Data description :

*Age of the patient *year of operation has done *Number of positive nodes *Survival status (1 = the patient survived 5 years or more 2 = the patient died within 5 years)

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
df=pd.read_csv("C:\\Users\\Ashok malla\\Downloads\\haberman.csv")
```

In [2]:
```
#top 5 rows
#last 5 rows
df.head
df.tail
```

Out[2]:
```
<bound method NDFrame.tail of      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
..   ...   ...    ...     ...
301   75    62      1       1
302   76    67      0       1
303   77    65      3       1
304   78    65      1       2
305   83    58      2       2

[306 rows x 4 columns]>
```

In [3]:
```
#no of columns and rows in the data set
```

```
df.shape
```

Out[3]:
```
(306, 4)
```

In [4]:
```
#column names
df.columns
```

Out[4]:
```
Index(['age', 'year', 'nodes', 'status'], dtype='object')
```

EDA

In [5]:
```
#Null values in the data set
df.isnull().sum()
```

Out[5]:
```
age       0
year      0
nodes     0
status    0
dtype: int64
```

In [6]:
```
df['status'].value_counts(normalize=True).mul(100).round(1).astype(str)
 + '%'
```

Out[6]:
```
1    73.5%
2    26.5%
Name: status, dtype: object
```

observation :

*percentage of categorial data in status variable *73.5% = the patient survived 5 years or longer *26.5%= the patient died within 5 years

In [7]:
```
# unique values with type in data set
df["age"].unique()
```

Out[7]:
```
array([30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46,
```

```
47,
       48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63,
64,
       65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 83],
      dtype=int64)
```

In [8]:
```
df.describe()
```

Out[8]:

	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 :

*total number of datase in Rows = 306 (count)*Avg of each column (mean) *min number in variable (min)*maximum number in variable (max)

*total number of datase in Rows = 306 (count) *Avg of each column (mean) *min number in variable (min) *maximum number in variable (max)

In [9]:
```
#types of variable in the data
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 int64
