In [1]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
import warnings
warnings.filterwarnings("ignore")
```

In [2]:
```
data =pd.read_csv('haberman.csv')
```

Assignment to be solved

1) High level statistics of the dataset: number of points, numer of features, number of classes, data-points per class.

2) Explain objective.

3) Perform Univaraite analysis(PDF, CDF, Boxplot, Voilin plots) to understand which features are useful towards classification.

4) Perform Bi-variate analysis (scatter plots, pair-plots) to see if combinations of features are useful in classfication.

5) Write your observations in english as crisply and unambigously as possible. Always quantify your results.

In [3]:
```
data['Status']=np.where(data['status']==2, 'Not survived', 'survived')
```

In [4]:
```
data.drop('status',axis=1,inplace=True)
```

In [5]:
```
data.rename(columns = {'Status':'status'},inplace=True)
```

In [6]:
```
print('Number of points : ',data.shape[0]),
print('Number of features is ',data.shape[1], ' and they are ',data.columns[0],'
print('Number of classes',len(data['status'].unique()),' they are ',data['status
print('data-points per class','\n',data['status'].value_counts())
```

```
Number of points :  306
Number of features is  4  and they are  age ,  year ,  nodes ,  status
Number of classes 2  they are  ['survived' 'Not survived']
data-points per class
 survived        225
Not survived     81
Name: status, dtype: int64
```

In [7]:
```
#Data imbalance

Status_1=round(225/(225+81),2)
Status_2=round(81/(225+81),2)

print('Dataset is imbalance with the ratio',Status_1,':',Status_2)
```

```
Dataset is imbalance with the ratio 0.74 : 0.26
```

In [8]:
```
#Checking for Null values
data.isnull().sum()
```

Out[8]:
```
age       0
year      0
nodes     0
status    0
dtype: int64
```

Observation:
1) Dataset is imbalance with the ratio 0.74 : 0.26
2) There is zero data point with null values

Note: Survival status
1 = the patient survived 5 years or longer(survived)
2 = the patient died within 5 year (Not survived)

