In [10]:

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

warnings.filterwarnings("ignore")
```

In [4]:

```
#read csv file data
data=pd.read_csv('C:/Users/Shiva/Downloads/haberman.csv')
```

In [5]:

```
#Returns the first 5 rows of the dataframe
data.head()
```

Out[5]:

	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

The dataset has four(4) labes which are:

Age
which describes age of the patient when the operation was performed.

Year
which describes the year in which the patient had the operation.

Nodes
which describe the number of axiliary nodes which the patient had at the time of operation.

Status
which describes whether tha patient has lived past 5 years post opernation where '1' being alive and '2' being passed away.

Check the null values

In [6]:

```
data.isnull().values.any()
```

Out[6]:

```
False
```

Shape of Data

In [13]:

```
data.shape
```

Out[13]:

```
(306, 4)
```

Value count of unique class

In [8]:

```
data.status.value_counts()
```

Out[8]:

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

In [14]:

```
data.describe()
```

Out[14]:

	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

Observation

we observe that we have 306 rosw and 4 columns

there is not any null value

data imbalance

The important thing to be noted is that the 75% of the patients have nodes <=4

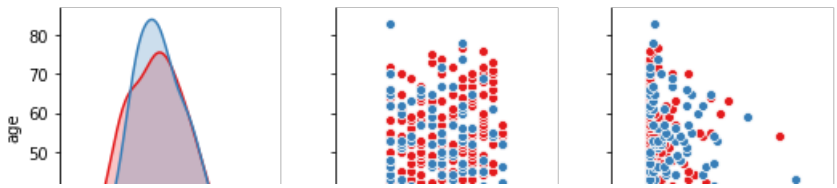
The age of the patients are from 30 to 83.

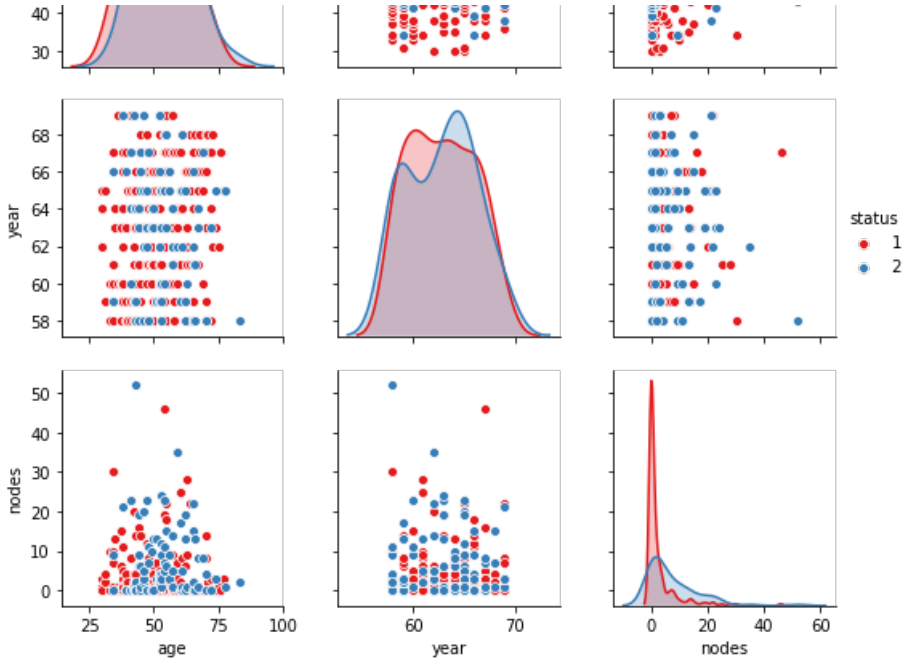
75% of the patients have age <=60

Pair Plot

In [11]:

```
sns.pairplot(data,hue='status',palette='Set1',vars=["age", "year", "nodes"],size=2.5)
plt.show()
```





Observation

Pair plots which visualize how the attributes vary with respect to each other.

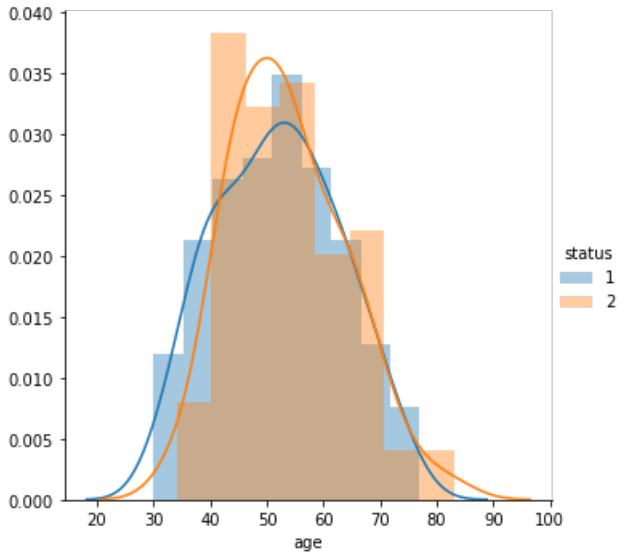
The scatter plot between nodes vs age shows that most of the patients who survived have less than 10 nodes.

It can also be observed from the nodes vs year plot that most the patients from the year 65 haven't lived past 5 years.

Univariate Analysis

In [12]:

```
#
sns.FacetGrid(data,hue='status',size=5)\
   .map(sns.distplot,'age')\
   .add_legend()
plt.show()
```



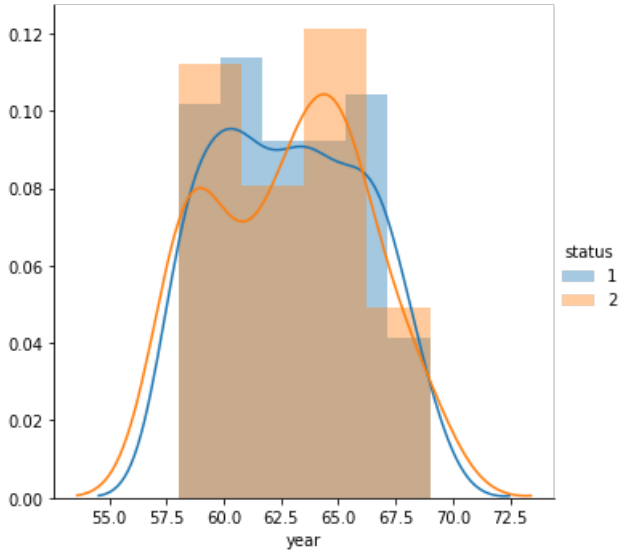
The age of patients lies between the range of 30 to 83

It has been observed that patients between the ages 40 and 60 have a lesser survival rate than the rest.

While the patients between 30 and 55 have an improved survial percentage

In [30]:

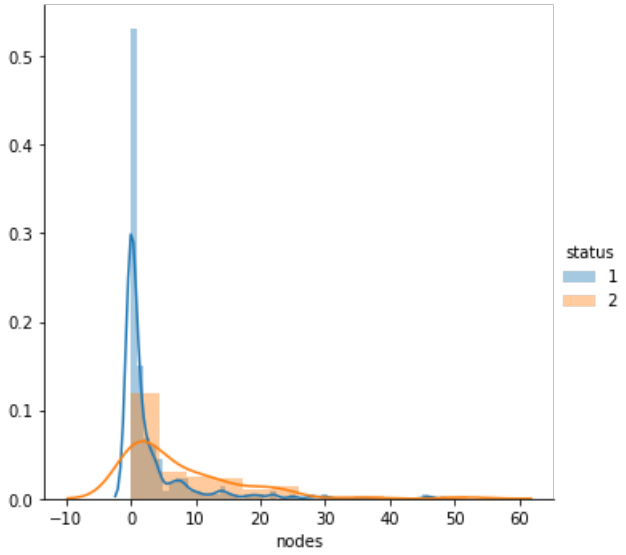
```
sns.FacetGrid(data,hue='status',size=5)\
.map(sns.distplot,'year')\
.add_legend()
plt.show()
```



there is no much information to extract from **year** feature

In [32]:

```
sns.FacetGrid(data,hue='status',size=5)\
.map(sns.distplot,'nodes')\
.add_legend()
plt.show()
```



patient who have lesser number of nodes have higher chance of survival. who have node<=2

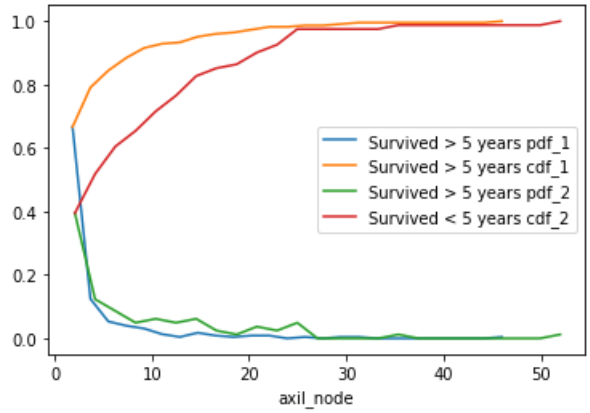
In [15]:

```
#haberman_1 defines class_1 elements
data_1=data[data['status']==1]
#haberman_2 defines class_2 elements
data_2=data[data['status']==2]
```

In [37]:

```
count_1, bin_edges_1=np.histogram(data_1['nodes'], bins=25, density=True)
```

```
count_1, bin_edges_1=np.histogram(data_1['nodes'],bins=25,density=True)
count_2,bin_edges_2=np.histogram(data_2['nodes'],bins=25,density=True)
pdf_1=count_1/sum(count_1)
pdf_2=count_2/sum(count_2)
cdf_1=np.cumsum(pdf_1)
cdf_2=np.cumsum(pdf_2)
plt.plot(bin_edges_1[1:],pdf_1)
plt.plot(bin_edges_1[1:],cdf_1)
plt.plot(bin_edges_2[1:],pdf_2)
plt.plot(bin_edges_2[1:],cdf_2)
plt.legend(["Survived > 5 years pdf_1", "Survived > 5 years cdf_1",
            "Survived > 5 years pdf_2", "Survived < 5 years cdf_2" ])
plt.xlabel('axil_node')
plt.show()
```



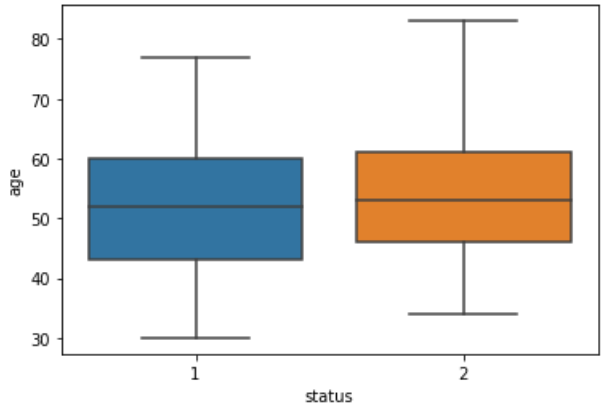
If axil_node <47 then patient is survived

If axil_node >47 then patient is not survived

Box Plot

In [38]:

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



We can observe that 75% of people who survived have their age <=60 While about 75% of people who died have their ages >=45

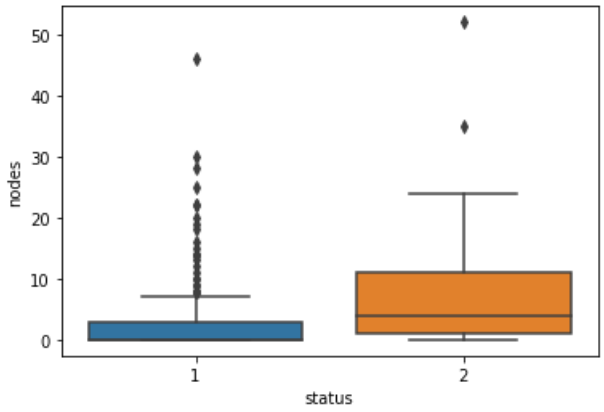
sns.boxplot(data=data,x='status',y='year') plt.show()

Violin Plot

In [40]:

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

```
plt.show()
```

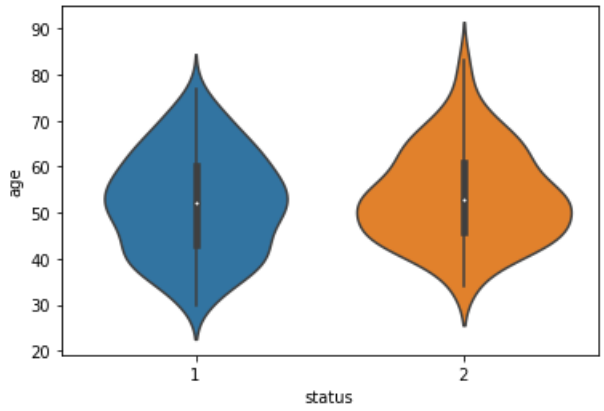


We can observe that 25% of the people who survived have nodes <=1 and 75% of people have nodes <=5.

We can also observe that 50% pf the people who died have nodes >=5.

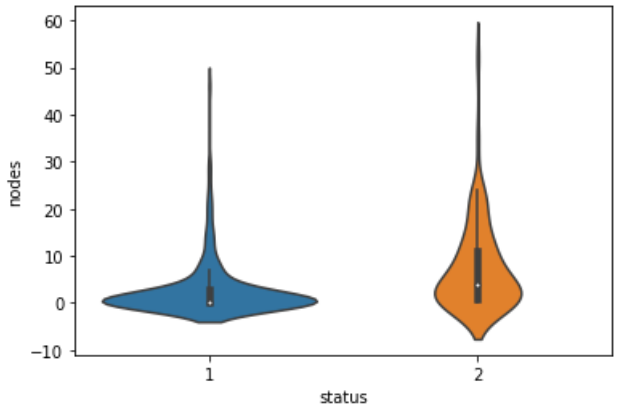
In [42]:

```
sns.violinplot(data=data,x='status',y='age')
plt.show()
```



In [44]:

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



By observation we can identify that people with lesser number of nodes have survived more than people with more number of nodes.

Summary

1-The average age of the patients who underwent the operation is around 50.

2-Patients who underwent operation have ages between 30 and 80.

3-we observed that 73% of the people who underwent the operation survived past 5 years.

4-It has been obatained that 26% of the people who underwent the operation did not live past 5 years

5-75% of the patients have their age below 60.

6-It has been observed that people below the age <=50 tend to have survived than people above the age of >50.

7-Hence we can assume that 'age' affect the patients percentage of surival.

8-It has been observed that a lot of the patients have nodes less than 1

9-Patients who have nodes more than >=2 tend to have died more than peo.

10-From the data we have observed that 64% of people have <=1 node.

11-People with nodes 0 or <=1 tend to have survived more post operation for longer than 5 years.

12-Hence we can assume that the number of 'nodes' affect the percentage of survival of a patient.

13-We have observed that when people who have youger age, even with higher number of nodes there is a chance of survival

14-however as age increases, people with more nodes during older age tend to have died.

Important Features

Number of nodes is important as we have observed that people with less number of nodes have survived past 5 years post operation than people with more number of nodes.

Age isn't impactful, however it has been observed that younger patients with more nodes have survived past 5 years and hence should duly be noted.

In [ ]:

```
```