dtypes: int64(4)
memory usage: 9.7 KB
```

*Name of the columns and the dtype of columns.

pair plot

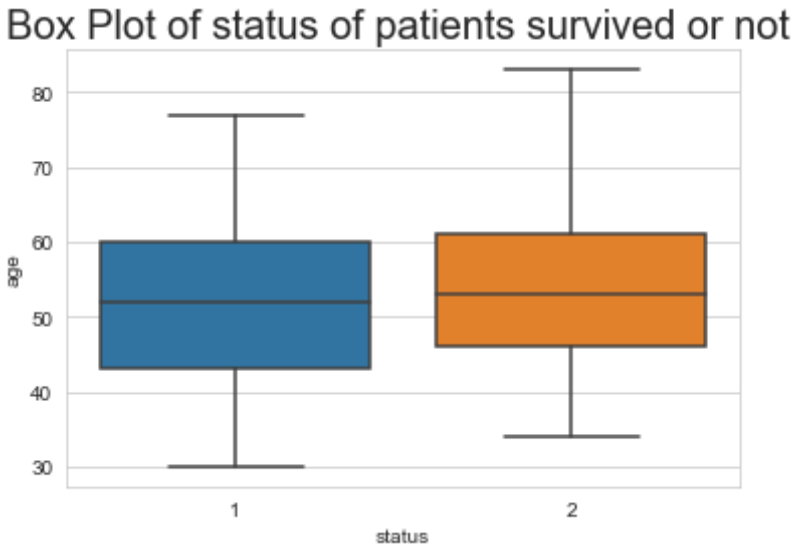
In [10]:
```
#scatter plot with pair plot
plt.close();
sns.set_style("whitegrid");
sns.pairplot(df, vars = ["age", "year", "nodes"], hue="status",height=3
);
plt.show()
```

observation :

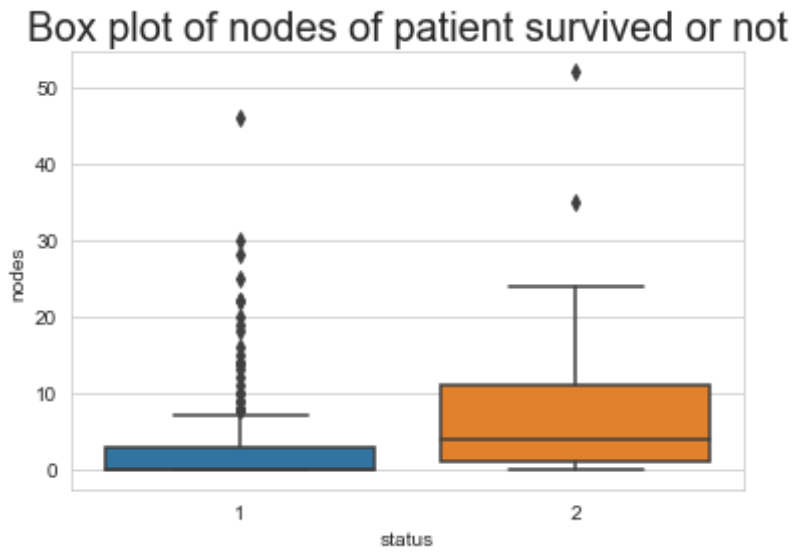
*in this pair plot blus lable is status of survived and the orange is dead. *age & nodes very usefull feature in the data set. *pair plot is use to saparation of the data set.

Box plot

In [11]:
```
sns.boxplot(x='status',y='age', data=df)
plt.title("Box Plot of status of patients survived or not ", fontsize=2
0)
plt.show()
```



In [12]:
```
sns.boxplot(x='status',y='nodes', data=df)
plt.title("Box plot of nodes of patient survived or not",fontsize=20)
plt.show()
```



observation :

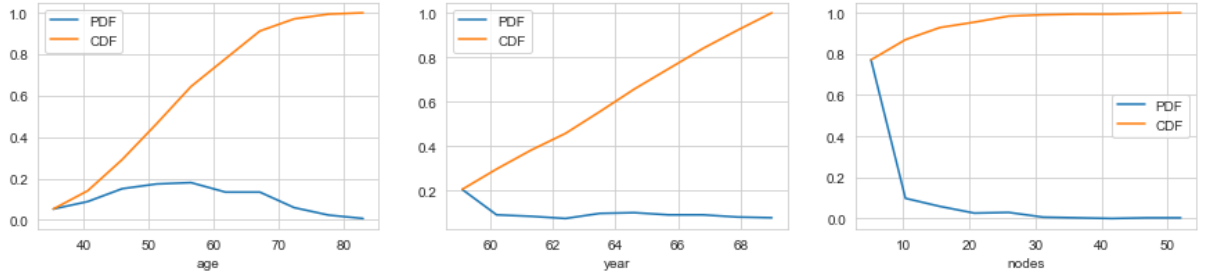
*box plot will give the outliers of a variable *And its define IQR value *in this positive axillary nodes is consist more outliers

