Haberman's survival data set:

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

Objective:

To classify whether a patient survived 5 year or longer or the patient died within 5 years

No. of instances:

306

No. of attribute:

4(including class atribute)

Attribute information:

```
    a.Age of patient at the time of operation(numerical)
    b.patient's year of operation(year-1900,numerical)
    c.no. of positive axillary nodes detected(numerical)
    d.survival status (class attribute)1=the patient survived 5 years o
r longer 2= the patient died within 5 years
```

In [2]:
```
import pandas as pd
import seaborn as sns
import numpy as np
import matplotlib.pyplot as plt

#loading haberman.csv into panda dataframe
haber= pd.read_csv("haberman.csv")
```

In [3]:
```
import os
os.getcwd()
```

Out[3]: `'/Users/user/Downloads'`

In [4]:
```
os.chdir("/Users/user/Downloads")
```

In [5]:
```
import warnings
warnings.filterwarnings('ignore')
```

In [5]:
```
#finding no. of datapoints and features
print(haber.shape)
```

```
(306, 4)
```

In [6]:
```
#finding the column names in our dataset
print(haber.columns)
```

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

In [7]:
```
#to find the survival status(class attribute)
haber["status"].value_counts()
```

Out[7]:
```
1    225
2     81
Name: status, dtype: int64
```

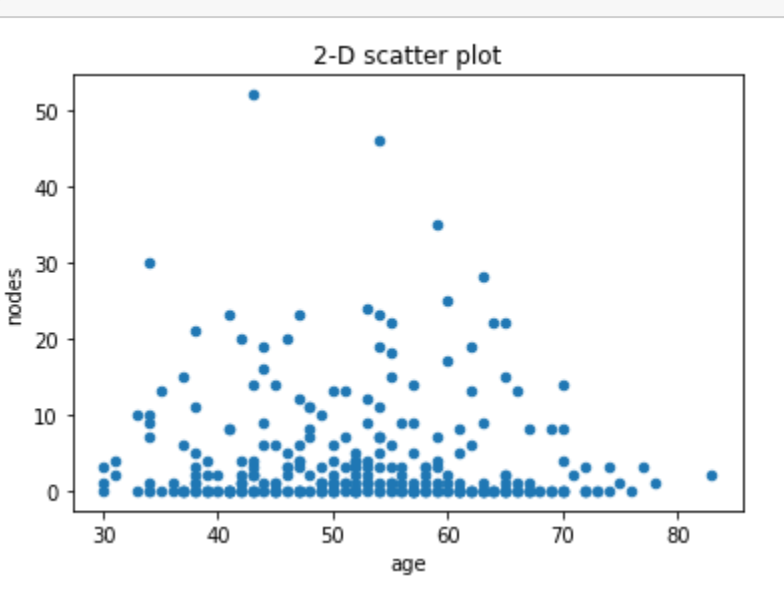
this shows 1) 225 patients survived 5 years or longer 2)81 patients died within 5 years

Bi-variate analysis

2-D Scatter plot:

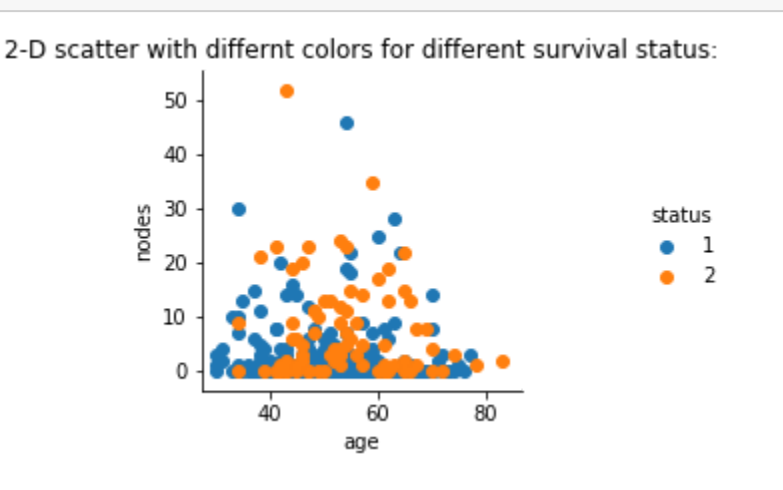
hard to classify with only one colour.