Objective: To predict/classify survival of patients who had undergone surgery for breast cancer. i.e whether patient survived more than 5 years or survived less than 5 years

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

In [9]:
```
#Making two sub dataset

status_1=data[data['status']=='survived']
status_2=data[data['status']=='Not survived']
```

In [10]:
```
status_1.columns
```

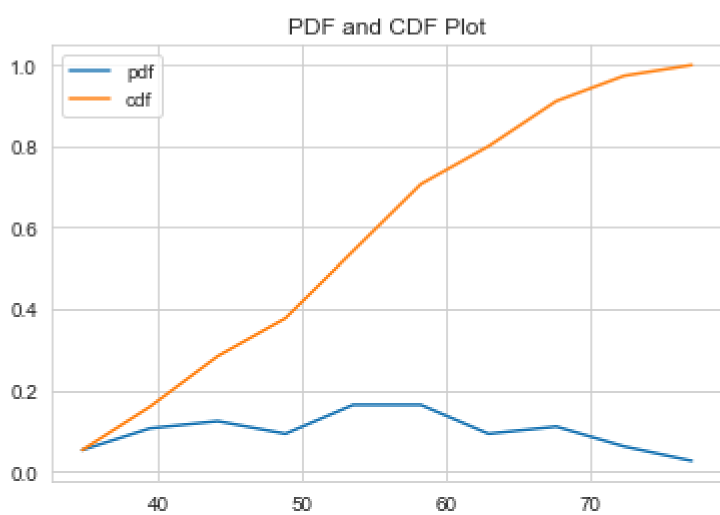
Out[10]:
```
Index(['age', 'year', 'nodes', 'status'], dtype='object')
```

In [11]:
```
counts_1age, bin_edges_1age = np.histogram(status_1['age'], bins=10,
                                 density = True)
counts_1year, bin_edges_1year = np.histogram(status_1['year'], bins=10,
                                 density = True)
counts_1nodes, bin_edges_1nodes = np.histogram(status_1['nodes'], bins=10,
                                 density = True)
counts_2age, bin_edges_2age = np.histogram(status_2['age'], bins=10,
                                 density = True)
counts_2year, bin_edges_2year = np.histogram(status_2['year'], bins=10,
                                 density = True)
counts_2nodes, bin_edges_2nodes = np.histogram(status_2['nodes'], bins=10,
                                 density = True)
```

In [38]:
```
# User defined function for creating PDF and CDF plots
def pdf_cdf_plot(counts,bin_edges):
    pdf = counts/(sum(counts))
    print('pdf values :',pdf);
    #print(bin_edges);
    cdf = np.cumsum(pdf)
    plt.title('PDF and CDF Plot')
    plt.plot(bin_edges[1:],pdf,)
    plt.plot(bin_edges[1:], cdf)
    plt.legend(['pdf','cdf'])
```

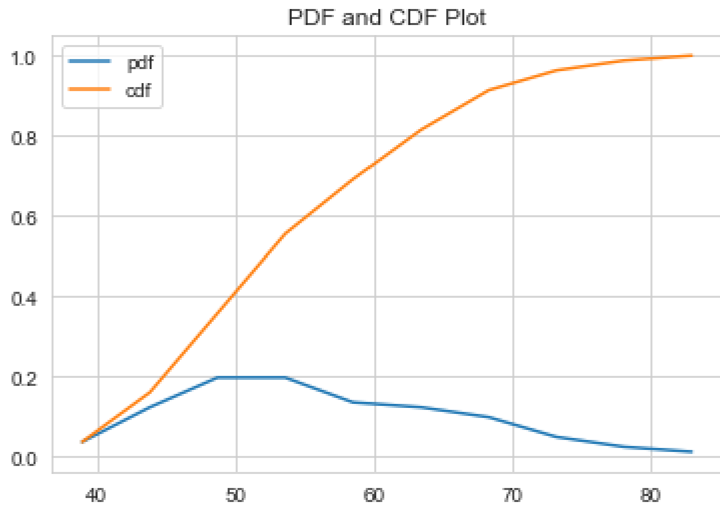
In [39]:
```
pdf_cdf_plot(counts_1age, bin_edges_1age)
```

```
pdf values : [0.05333333 0.10666667 0.12444444 0.09333333 0.16444444 0.16444444
 0.09333333 0.11111111 0.06222222 0.02666667]
```



In [40]:
```
pdf_cdf_plot(counts_2age, bin_edges_2age)
```

```
pdf values : [0.03703704 0.12345679 0.19753086 0.19753086 0.13580247 0.12345679
 0.09876543 0.04938272 0.02469136 0.01234568]
```

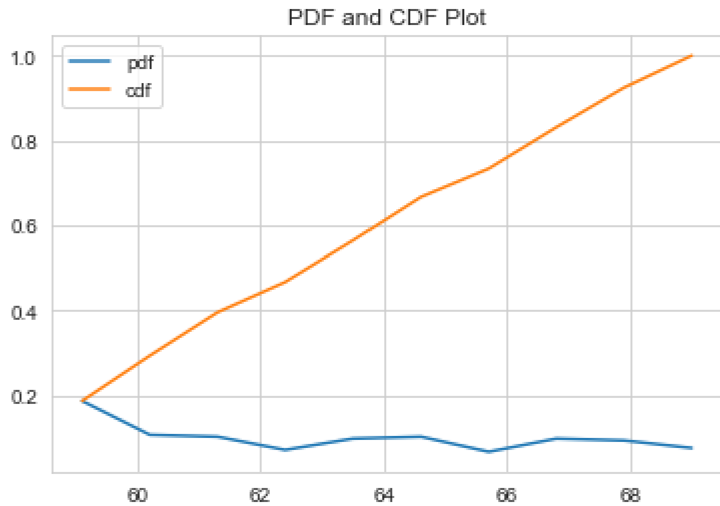


Observation:

From the above to plot , its evident that the people having age less than or equal to 40 have very high chance of survival.