PDF(probability density function) & CDF (probability density function)

In [13]:
```
#pdf abd cdf refer by(https://www.kaggle.com/gokulkarthik/haberman-s-survival-exploratory-data-analysis)
plt.figure(figsize=(15,3))
for idx, feature in enumerate(list(df.columns)[:-1]):
    plt.subplot(1, 3, idx+1)
    print("********* "+feature+" *********")
    counts, bin_edges = np.histogram(df[feature], bins=10, density=True
)
    print("Bin Edges: {}".format(bin_edges))
    pdf = counts/sum(counts)
```

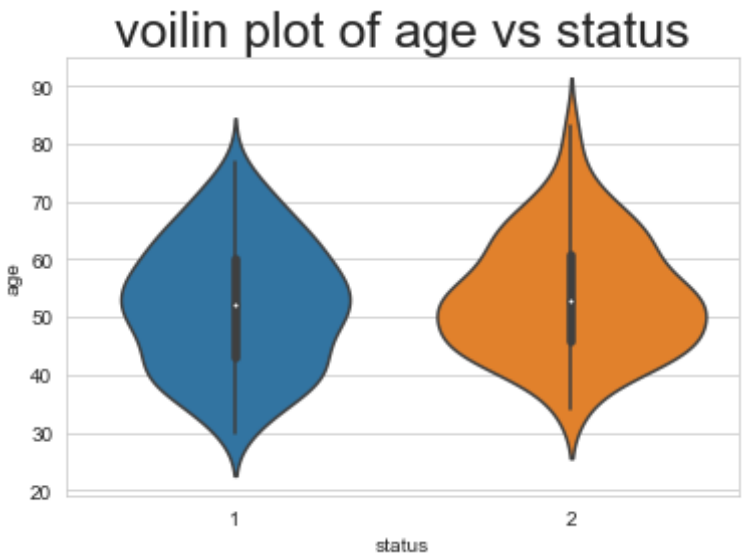
```
    print("PDF: {}".format(pdf))
    cdf = np.cumsum(pdf)
    print("CDF: {}".format(cdf))
    plt.plot(bin_edges[1:], pdf, bin_edges[1:], cdf)
    plt.xlabel(feature)
    plt.legend(('PDF','CDF'))
```

```
********* age *********
Bin Edges: [30.  35.3 40.6 45.9 51.2 56.5 61.8 67.1 72.4 77.7 83. ]
PDF: [0.05228758 0.08823529 0.1503268  0.17320261 0.17973856 0.13398693
 0.13398693 0.05882353 0.02287582 0.00653595]
CDF: [0.05228758 0.14052288 0.29084967 0.46405229 0.64379085 0.77777778
 0.91176471 0.97058824 0.99346405 1.        ]