In [3]:
```
haber.plot(kind='scatter',x='age',y='nodes');
plt.title("2-D scatter plot")
plt.show()
```



2-D scatter with differnt colors for different survival status:

In [6]:
```
sns.FacetGrid(haber,hue="status",size=3).map(plt.scatter,"age","nodes").add_le
gend();
plt.title("2-D scatter with differnt colors for different survival status:")
plt.show()
```



from the above figure it is hard to classify status 1 and status2 ,as they overlap at many places.

2-D pair plot:

```
1)suppose if there are more than 2 features , then pair plot is used ,w
here different pairs of features are tried.
2)It is used to visualize the data in 2-D and it cannot be used for 3-D
or 4-D etc.
```

In [11]:
```
sns.set_style("whitegrid");a= sns.pairplot(haber, hue="status",vars=["age", "y
ear", "nodes"], height=3);
a.fig.suptitle("2 D pair plot")
```

Out[11]: `Text(0.5,0.98,'2 D pair plot')`

Observation from bi-variate analysis:

```
1)In plots of ,age and year data overlaps with each other.
2)Nodes is a better attribute to classify.
```

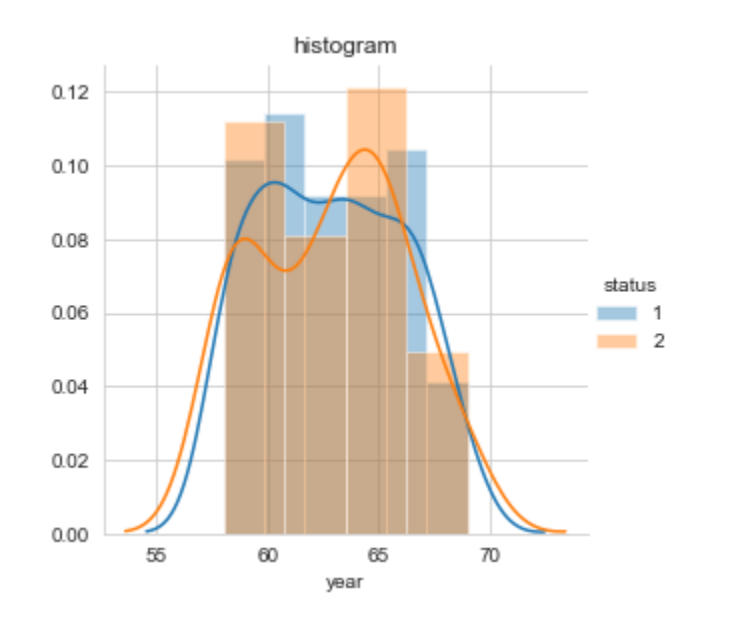
Univariate analysis:

Histogram:

In [13]:
```
sns.FacetGrid(haber,hue='status',height=4).map(sns.distplot,"year").add_legend
();

plt.title("histogram for year")
```