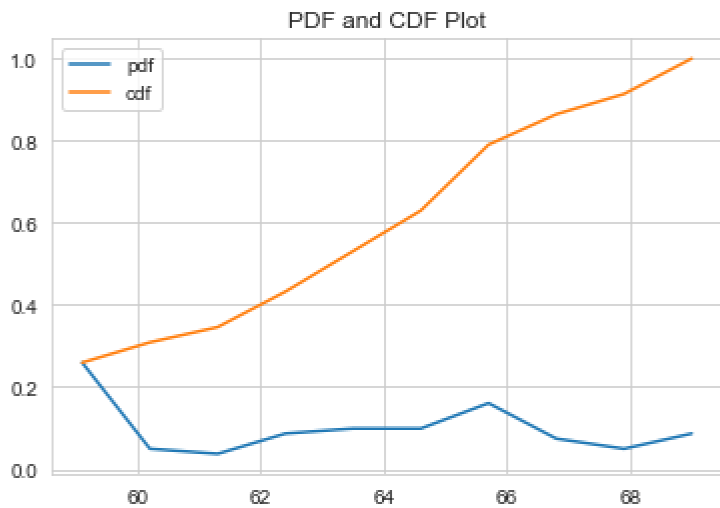
In [41]:
```
pdf_cdf_plot(counts_1year, bin_edges_1year)
```

```
pdf values : [0.18666667 0.10666667 0.10222222 0.07111111 0.09777778 0.10222222
 0.06666667 0.09777778 0.09333333 0.07555556]
```



In [42]:
```
pdf_cdf_plot(counts_2year, bin_edges_2year)
```

```
pdf values : [0.25925926 0.04938272 0.03703704 0.08641975 0.09876543 0.09876543
 0.16049383 0.07407407 0.04938272 0.08641975]
```

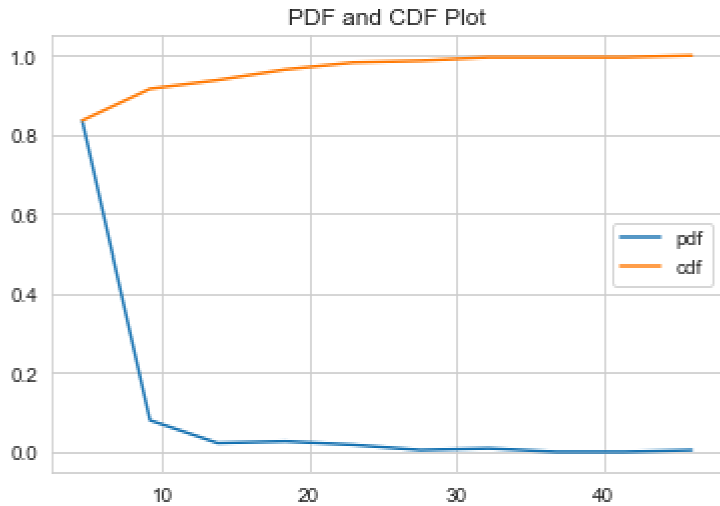


Observation:

Year feature resembles the same as the age feature.

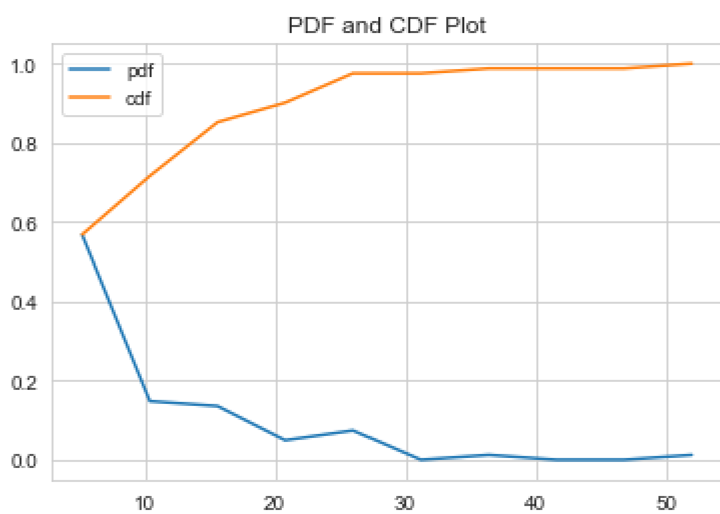
In [43]:
```
pdf_cdf_plot(counts_1nodes, bin_edges_1nodes)
```

```
pdf values : [0.83555556 0.08       0.02222222 0.02666667 0.01777778 0.00444444
 0.00888889 0.         0.         0.00444444]
```



In [44]:
```
pdf_cdf_plot(counts_2nodes, bin_edges_2nodes)
```

```
pdf values : [0.56790123 0.14814815 0.13580247 0.04938272 0.07407407 0.