********* year *********
Bin Edges: [58.  59.1 60.2 61.3 62.4 63.5 64.6 65.7 66.8 67.9 69. ]
PDF: [0.20588235 0.09150327 0.08496732 0.0751634  0.09803922 0.10130719
 0.09150327 0.09150327 0.08169935 0.07843137]
CDF: [0.20588235 0.29738562 0.38235294 0.45751634 0.55555556 0.65686275
 0.74836601 0.83986928 0.92156863 1.        ]
********* nodes *********
Bin Edges: [ 0.   5.2 10.4 15.6 20.8 26.  31.2 36.4 41.6 46.8 52. ]
PDF: [0.77124183 0.09803922 0.05882353 0.02614379 0.02941176 0.00653595
 0.00326797 0.         0.00326797 0.00326797]
CDF: [0.77124183 0.86928105 0.92810458 0.95424837 0.98366013 0.99019608
 0.99346405 0.99346405 0.99673203 1.        ]
```



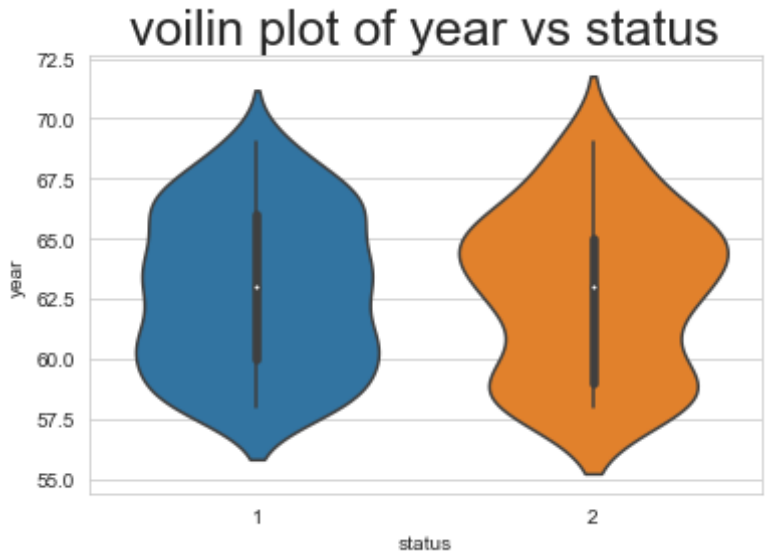
In [14]:
```
#vailin plot is like a box plot
sns.violinplot(x="status",y="age",data=df)
plt.title("voilin plot of age vs status",fontsize=25)
```

Out[14]: Text(0.5,1,'voilin plot of age vs status')



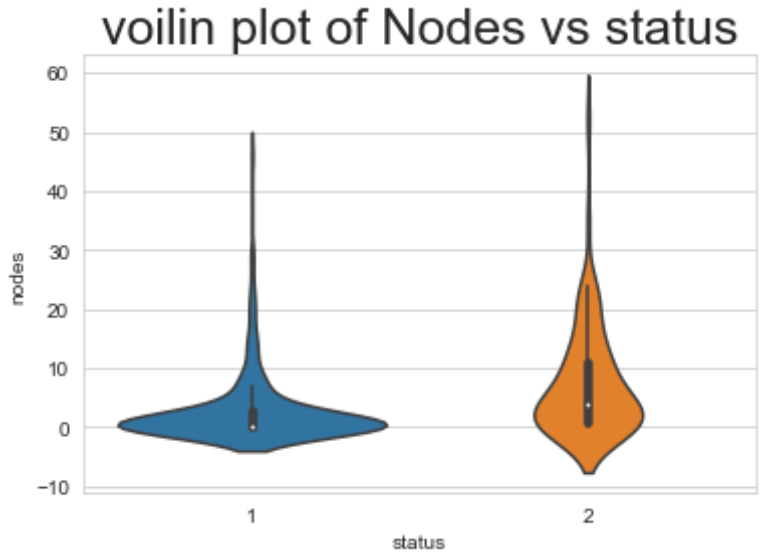
In [15]:
```
sns.violinplot(x="status",y="year",data=df)
plt.title("voilin plot of year vs status",fontsize=25)
```

Out[15]: Text(0.5,1,'voilin plot of year vs status')