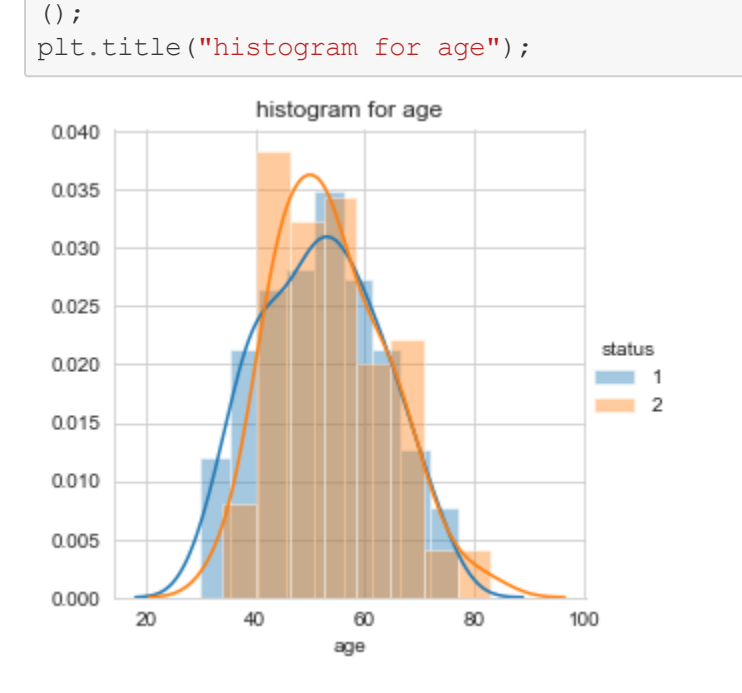
Out[13]: `Text(0.5,1,'histogram')`



Observation:

the data is overlapping so it is hard to classify

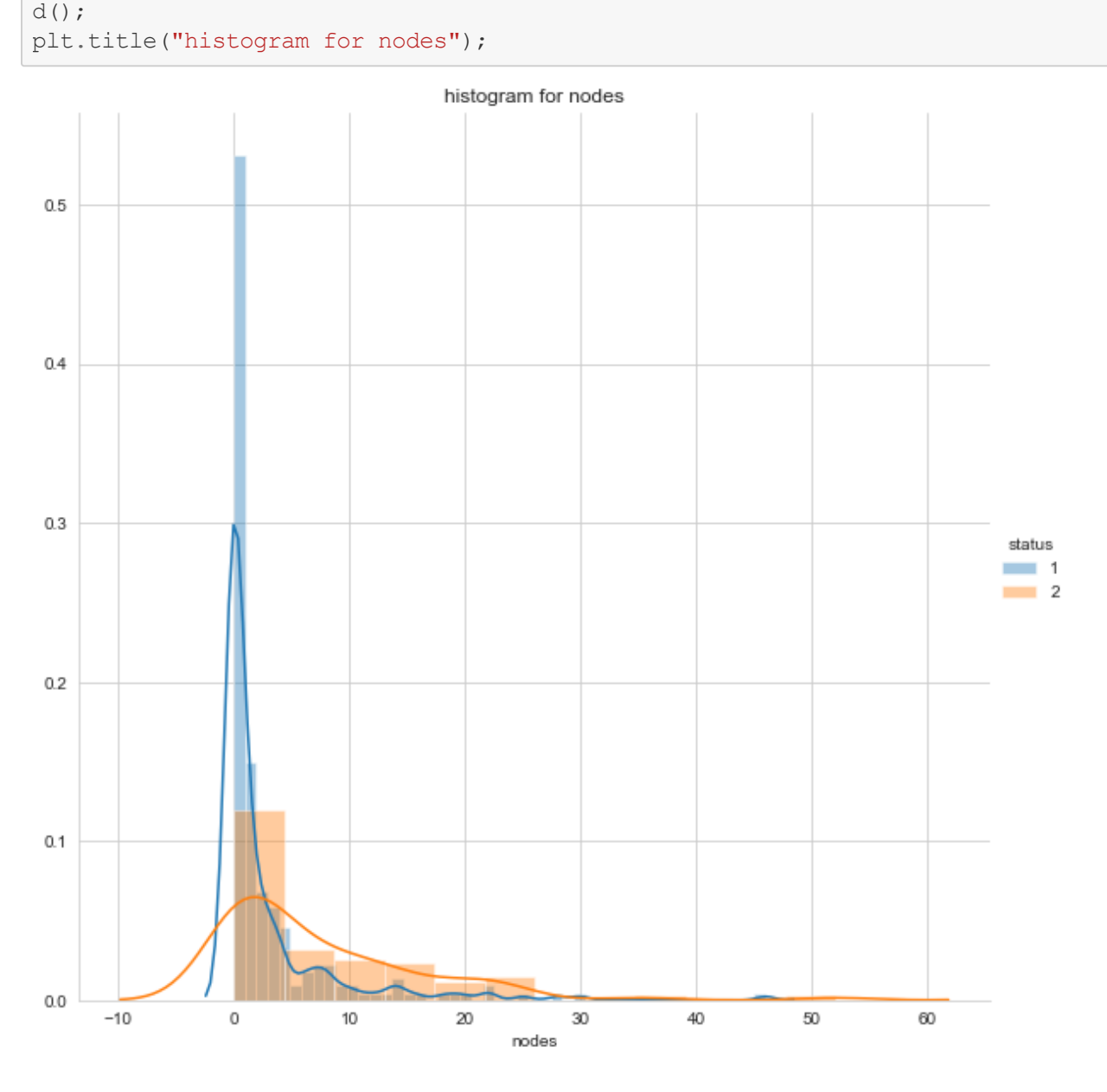
In [14]:
```
sns.FacetGrid(haber,hue='status',height=4).map(sns.distplot,"age").add_legend
();
plt.title("histogram for age");
```



