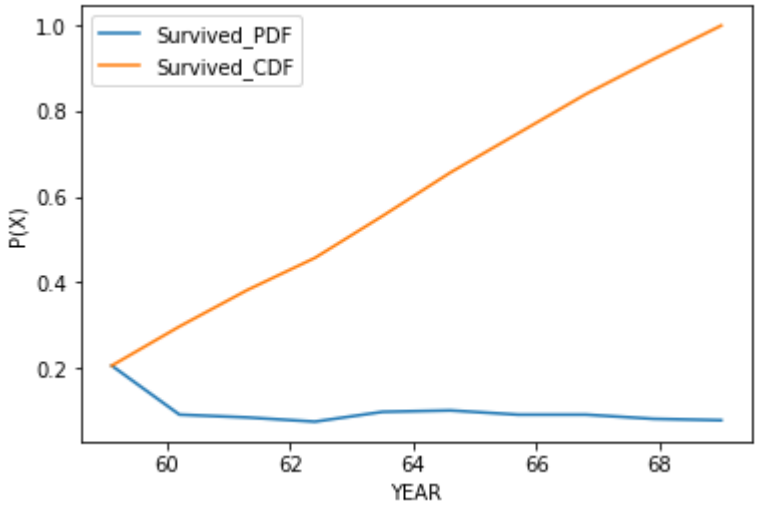


OBSERVATIONS for CDF

WHEN we plot CDF for AGE we get to know that more the AGE the less chance of survival of more than 5 years.

In [85]:
```
#PDF- YEAR

counts, bin_edges = np.histogram(haberman['year'], bins=10, density = True)

pdf = counts/(sum(counts))
print(pdf);
print(bin_edges)

#compute CDF
cdf = np.cumsum(pdf)

plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)

plt.legend(['Survived_PDF', 'Survived_CDF'])
plt.xlabel("YEAR")
plt.ylabel("P(X)")



plt.show();
```

```
[0.20588235 0.09150327 0.08496732 0.0751634  0.09803922 0.10130719
 0.09150327 0.09150327 0.08169935 0.07843137]
[58.  59.1 60.2 61.3 62.4 63.5 64.6 65.7 66.8 67.9 69. ]
```

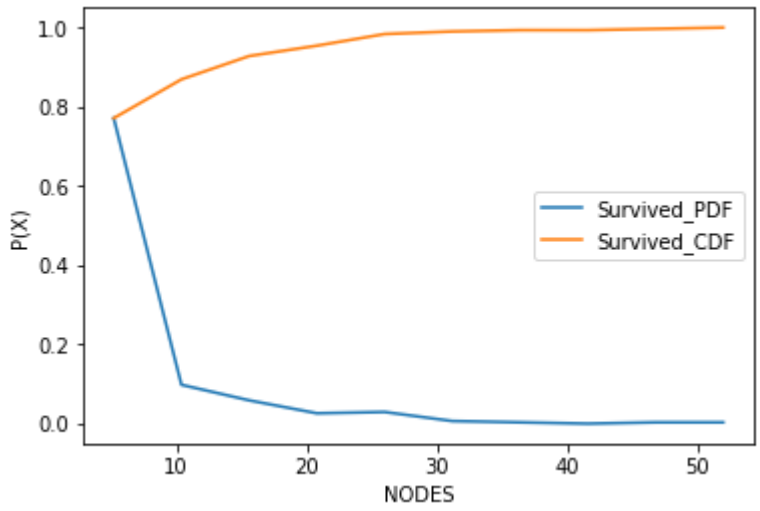


OBSERVATIONS

YEAR IS AMBIGIOUS TO CALCULATE

In [84]:
```
#PDF NODES

counts, bin_edges = np.histogram(haberman['nodes'], bins=10, density = True)

pdf = counts/(sum(counts))
print(pdf);
print(bin_edges)

#compute CDF
cdf = np.cumsum(pdf)

plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)

plt.legend(['Survived_PDF', 'Survived_CDF'])
plt.xlabel("NODES")
plt.ylabel("P(X)")



plt.show();
```

```
[0.77124183 0.09803922 0.05882353 0.02614379 0.02941176 0.00653595
 0.00326797 0.         0.00326797 0.00326797]
[ 0.   5.2 10.4 15.6 20.8 26.  31.2 36.4 41.6 46.8 52. ]
```