In [16]:
```
sns.violinplot(x="status",y="nodes",data=df)
plt.title("voilin plot of Nodes vs status",fontsize=25)
```

Out[16]:
```
Text(0.5,1,'voilin plot of Nodes vs status')
```

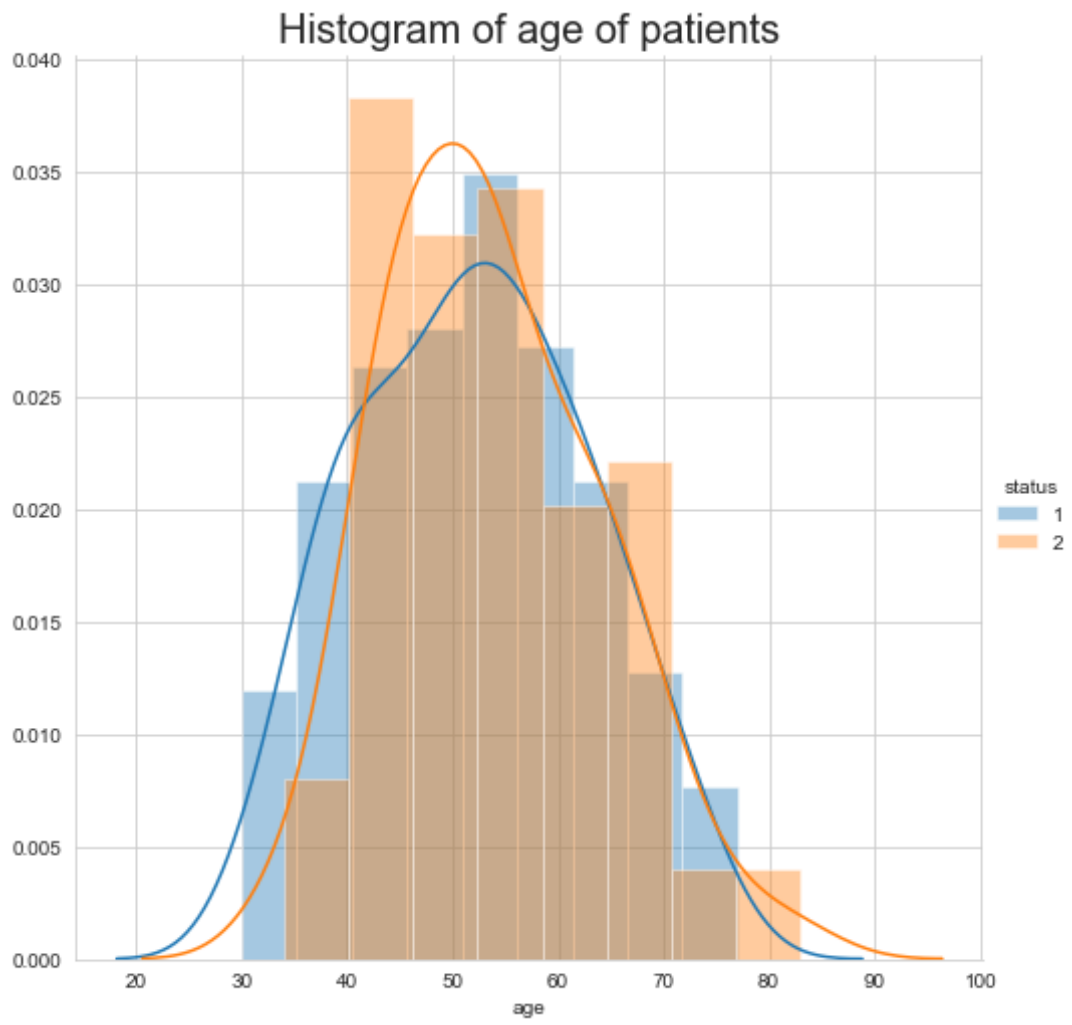


observation :

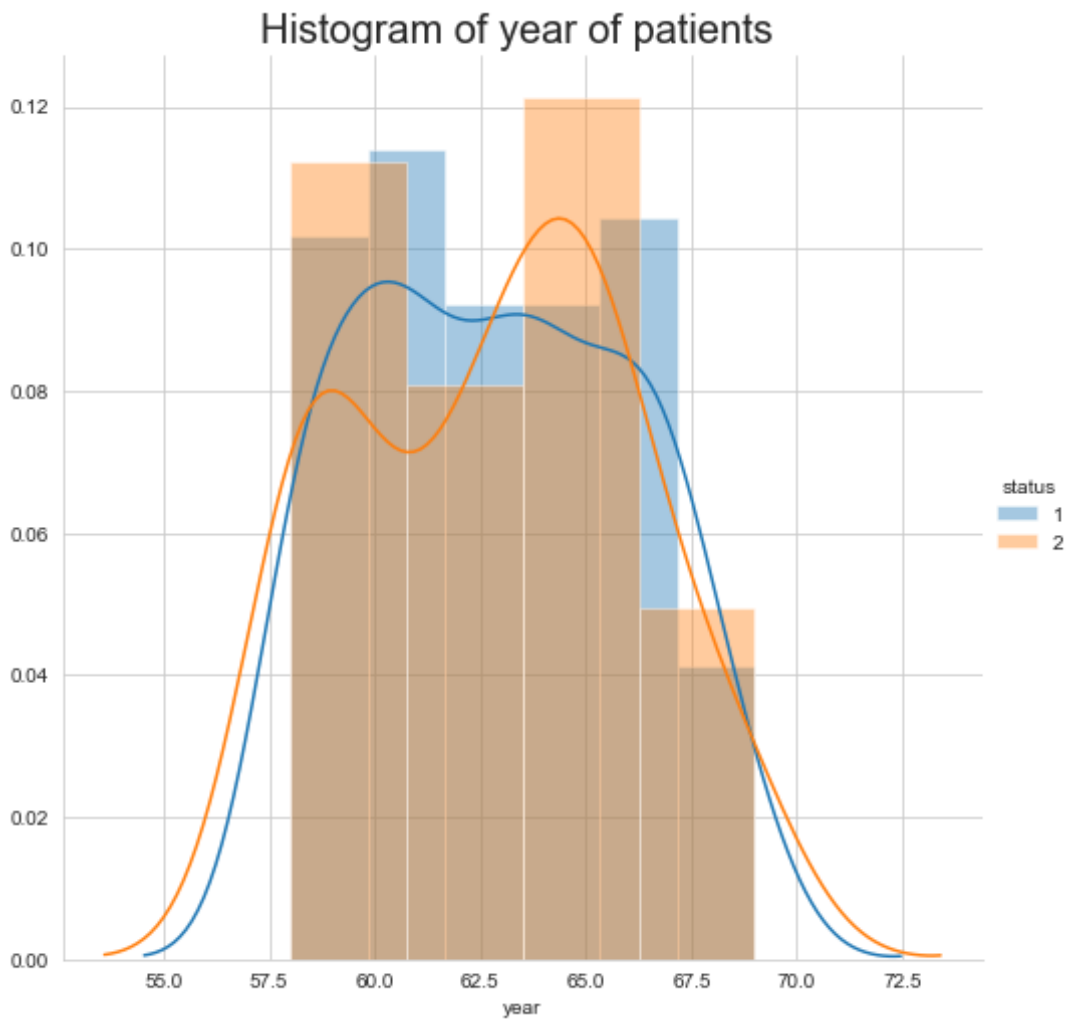
*voilin plot also like a box plot *it will improve the prasentation and it makes beautifull as compare to box plot.
*difference between box & voilin plot is box plot well understanding plot.

PDF

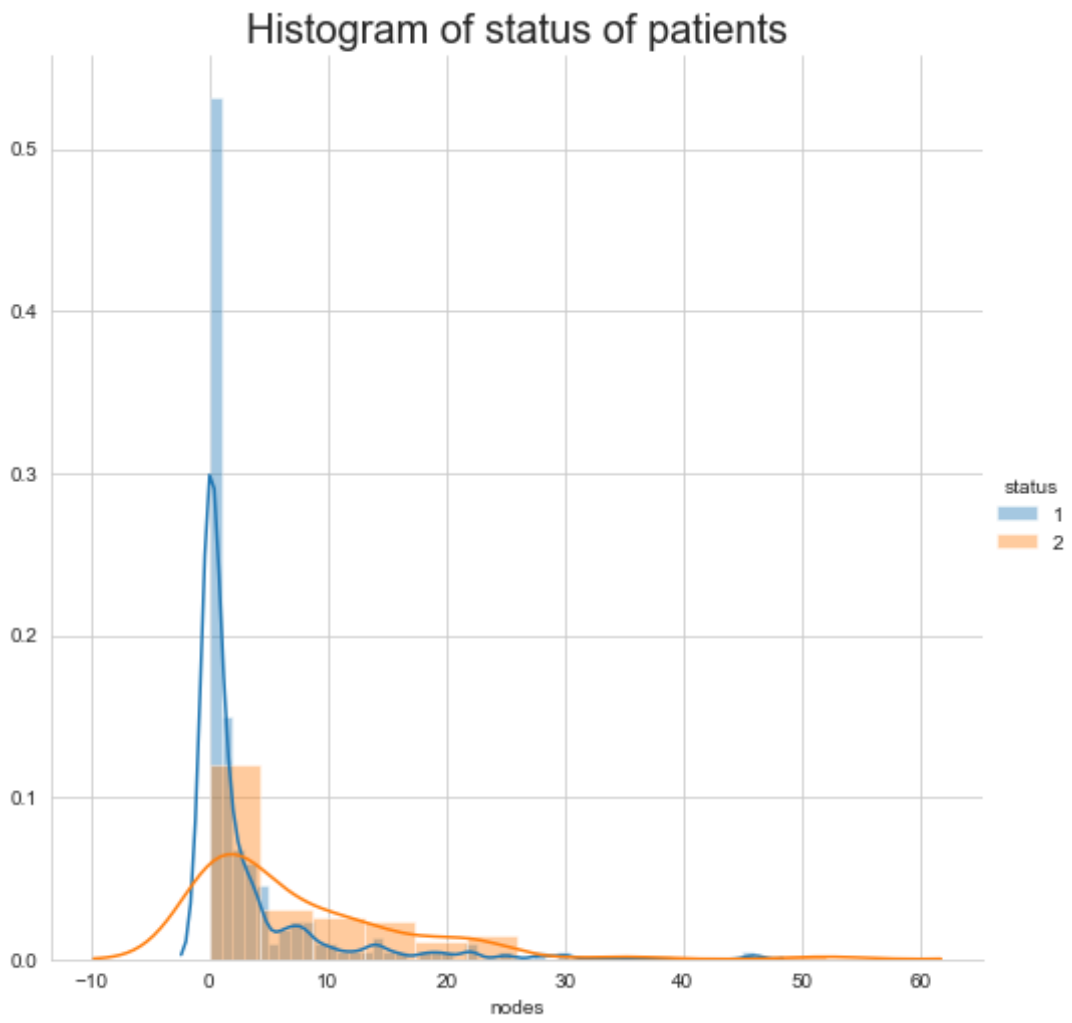
In [17]:
```
sns.set_style("whitegrid");
sns.FacetGrid(df , hue = "status" , height=7 ).map(sns.distplot , "age"
).add_legend();
plt.title("Histogram of age of patients",fontsize=20)
plt.show()
```



In [18]:
```
sns.set_style("whitegrid");
sns.FacetGrid(df , hue = "status" , height=7 ).map(sns.distplot , "yea
r").add_legend();
plt.title("Histogram of year of patients ",fontsize=20)
plt.show()
```



In [19]:
```
sns.set_style("whitegrid");
sns.FacetGrid(df , hue = "status" , height =7 ).map(sns.distplot , "nod
es").add_legend();
