Plotting for Exploratory data analysis (EDA)

In [1]:
```
from google.colab import drive
drive.mount('/gdrive')
%cd /gdrive
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3aietf%3awg%3aoauth%3a2.0%3aoob&response_type=code&scope=email%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdocs.test%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive.photos.readonly%20https%3a%2f%2fwww.googleapis.com%2fauth%2fpeopleapi.readonly (https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3aietf%3awg%3aoauth%3a2.0%3aoob&response_type=code&scope=email%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdocs.test%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdrive.photos.readonly%20https%3a%2f%2fwww.googleapis.com%2fauth%2fpeopleapi.readonly)

Enter your authorization code:
··········
Mounted at /gdrive
/gdrive
```

Importing Library

In [0]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
import pandas.util.testing as tm
```

Importing Haberman Dataset

In [5]:
```
haberman = pd.read_csv('/content/haberman.csv')
print(haberman.head())
```

```
   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
```

How many data-points and features?

In [0]:
```
print(haberman.shape)
```

```
(306, 4)
```

What are the column names in our dataset?

In [0]:
```
print(haberman.columns)
```

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

How many data points for each class are present?

In [0]:
```
haberman['status'].value_counts()
```

Out[8]:
```
1    225
2     81
Name: status, dtype: int64
```

Observation

1.This is an Imbalanced dataset as one Class object is more than the other

Checking for Missing Values in the dataset

In [0]:
```
haberman.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 306 entries, 0 to 305
Data columns (total 4 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   age     306 non-null    int64
 1   year    306 non-null    int64
 2   nodes   306 non-null    int64
 3   status  306 non-null    int64
dtypes: int64(4)
memory usage: 9.7 KB
```

Calculating MEAN, STD DEV, Percentiles, MIN and MAX

In [0]:
```
haberman.describe()
```

Out[53]:

	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