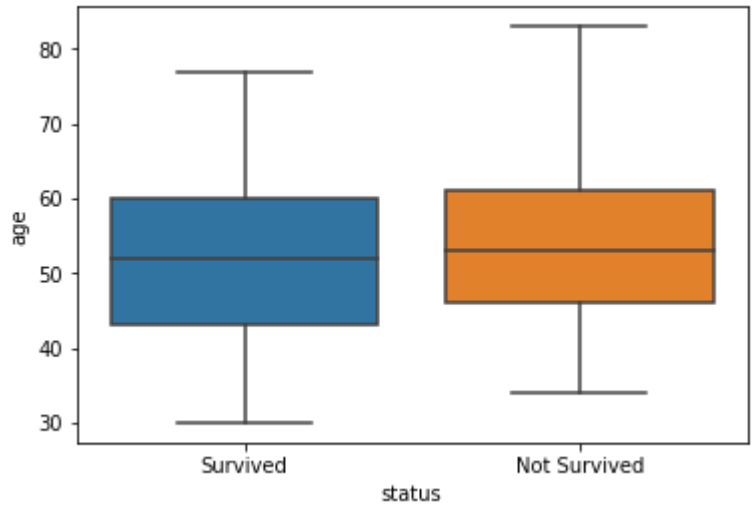


OBSERVATIONS

FROM THE ABOVE GRAPH WE CAN SAY THAT 4% HAVE LESS THAN 10 AUXILLARY NODES DETECTED AND SURVIVED

3. BOX PLOT

In [78]:
```
sns.boxplot(x='status',y='age', data=haberman)
plt.show()
```



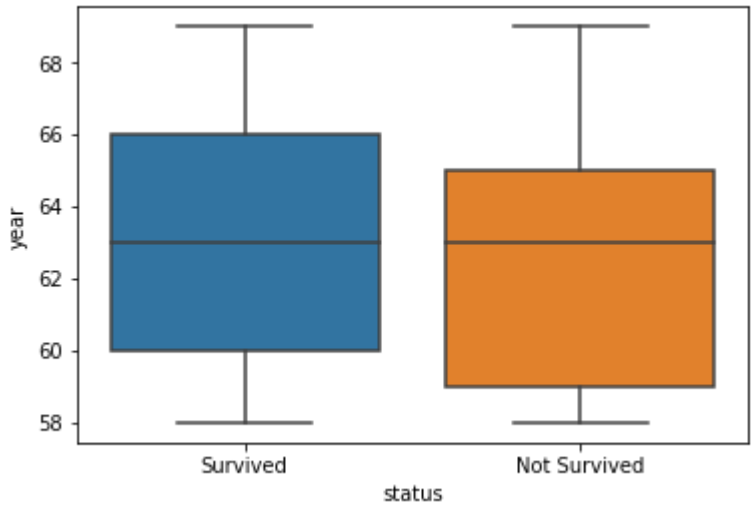
OBSERVATIONS WITH X-AXIS AS STATUS AND Y-AXIS AS AGE

PEOPLE WILL SURVIVE MORE THAN 5 YEARS IF THE AGE IS BETWEEN 42 AND 60

PEOPLE WILL SURVIVE LESS THAN 5 YEARS IF THE AGE IS BETWEEN 45 AND 61

COMBINING THE ABOVE TWO WE CAN CONCLUDE THAT AGE LESS THAN 45 WILL SURVIVE MORE THAN 5 YEARS AND AGE MORE THAN 60 WILL NOT SURVIVE MORE THAN 5 YEARS