plt.title("Histogram of status of patients",fontsize=20)
plt.show()
```



In [20]:
```
counts, bin_edges = np.histogram(df['age'], bins=10,
                                 density = True)
pdf = counts/(sum(counts))
print(pdf);
print(bin_edges)
cdf = np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf)
```

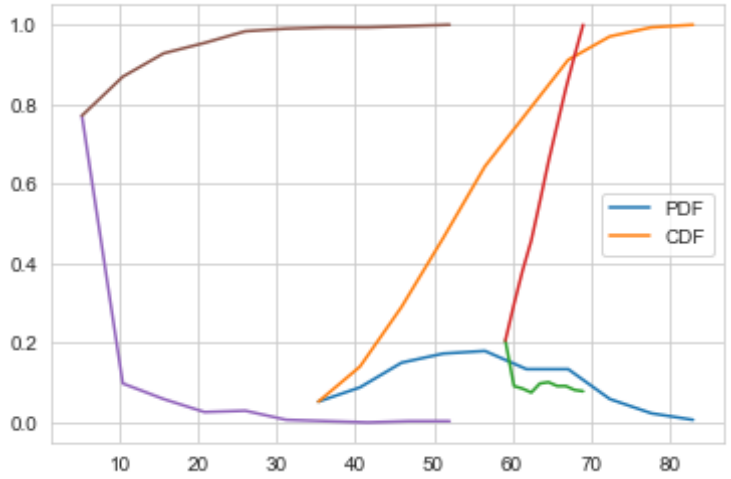
```
plt.plot(bin_edges[1:], cdf)


# virginica
counts, bin_edges = np.histogram(df['year'], 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)


#versicolor
counts, bin_edges = np.histogram(df['nodes'], 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.legend(('PDF','CDF'))

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. ]
[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. ]
[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. ]
```



observation :

*80% of the patients have <= equal to 5 positive lymph node. *A Huge no of overlapping can be observed among the classes *The objective of classifying the survival status of a new patient based on the given features is a little bit difficult task.