Observations

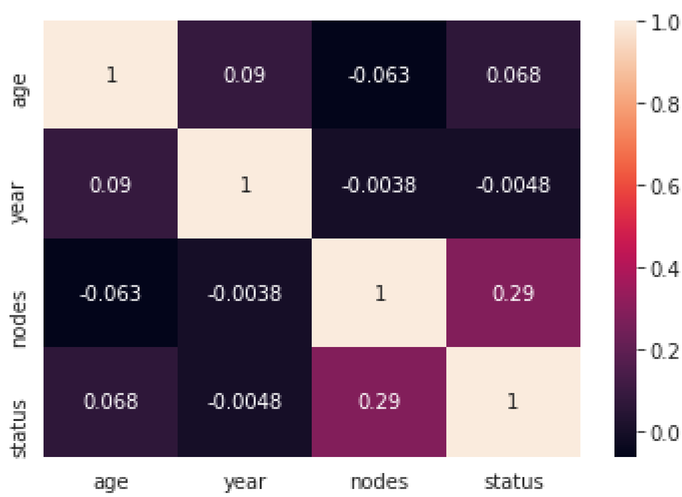
1.From the above results we can observe that MEAN & MEDIAN for AGE and age are almost equal

2.There is notably a large difference between 75th %tile and max values of NODES

3.MEDIAN & MEAN for NODES are significantly different as there are OUTLIERS in the NODES data which can be visualized using BOX Plot

Plotting Heat Map to understand correlation b/w independent variables

In [0]:
```
sns.heatmap(haberman.corr(), annot = True);
plt.show()
```

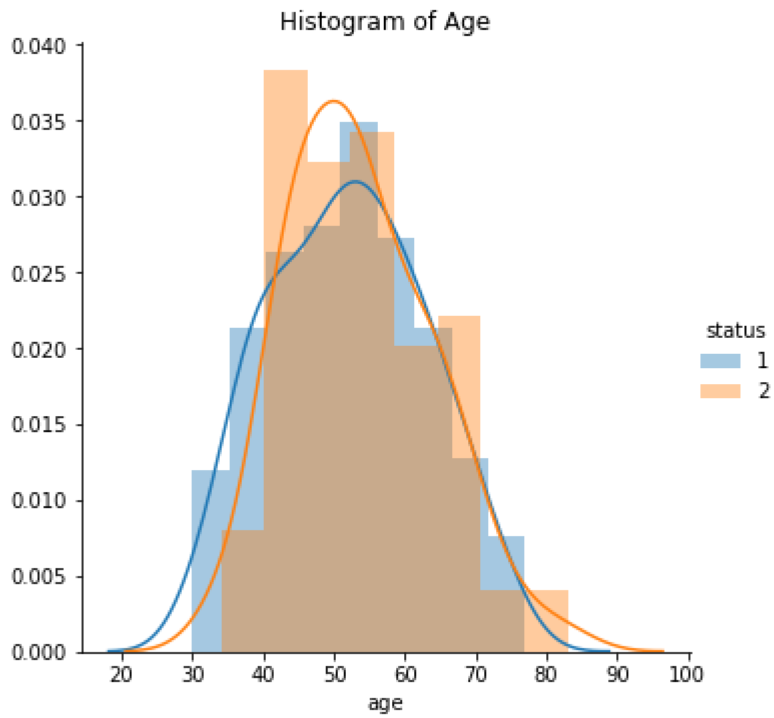


Observations

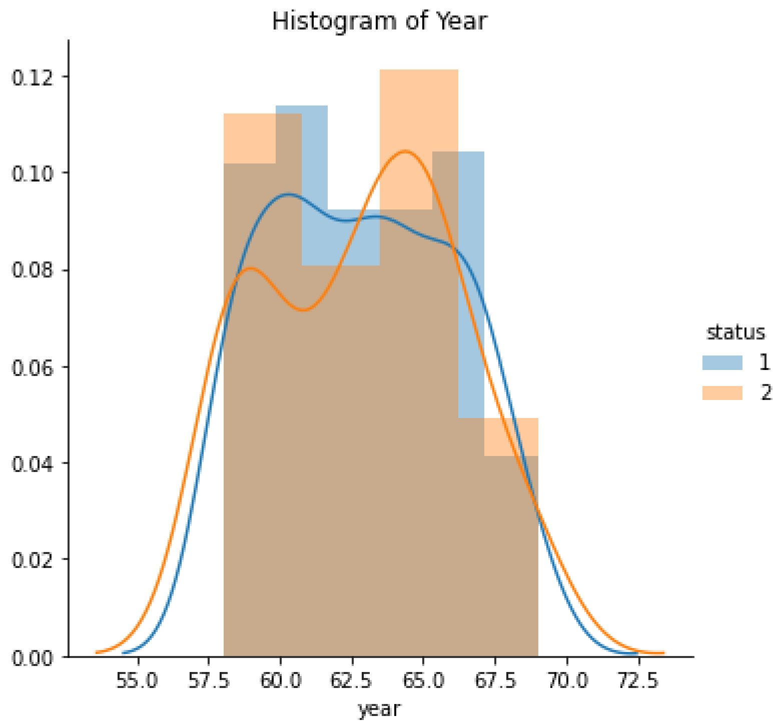
1.From the below Heat MAp we can see that NODES is negatively correlated with YEAR & AGE

Performing Univariate Analysis using Histogram/PDF Plots

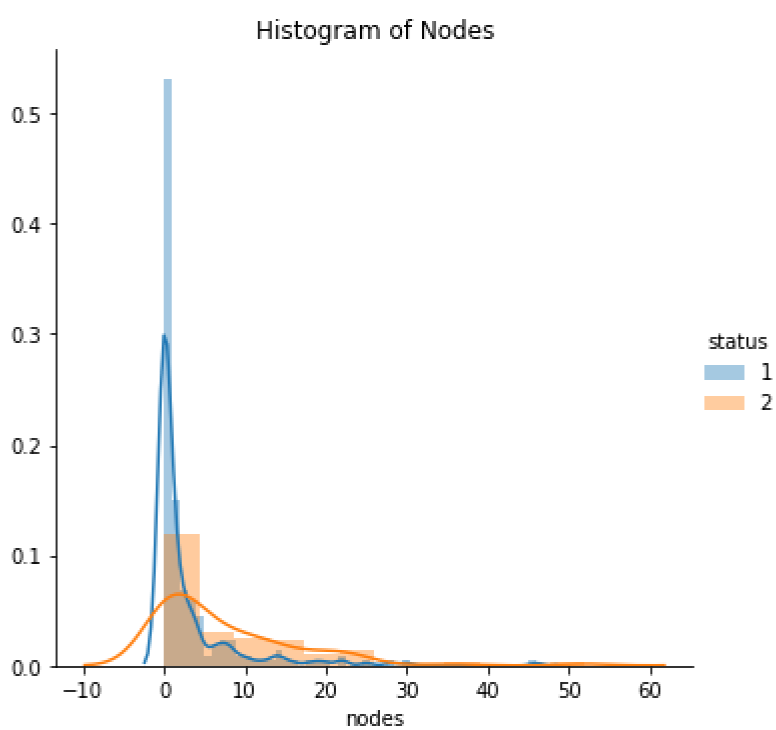
In [6]:
```
sns.FacetGrid(haberman, hue="status", height=5) \
   .map(sns.distplot, "age") \
   .add_legend()
plt.title('Histogram of Age')
plt.show();
```



In [7]:
```
sns.FacetGrid(haberman, hue="status", height=5) \
   .map(sns.distplot, "year") \
   .add_legend();