 0.01234568 0.         0.         0.01234568]
```

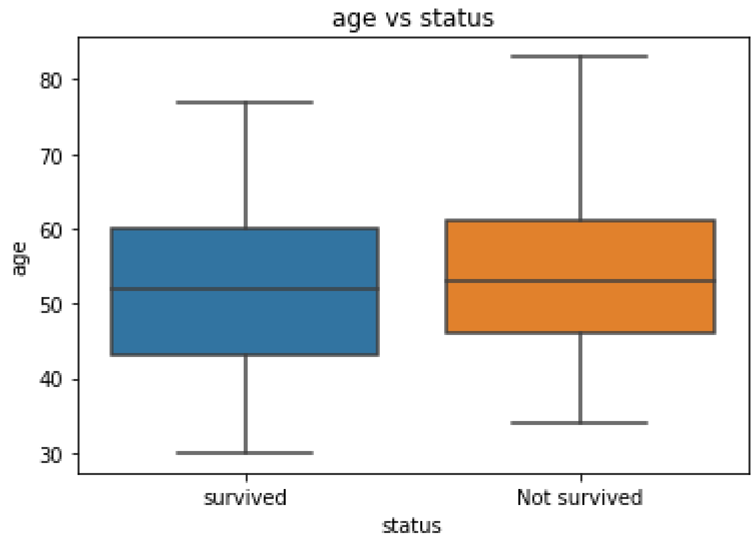


Observation:

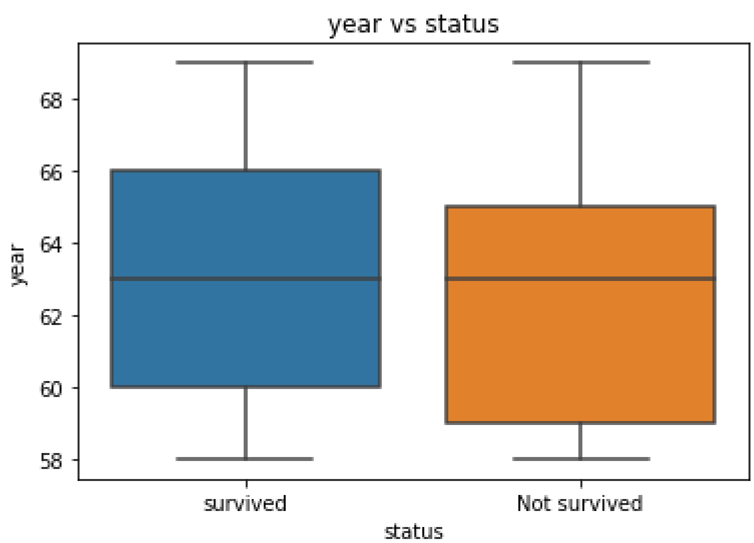
The patient having 50+ auxillary_lymph_node never survived.
The patient having less than 5 auxillary_lymph_node has neverly 83% of survival chance.

