In [2]:

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

In [3]:

```
import os
os.getcwd()
os.chdir(r'C:\Users\omkar reddy\Desktop\Pynb')
```

In [34]:

```
df=pd.read_csv('haberman.csv')
df.shape  #Finding out the size of data to deal with
```

Out[34]:

```
(306, 4)
```

In [35]:

```
df.head() #Having a look at some sample data.
```

Out[35]:

	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

In [6]:

```
df.columns
```

Out[6]:

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

Data has 4 features

1. Age of the Patient
2. Year of the operation
3. Number of positive axillary nodes detected
4. Status of the patient(1 patients who survived >=5 years, 2 patients who survived <5 years)

In [7]:

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

Out[7]:

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

The data has 2 classes -- 225 patients survived for 5 year or more, 81 patients survived for less than 5 years.

In [36]:

```
list(df['status'].unique())
```

Out[36]:

```
[1, 2]
```

In [37]:

```
df['status']= df['status'].astype('category')
```

Converted the status feature to category, which previously were integers.

In [38]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 306 entries, 0 to 305
Data columns (total 4 columns):
age        306 non-null int64
year       306 non-null int64
nodes      306 non-null int64
status     306 non-null category
dtypes: category(1), int64(3)
memory usage: 7.6 KB
```

Statistics

In [47]:

```
df.describe()
```

Out[47]:

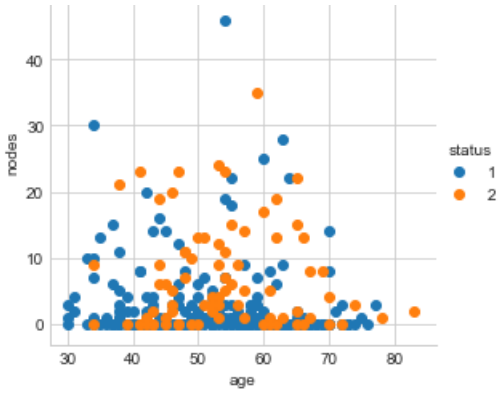
	age	year	nodes
count	306.000000	306.000000	306.000000
mean	52.457516	62.852941	4.026144
std	10.803452	3.249405	7.189654
min	30.000000	58.000000	0.000000
25%	44.000000	60.000000	0.000000
50%	52.000000	63.000000	1.000000
75%	60.750000	65.750000	4.000000
max	83.000000	69.000000	52.000000

From the above descriptive statistics we can observe that more than 75% of the data has node value of less than 4.

Plotting Scatter plot nodes vs age

In [21]:

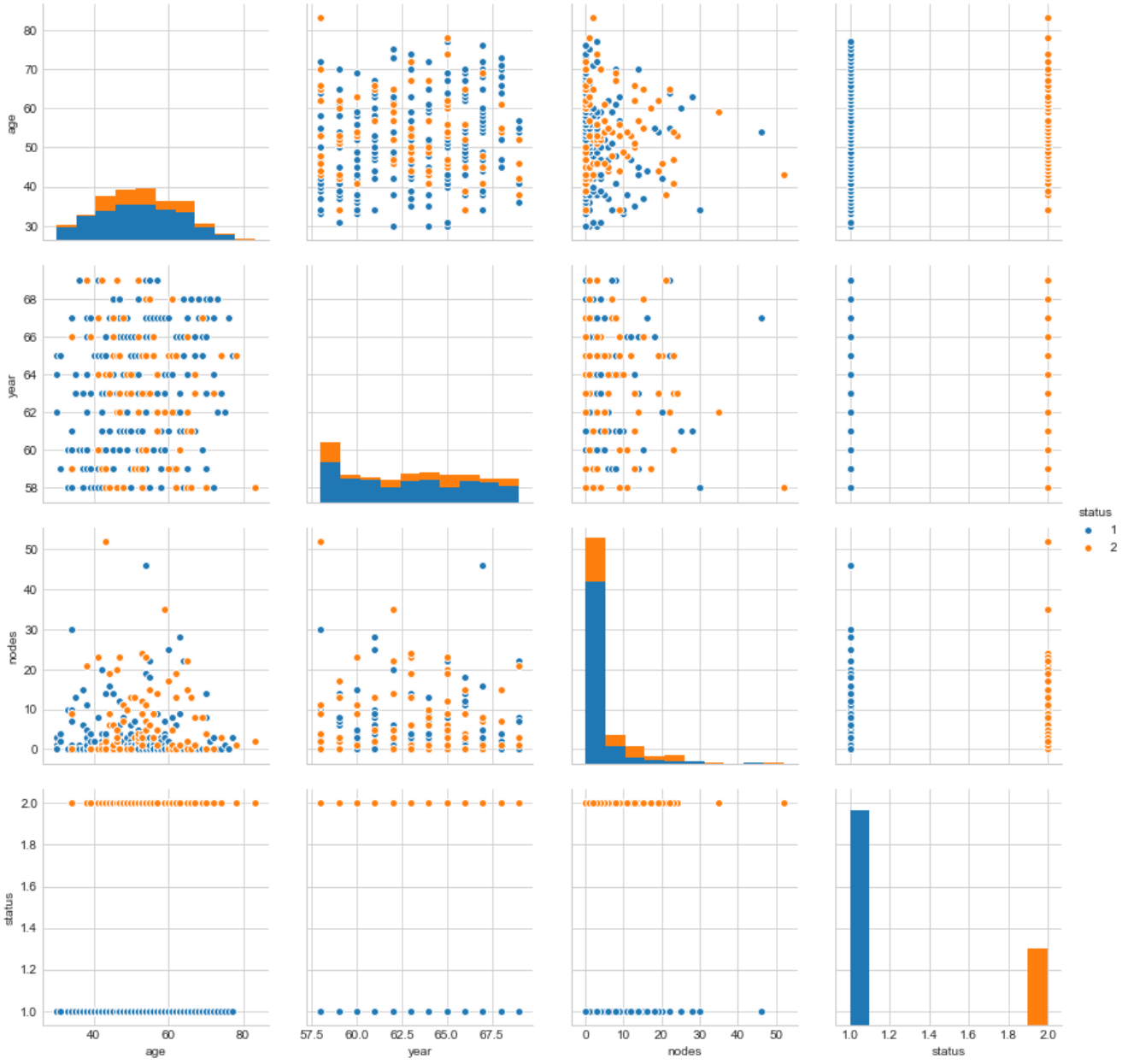
```
sns.set_style('whitegrid')
sns.FacetGrid(df,hue='status',size=4)\
    .map(plt.scatter, 'age', 'nodes')\
    .add_legend()
plt.show()
```



All the possible pair plots for the data

In [20]:

```
sns.set_style('whitegrid')
sns.pairplot(df,hue ='status',size=3)
plt.show()
```



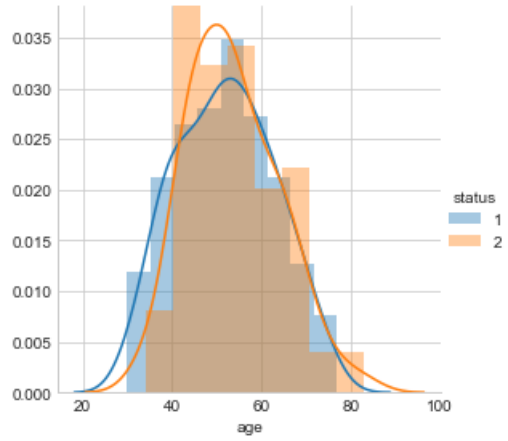
Most of the plots are cluttered and no real conclusion can be drawn, hence should go for the univariate analysis.

Univariate Analysis: Examining each feature.

In [44]:

```
#univariate analysis
sns.FacetGrid(df,hue='status',size=4)\
    .map(sns.distplot,'age')\
    .add_legend()
plt.show()
```

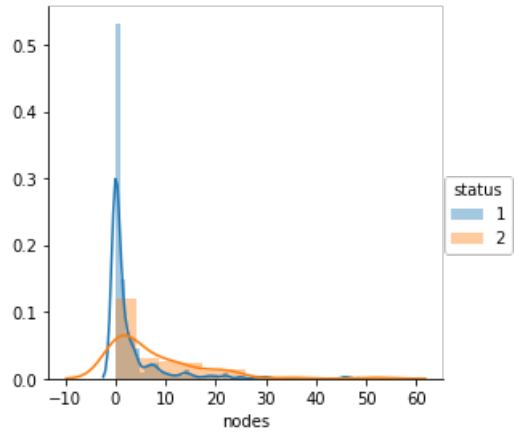
```
C:\Users\omkar reddy\Anaconda3-1\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: The
'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
C:\Users\omkar reddy\Anaconda3-1\lib\site-packages\matplotlib\axes\_axes.py:6462: 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 [9]:

```
sns.FacetGrid(df,hue='status',size=4)\
    .map(sns.distplot,'nodes')\
    .add_legend()
plt.show()
```

```
C:\Users\omkar reddy\Anaconda3-1\lib\site-packages\matplotlib\axes\_axes.py:6462: 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:\Users\omkar reddy\Anaconda3-1\lib\site-packages\matplotlib\axes\_axes.py:6462: UserWarning: The
'normed' kwarg is deprecated, and has been replaced by the 'density' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```



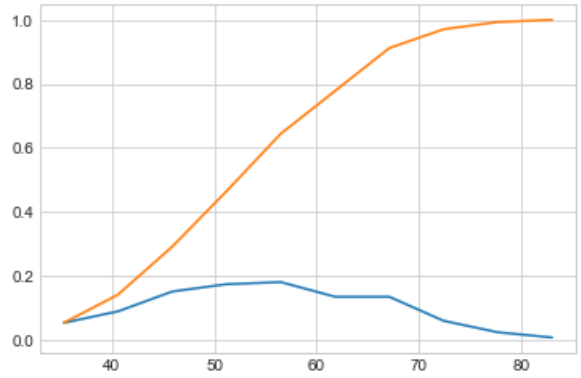
Plotting PDF and CDF

In [45]:

```
#Plotting PDF & CDF
count, bin_ed = np.histogram(df['age'], bins=10,
                                    density = True)
pdf=count/sum(count)
print(pdf)
cdf=np.cumsum(pdf)
```

```
print(cdf)
plt.plot(bin_ed[1:],pdf)
plt.plot(bin_ed[1:],cdf)
plt.show()
```

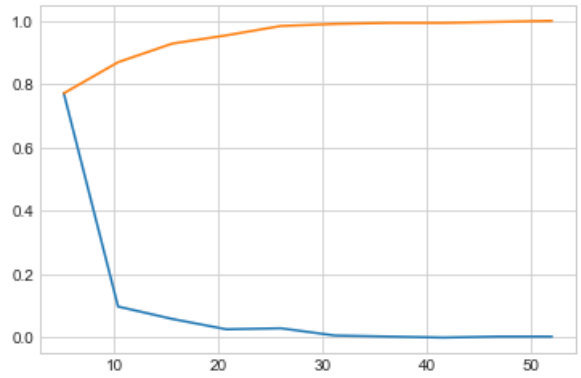
```
[0.05228758 0.08823529 0.1503268  0.17320261 0.17973856 0.13398693
 0.13398693 0.05882353 0.02287582 0.00653595]
[0.05228758 0.14052288 0.29084967 0.46405229 0.64379085 0.77777778
 0.91176471 0.97058824 0.99346405 1.        ]
```



In [46]:

```
count, bin_ed = np.histogram(df['nodes'], bins=10,
                             density = True)
pdf=count/sum(count)
print(pdf)
cdf=np.cumsum(pdf)
print(cdf)
plt.plot(bin_ed[1:],pdf)
plt.plot(bin_ed[1:],cdf)
plt.show()
```

```
[0.77124183 0.09803922 0.05882353 0.02614379 0.02941176 0.00653595
 0.00326797 0.         0.00326797 0.00326797]
[0.77124183 0.86928105 0.92810458 0.95424837 0.98366013 0.99019608
 0.99346405 0.99346405 0.99673203 1.        ]
```



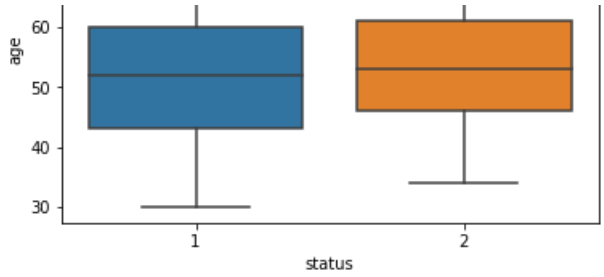
Box plots

In [10]:

```
sns.boxplot(x='status', y='age',data=df)
```

Out[10]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x299168c5278>
```

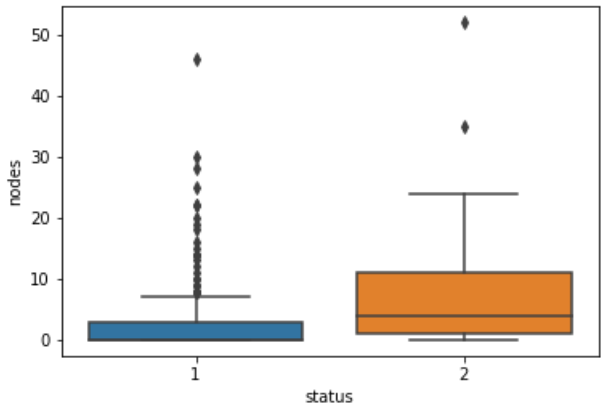


In [11]:

```
sns.boxplot(x='status',y='nodes',data=df)
```

Out[11]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29916942748>
```



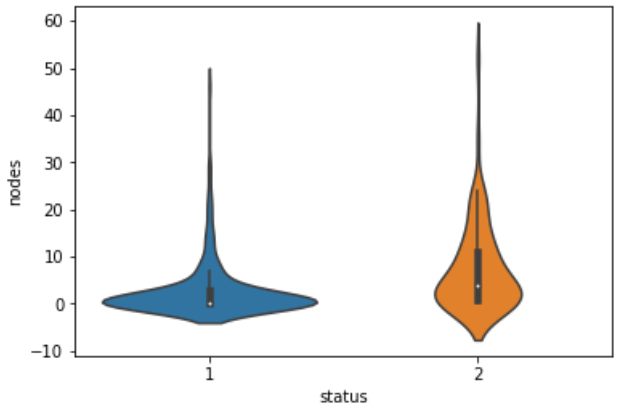
Violin Plots

In [14]:

```
sns.violinplot(x='status',y='nodes',data=df)
```

Out[14]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29916e192e8>
```



Observations:

1.Around 78% of the patients have a positive axilliary node value of 5 or less.

1. Considering the general distribution of data through Box and Violin plots we can see that people who survived after 5 year tend to have more node values of less than 10.