Observation:

```
1)Patients within age 30-34 have survived more than five years after op
eration.
2)Patients within age 77-84 have not survived more than 5 years after o
peration.
3)The rest of the data is overlapping.
```

In [15]:
```
sns.FacetGrid(haber,hue='status',height=8).map(sns.distplot,"nodes").add_legen
d();
plt.title("histogram for nodes");
```



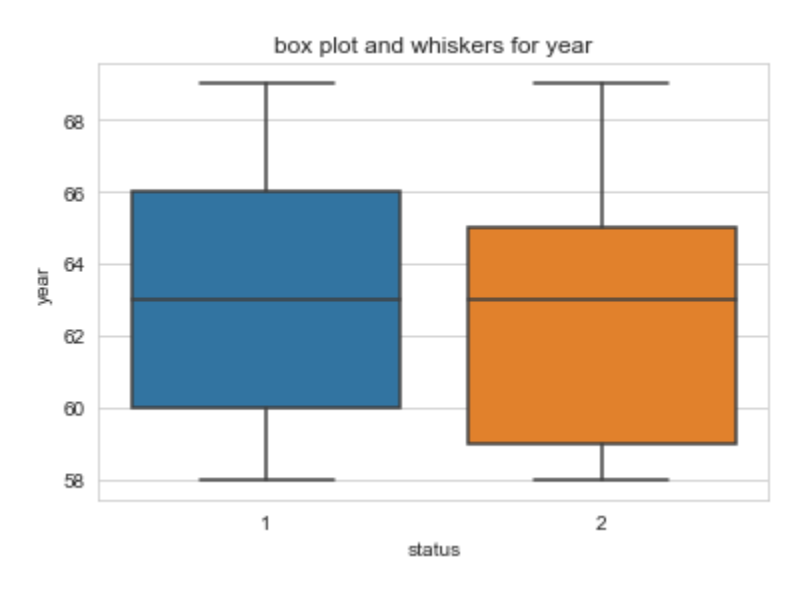
Observations:

```
1)As the no. of nodes increases, survival status decreases.
2)The rest of the data is overlapping.
```

Box plot and whiskers:

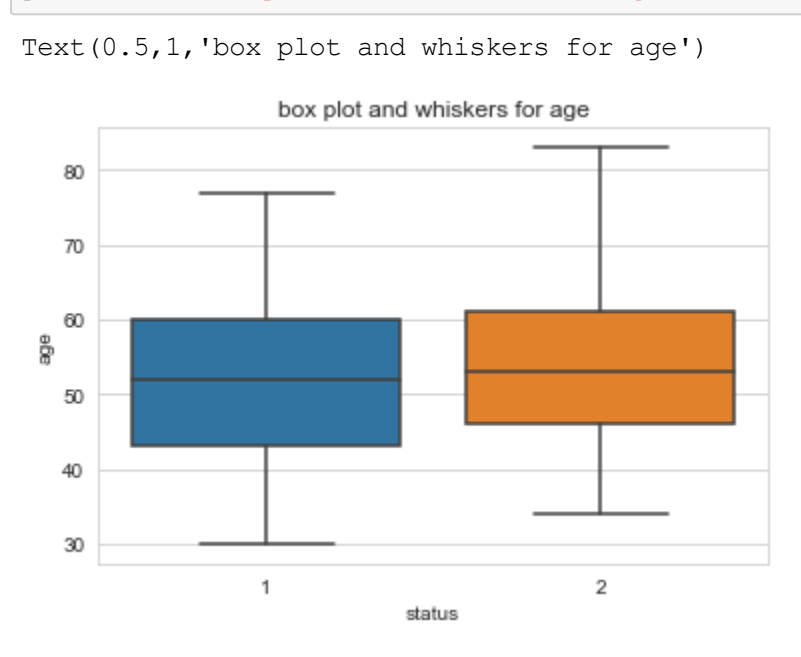
In [16]:
```
sns.boxplot(x='status',y='year',data=haber)
plt.title("box plot and whiskers for year")
```

Out[16]: `Text(0.5,1,'box plot and whiskers for year')`



In [17]:
```
sns.boxplot(x='status',y='age',data=haber)
plt.title("box plot and whiskers for age")
```

Out[17]: `Text(0.5,1,'box plot and whiskers for age')`

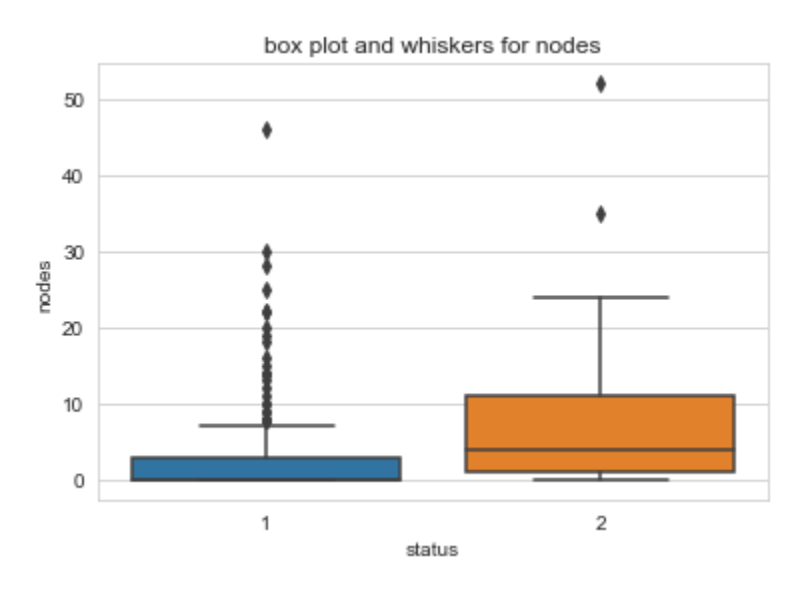


Observation:

```
1)Patients within age 30-34 have survived more than five years after op
eration.
2)Patients within age 77-83 have not survived more than five years afte
r operation.
```

In [20]:
```
sns.boxplot(x='status',y='nodes',data=haber)
plt.title("box plot and whiskers for nodes")
```

Out[20]: `Text(0.5,1,'box plot and whiskers for nodes')`



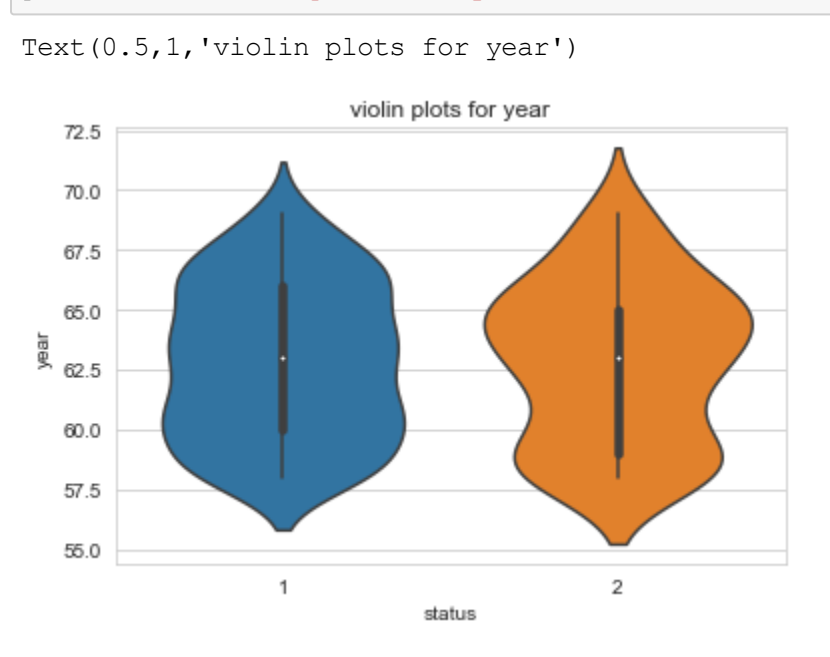
Observation:

```
1)Patients with 0 nodes have higher chance of survival
```

Violin plots:

In [21]:
```
sns.violinplot(x='status',y='year',data=haber)
plt.title("violin plots for year")
```

Out[21]: `Text(0.5,1,'violin plots for year')`



Observation:

```
1)Hard to classify as the data is overlapping.
```

In [22]:
```
sns.violinplot(x='status',y='age',data=haber)
plt.title("violin plot for age")
```

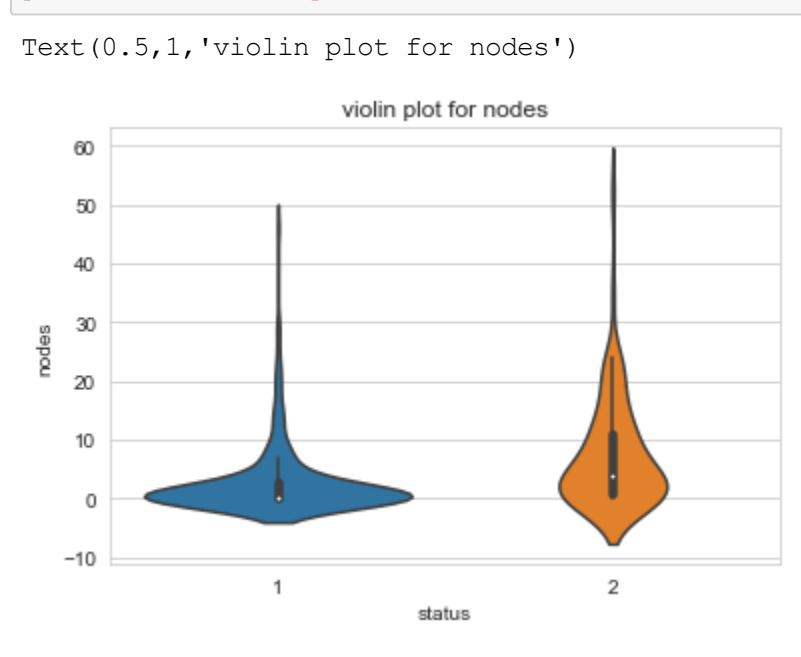
Out[22]: `Text(0.5,1,'violin plot for age')`

Observation:

```
1)Hard to classify as the data is overlapping.
```

In [23]:
```
sns.violinplot(x='status',y='nodes',data=haber)
plt.title("violin plot for nodes")
```

Out[23]: `Text(0.5,1,'violin plot for nodes')`

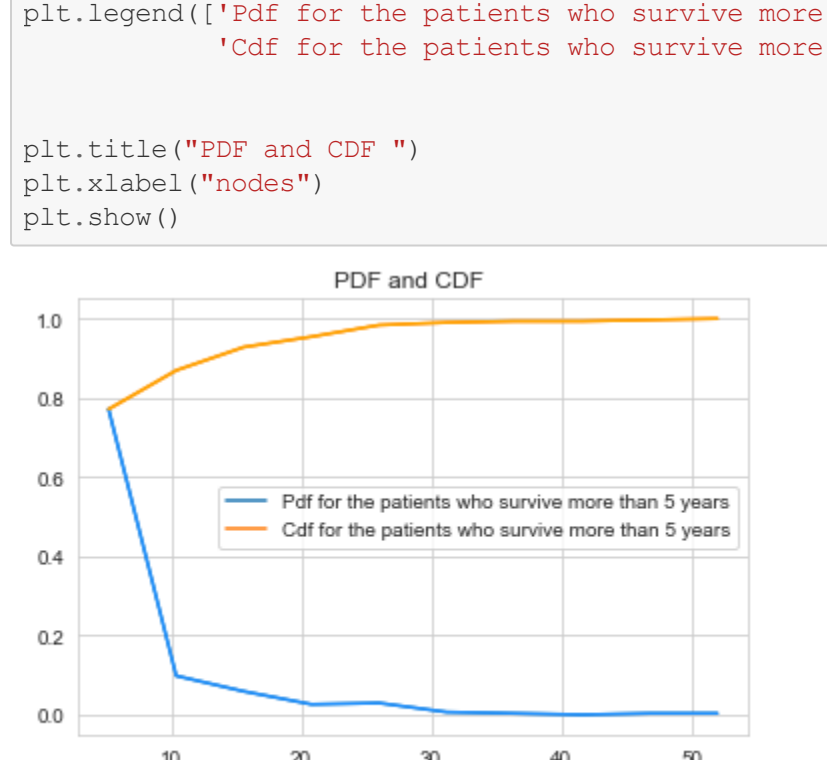


PDF:

In [24]:
```
counts,bin_edges=np.histogram(haber['nodes'],bins=10,density=True)
pdf=counts/(sum(counts))
cdf=np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)

counts,bin_edges=np.histogram(haber['nodes'],bins=10,density=True)
pdf=counts/(sum(counts))
cdf=np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf,color="dodgerblue")
plt.plot(bin_edges[1:],cdf,color="orange")
plt.legend(['Pdf for the patients who survive more than 5 years',
            'Cdf for the patients who survive more than 5 years'])


plt.title("PDF and CDF ")
plt.xlabel("nodes")
plt.show()
```



Mean

In [20]:
```
less_than_five=haber[haber['status']==2]
more_than_five=haber[haber['status']==1]
```

In [20]:
```
print(np.mean(more_than_five))
```

```
age       52.017778
year      62.862222
nodes      2.791111
status     1.000000
dtype: float64
```

In [21]:
```
print(np.mean(less_than_five))
```

```
age       53.679012
year      62.827160
nodes      7.456790
status     2.000000
dtype: float64
```

Observation from univariate analysis:

```
1)Mean age of patients who survived more than 5 years is 52 and who did
not survive is 54
2)Patients having nodes less than 3 nodes have survived more than 5 yea
```