Box Plot

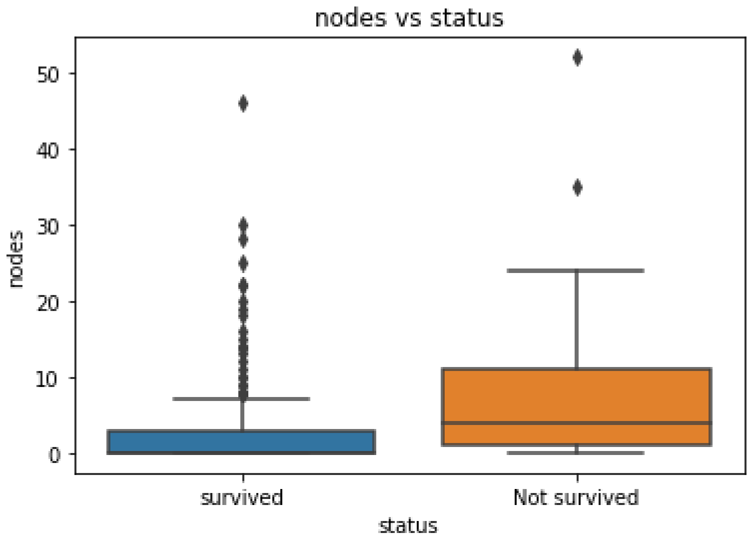
In [19]:
```
sns.boxplot(x='status',y='age', data=data,).set_title("age vs status")
plt.show()
```



In [20]:
```
sns.boxplot(x='status',y='year', data=data).set_title("year vs status")
plt.show()
```



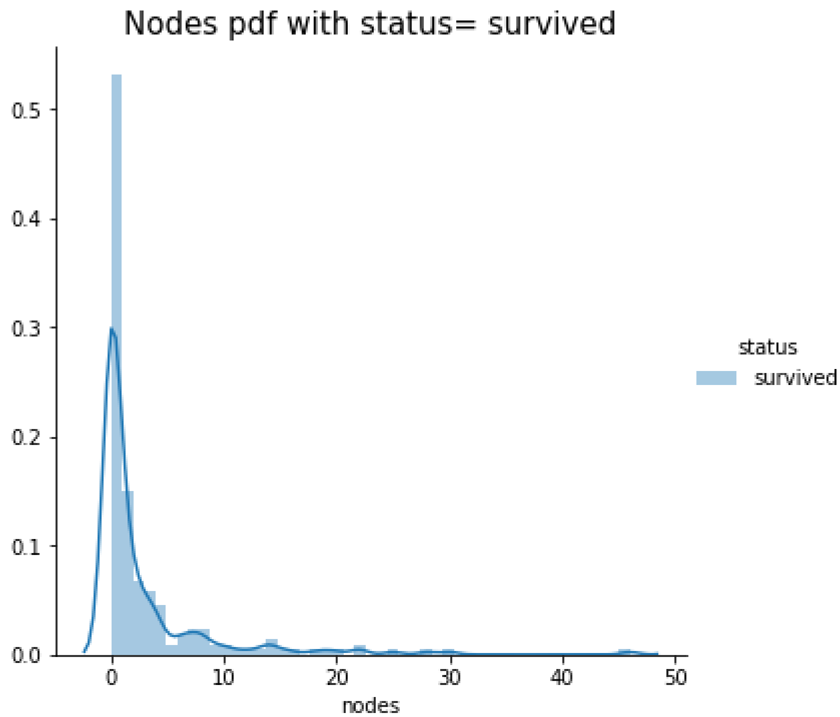
In [21]:
```
sns.boxplot(x='status',y='nodes', data=data).set_title("nodes vs status")
plt.show()
```



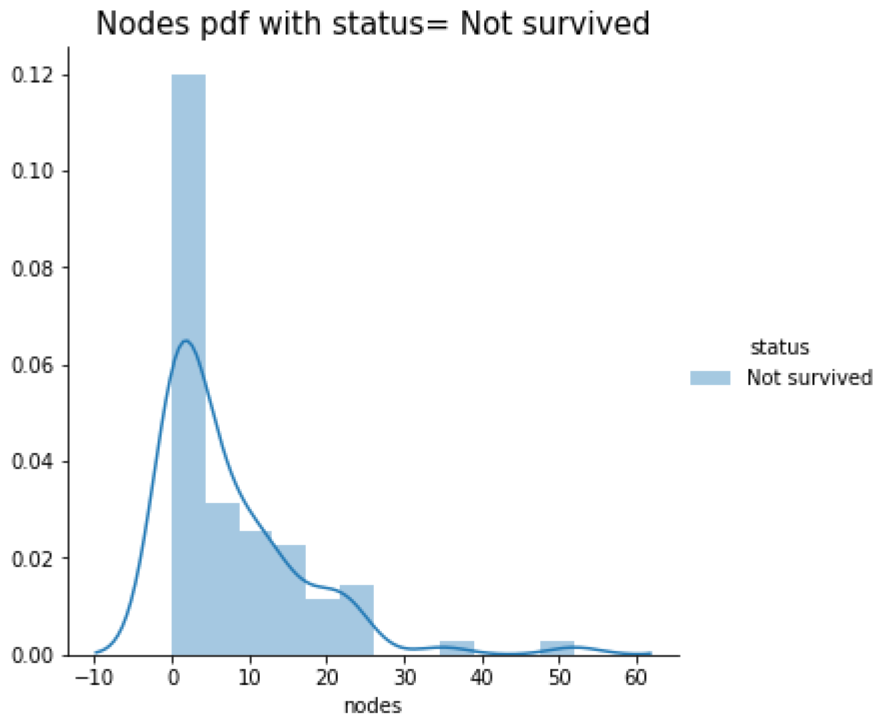
Observation:

One can easily see lot of outlier in the survival class.