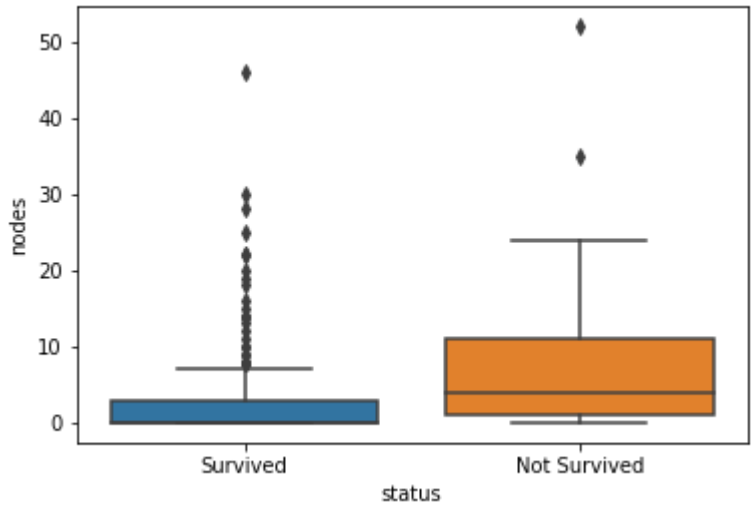
In [79]:
```
sns.boxplot(x='status',y='year', data=haberman)
plt.show()
```



OBSERVATIONS WITH X-AXIS AS STATUS AND Y-AXIS AS YEAR

YEAR IS AMBIGIOUS TO CALCULATE

In [80]:
```
sns.boxplot(x='status',y='nodes', data=haberman)
plt.show()
```



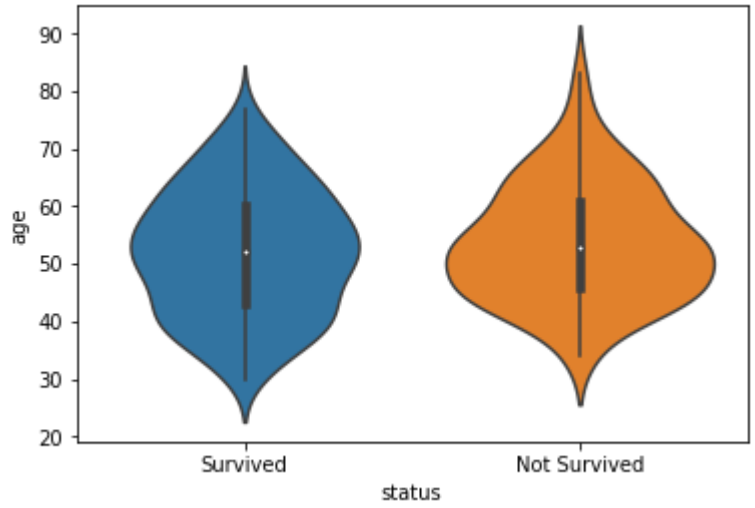
OBSERVATIONS

PEOPLE WILL SURVIVE MORE THAN 5 YEARS IF THE NODES IS 3 OR LESS

PEOPLE WILL SURVIVE LESS THAN 5 YEARS IF THE NODES IS 4 OR MORE

4. Violin Plot

In [81]:
```
sns.violinplot(x="status", y="age", data=haberman, size=8)
plt.show()
```



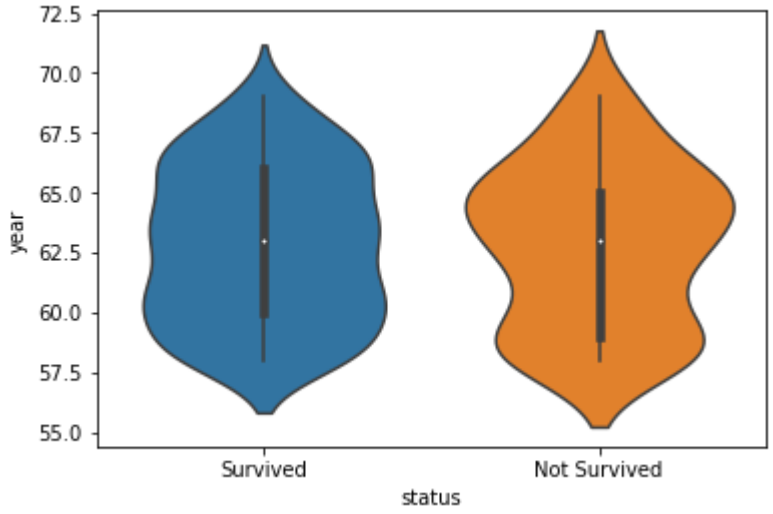
OBSERVATIONS- same as box plot

PEOPLE WILL SURVIVE MORE THAN 5 YEARS IF THE AGE IS BETWEEN 42 AND 60

PEOPLE WILL SURVIVE LESS THAN 5 YEARS IF THE AGE IS BETWEEN 45 AND 61

COMBINING THE ABOVE TWO WE CAN CONCLUDE THAT AGE LESS THAN 45 WILL SURVIVE MORE THAN 5 YEARS AND AGE MORE THAN 60 WILL NOT SURVIVE MORE THAN 5 YEARS

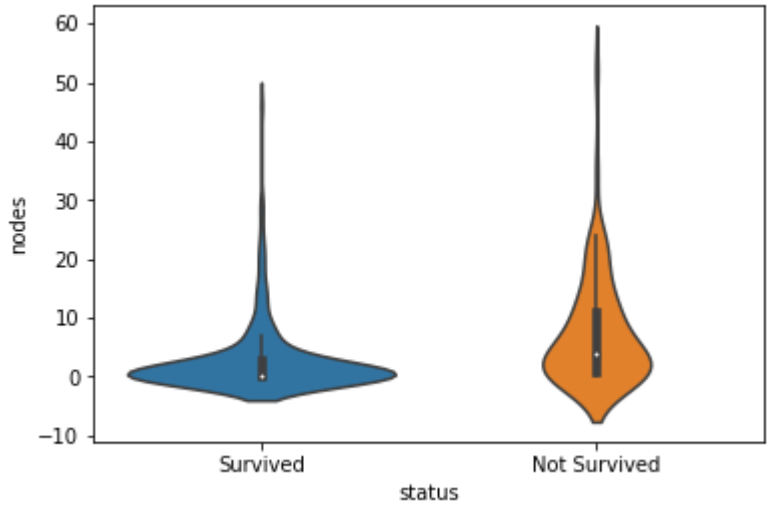
In [82]:
```
sns.violinplot(x="status", y="year", data=haberman, size=8)
plt.show()
```



OBSERVATIONS

YEAR IS AMBIGIOUS TO CALCULATE

In [83]:
```
sns.violinplot(x="status", y="nodes", data=haberman, size=8)
plt.show()
```



OBSERVATIONS

PEOPLE WILL SURVIVE MORE THAN 5 YEARS IF THE NODES IS 3 OR LESS

PEOPLE WILL SURVIVE LESS THAN 5 YEARS IF THE NODES IS 4 OR MORE

CONCLUSION

BY PLOTTING ALL THE PLOTS WE GET TWO CONCLUSIONS :

1. IF NUMBER OF AXILLARY NODE IS LESS,THAN SURVIVAL OF PATIENTS IS MORE. (HIGH CHANCE)

2. IF AGE LESS THAN 45 WILL SURVIVE MORE THAN 5 YEARS AND AGE MORE THAN 60 WILL NOT SURVIVE MORE THAN 5 YEARS