plt.title('Histogram of Year')
plt.show();
```



In [8]:
```
sns.FacetGrid(haberman, hue="status", height=5) \
   .map(sns.distplot, "nodes") \
   .add_legend();
plt.title('Histogram of Nodes')
plt.show();
```



Observations from Histogram/PDF

1.The Status class is clearly overlapping w.r.t all the three variables and we cannot predict the STATUS based on one variable

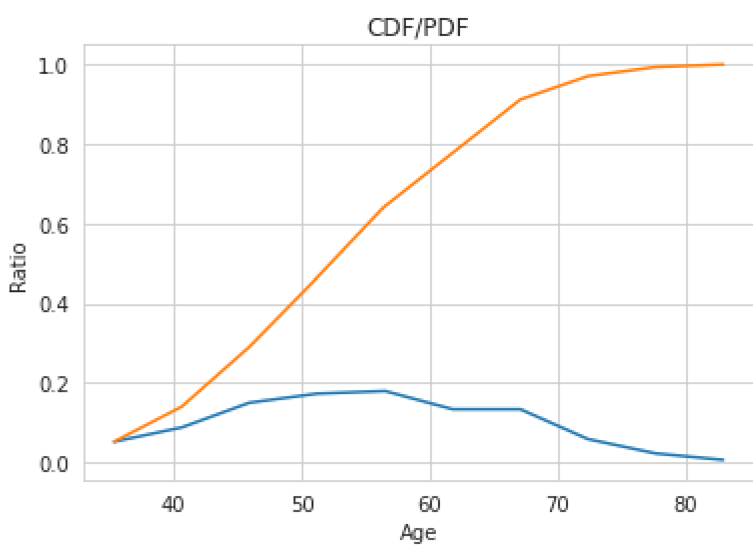
2.For nodes the data is left skewed i.e. Negatively Skewed

Plotting CDF Plots

In [0]:
```
counts, bin_edges = np.histogram(haberman['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)
plt.xlabel('Age')
plt.ylabel('Ratio')
plt.title('CDF/PDF')
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. ]
```



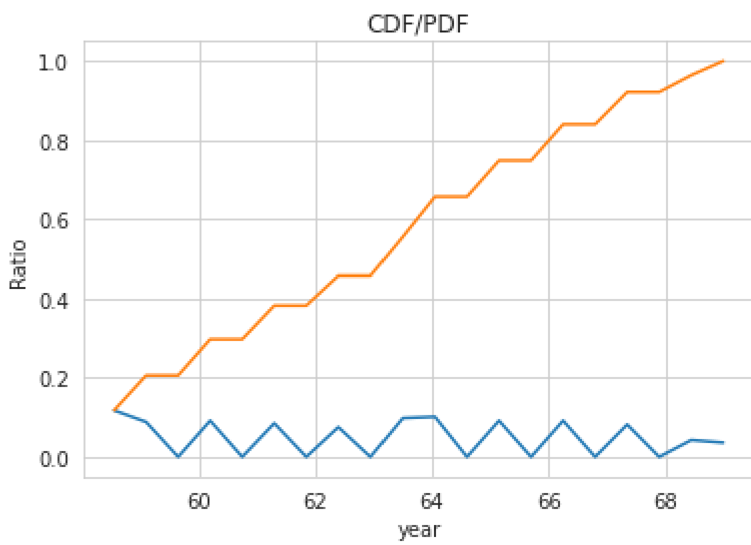
Observations

1.From above we can see that the 50% of records are less than age 55 and 90% records are less than age 67

In [0]:
```
counts, bin_edges = np.histogram(haberman['year'], bins=20, 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.xlabel('year')
plt.ylabel('Ratio')
plt.title('CDF/PDF')
plt.show();
```

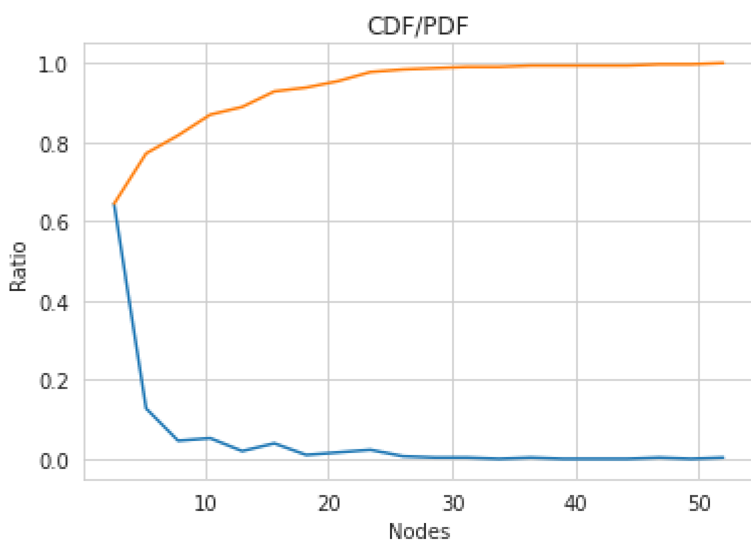
```
[0.11764706 0.08823529 0.         0.09150327 0.         0.08496732
 0.         0.0751634  0.         0.09803922 0.10130719 0.
 0.09150327 0.         0.09150327 0.         0.08169935 0.
 0.04248366 0.03594771]
[58.   58.55 59.1  59.65 60.2  60.75 61.3  61.85 62.4  62.95 63.5  64.05
 64.6  65.15 65.7  66.25 66.8  67.35 67.9  68.45 69.  ]
```



In [0]:
```
counts, bin_edges = np.histogram(haberman['nodes'], bins=20, 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.xlabel('Nodes')
plt.ylabel('Ratio')
plt.title('CDF/PDF')
plt.show();
```

```
[0.64379085 0.12745098 0.04575163 0.05228758 0.01960784 0.03921569
 0.00980392 0.01633987 0.02287582 0.00653595 0.00326797 0.00326797
 0.         0.00326797 0.         0.         0.         0.00326797
 0.         0.00326797]
[ 0.   2.6  5.2  7.8 10.4 13.  15.6 18.2 20.8 23.4 26.  28.6 31.2 33.8
 36.4 39.  41.6 44.2 46.8 49.4 52. ]
```

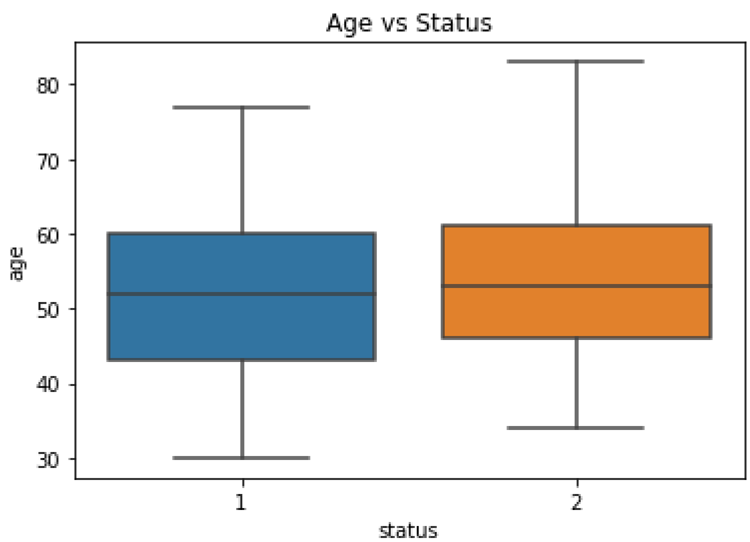


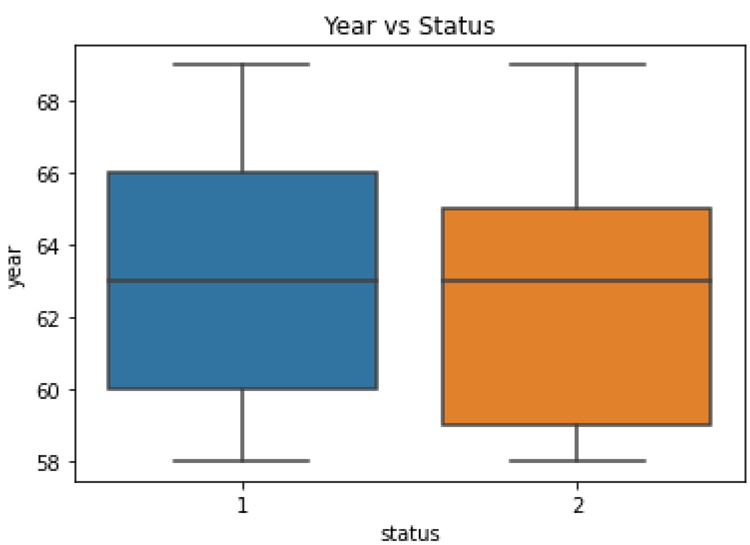
Plotting Box Plots

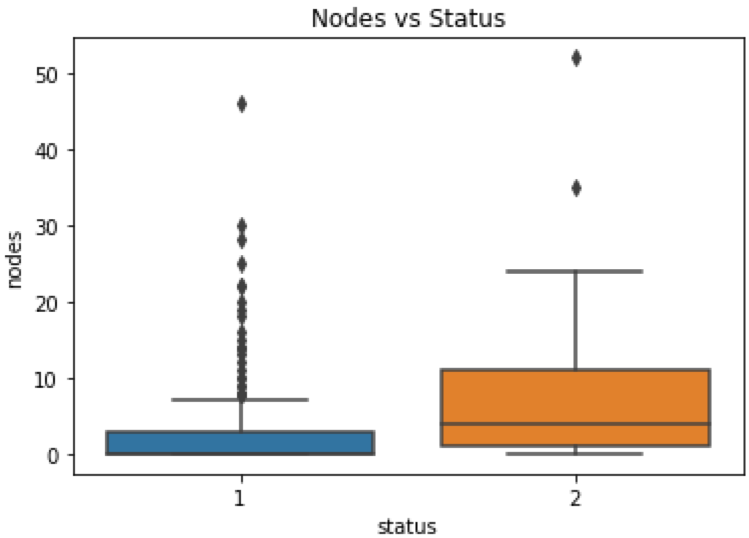
In [10]:
```
plt.figure(1)
sns.boxplot(x='status',y='age', data=haberman)
plt.title('Age vs Status')
plt.show()

plt.figure(2)
sns.boxplot(x='status',y='year', data=haberman)
plt.title('Year vs Status')
plt.show()

plt.figure(3)
sns.boxplot(x='status',y='nodes', data=haberman)
plt.title('Nodes vs Status')
plt.show()
```







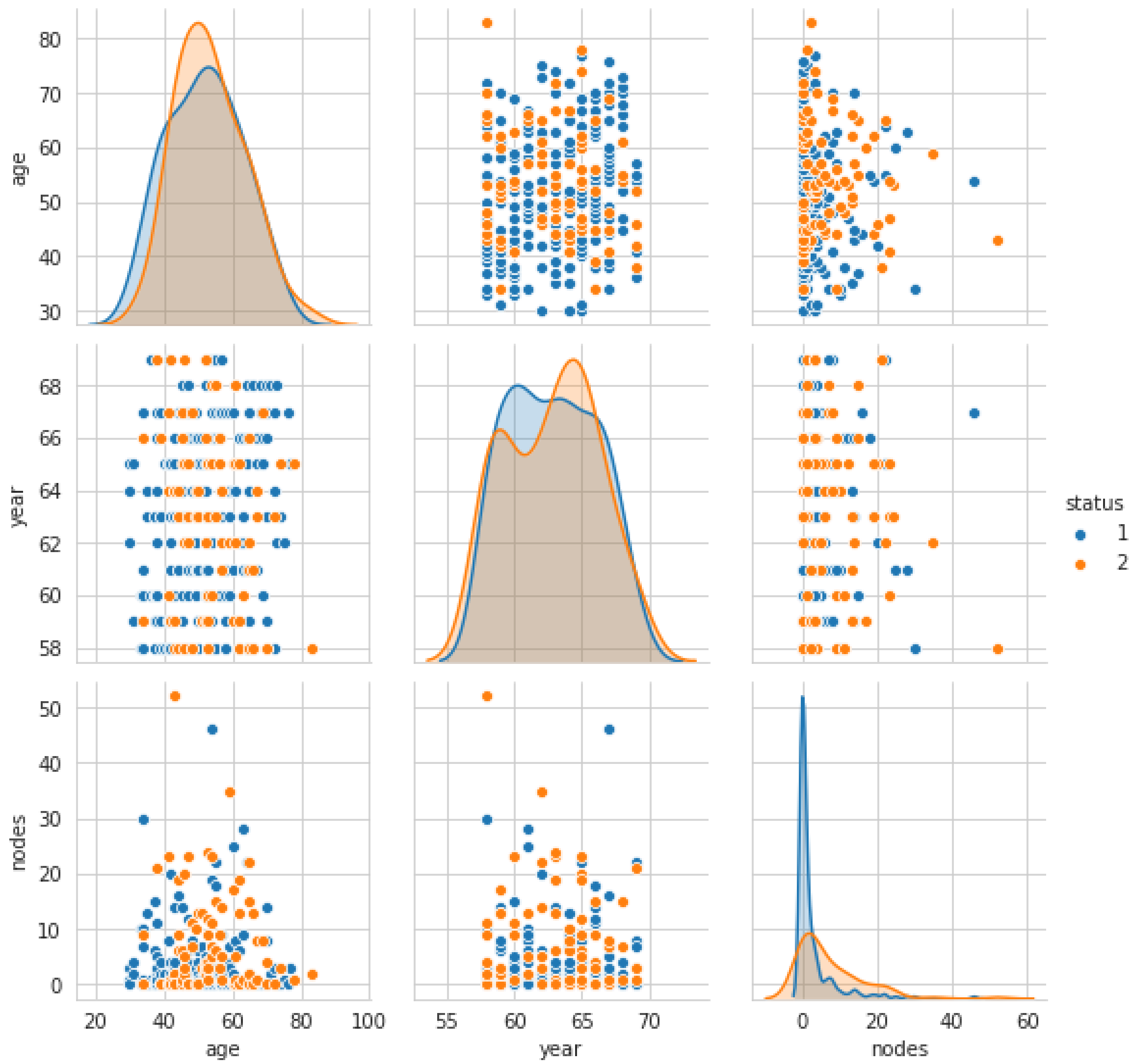
Observations

1.From the above BOX PLOT we can conculde that there are OUTLIERS in NODES and is above the 3rd Quartile

2.These OUTLIERS have to be treated to get proper classification

Bivariant Analysis using Pair Plot

In [0]:
```
sns.set_style("whitegrid");
sns.pairplot(haberman, hue="status", height=2.5);
plt.show()
```



Final Observations from EDA

1.Imbalanced dataset. Status Class 1 > Class 2

2.We cannot use only one variable to classify STATUS

3.No two variables can be used to classify STATUS

4.There are OUTLIERS in the NODES data which has to be treated to get better classification

5.Age column is Normally distributed

6.From the Heat MAp we can see that NODES is negatively correlated with YEAR & AGE