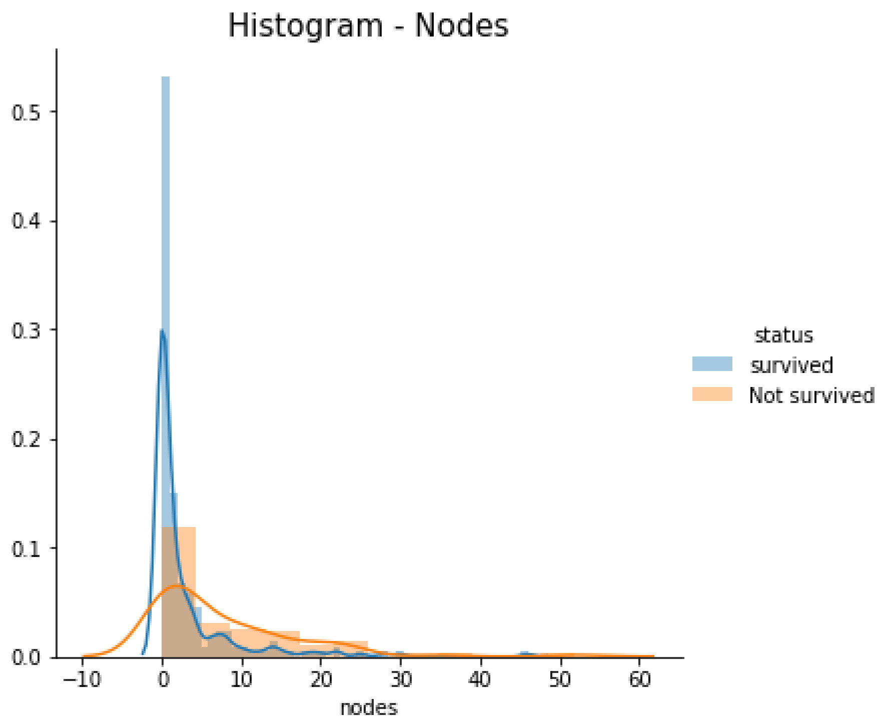
In [22]:
```
sns.FacetGrid(data[data['status']=='survived'], hue="status", size=5) \
   .map(sns.distplot, "nodes") \
   .add_legend();
plt.title('Nodes pdf with status= survived',fontsize=15)
plt.show();
```



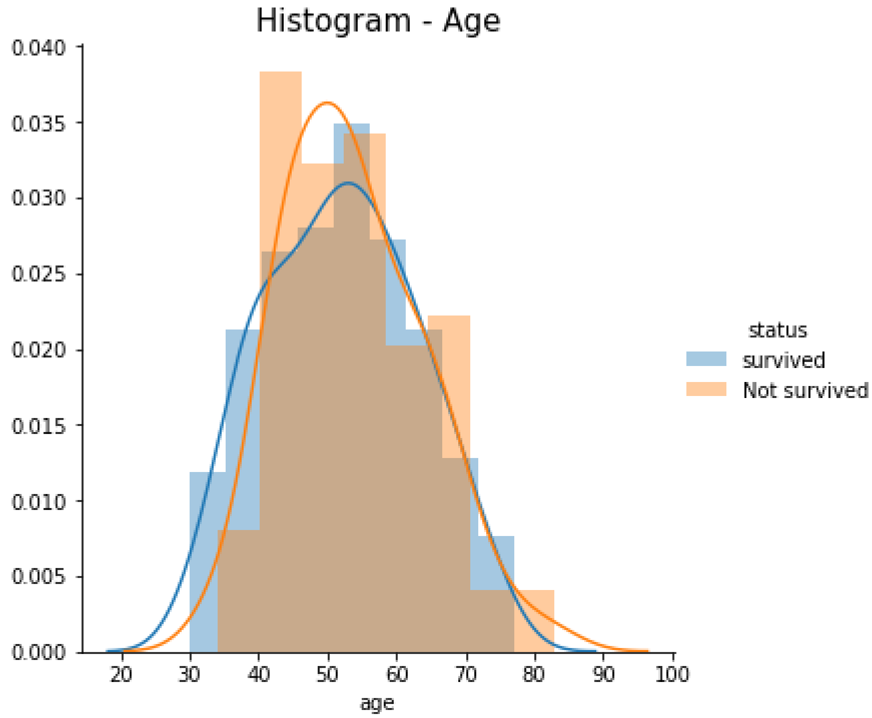
In [23]:
```
sns.FacetGrid(data[data['status']=='Not survived'], hue="status", size=5) \
   .map(sns.distplot, "nodes") \
   .add_legend();
plt.title('Nodes pdf with status= Not survived',fontsize=15)
plt.show();
```



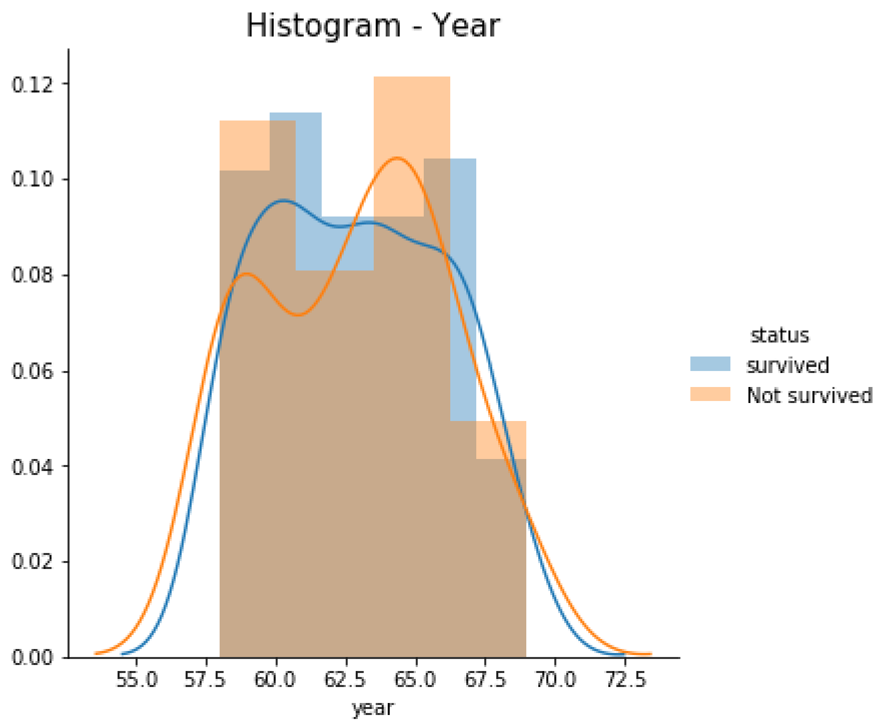
In [24]:
```
sns.FacetGrid(data, hue="status", size=5) \
   .map(sns.distplot, "nodes") \
   .add_legend();
plt.title('Histogram - Nodes',fontsize=15)
plt.show();
```



In [25]:
```
sns.FacetGrid(data, hue="status", size=5) \
   .map(sns.distplot, "age") \
   .add_legend();
plt.title('Histogram - Age',fontsize=15)
plt.show();
```



In [26]:
```
sns.FacetGrid(data, hue="status", size=5) \
   .map(sns.distplot, "year") \
   .add_legend();
plt.title('Histogram - Year',fontsize=15)
plt.show();
```



Observation:

There is no information that can be gather from the above as they are overlapped.

Bi-varaite analysis

In [27]:
```
plt.close();
sns.set_style("whitegrid");
sns.pairplot(data, hue="status", size=4);
plt.title('Pair-plot',fontsize=15)
plt.show()
```

Conclusion:

1) Age and nodes are useful features which talks clearly about the survival of patients who had undergone surgery for breast cancer.
2) People with age less than or equal 40 and having nodes less 30 have high probability of survival(more than 5 years) than others.
3) People having higher age have higher risk on the survival.
4) Around 90% of the people having node less than 10 have survived more than 5 year after a surgery.

In [ ]: