Assignment : To perform introductory basic data analysis EDA(with help of plotting techniques and staststical tools)

In [1]:

```
#objective 1:load supporting python libraries to accomplish the task
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [2]:

```
# to load dataset.
canc_patnt = pd.read_csv('D://Users//jalesh//Downloads/haberman.csv',header=None,
canc_patnt.tail(10)

#Observation:

#Assumption 1. class label 'survival_stat' has two categories 1 & 2 ,therefore,
# 1 would be: patients who could survive more(>5 years) &,
# 2 would be: patiens who couldnt survive more(<5 years)

#Assumption 2: feature 'year_of_operation' would be considered as operation was c
```

Out[2]:

	age_when_operated	year_of_operation	Aux_lymph_nodes	survival_stat
296	72	67	3	1
297	73	62	0	1
298	73	68	0	1
299	74	65	3	2
300	74	63	0	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

In [3]:
```
# to check no of datapoints,features & consice summary of canc_patnt dataset.
canc_patnt.shape
canc_patnt.columns
canc_patnt.describe()

#Observation:
#1.average age of pateients are ~52.4
#2.high deviation(scatterness) is seen in age_when_operted feature ~ 10.8
#3.Aux_lymph_nodes feature is spreaded more around its mean  ~ 7.18
```

Out[3]:

	age_when_operated	year_of_operation	Aux_lymph_nodes	survival_stat
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

In [4]:
```
canc_patnt['survival_stat'].value_counts()

#Observation:
#1.class label is imbalaced as it has hetregenous count of 1(who survived more) &
#2.81 patients operated upon and who couldnt survived more(2)
#3.225 people were operated upon and could survive more.(1)
#4.306 people were operated upon in totality.
```

Out[4]:
```
1    225
2     81
Name: survival_stat, dtype: int64
```

Objective: to calculate various statistical operation on given dataset:

In [5]:
```
canc_patnt['age_when_operated'].mean()
```

Out[5]:
```
52.45751633986928
```

In [137]:
```
canc_patnt['age_when_operated'].std()
```

Out[137]:
```
10.80345234930328
```

In [138]:
```
canc_patnt['Aux_lymph_nodes'].mean()
```

Out[138]:
```
4.026143790849673
```

In [139]:
```
canc_patnt['Aux_lymph_nodes'].std()
```

Out[139]:
```
7.189653506248565
```

In [141]:
```
canc_patnt['year_of_operation'].value_counts()

#Observation: 1958 was the year when maximum no of cancer petients were operatoed u
```

Out[141]:
```
58    36
64    31
63    30
66    28
65    28
60    28
59    27
61    26
67    25
62    23
68    13
69    11
Name: year_of_operation, dtype: int64
```

In [7]:
```
canc_patnt.groupby('survival_stat').max()
#max age of patients who survived and couldnt survive more after battling cancer
```

Out[7]:

	age_when_operated	year_of_operation	Aux_lymph_nodes
survival_stat			
1	77	69	46
2	83	69	52

In [140]:
```
canc_patnt.groupby('survival_stat').min()
```

Out[140]:

	age_when_operated	year_of_operation	Aux_lymph_nodes
survival_stat			
1	30	58	0
2	34	58	0

In [ ]:

In [143]:
```
canc_patnt.groupby('survival_stat').count()
#observation:
#1. the average person's age in who survived more and less list are ~52 and ~53 r
#2. the avgerage person's age in who survived more had lower no of Aux_lymph_node
```

Out[143]:

	age_when_operated	year_of_operation	Aux_lymph_nodes
survival_stat			
1	225	225	225
2	81	81	81

In [136]:
```
canc_patnt.head()
```

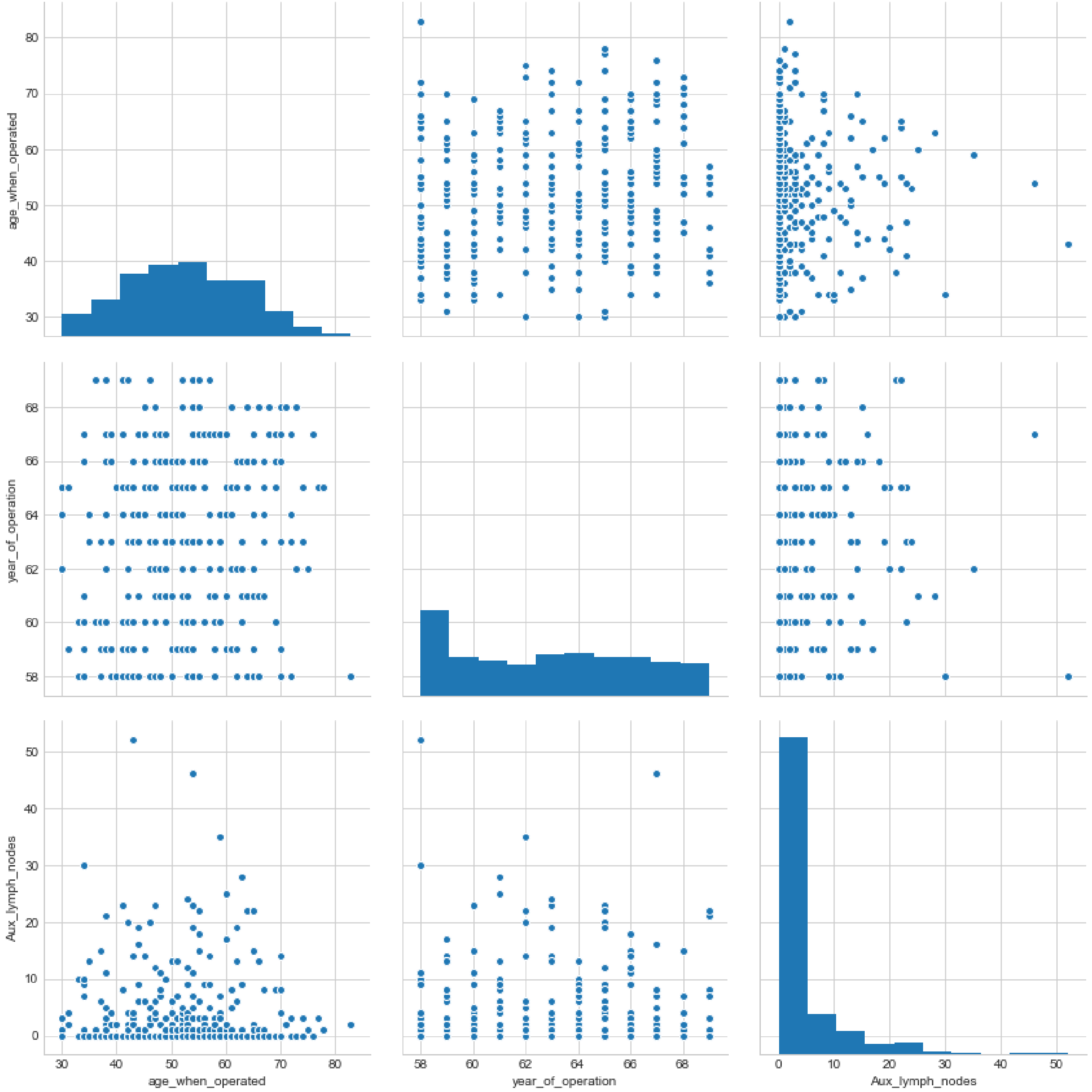
Out[136]:

	age_when_operated	year_of_operation	Aux_lymph_nodes	survival_stat
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

plots

```
In [4]: sns.set_style('whitegrid')
        sns.pairplot(canc_patnt.iloc[:,[0,1,2]], size=4)
        #observation:
        #1.no cconcrete assumption or conclusion can be made after seeing the pairplot be
```

```
Out[4]: <seaborn.axisgrid.PairGrid at 0xcbcd0b0>
```



```
In [46]: sum(canc_patnt[(canc_patnt['Aux_lymph_nodes'] < 5) & (canc_patnt['survival_stat']

         #observation:
         #1.patients having aux_lymph_nodes ~ <10 lived more after having operated.
```

```
Out[46]: 188
```

```
In [104]: print('the quantile is : {}'.format(np.percentile(canc_patnt['Aux_lymph_nodes'],
```

```
the quantile is : [ 0.  0.  1.  4.]
```

```
In [144]: canc_patnt.corr()
```

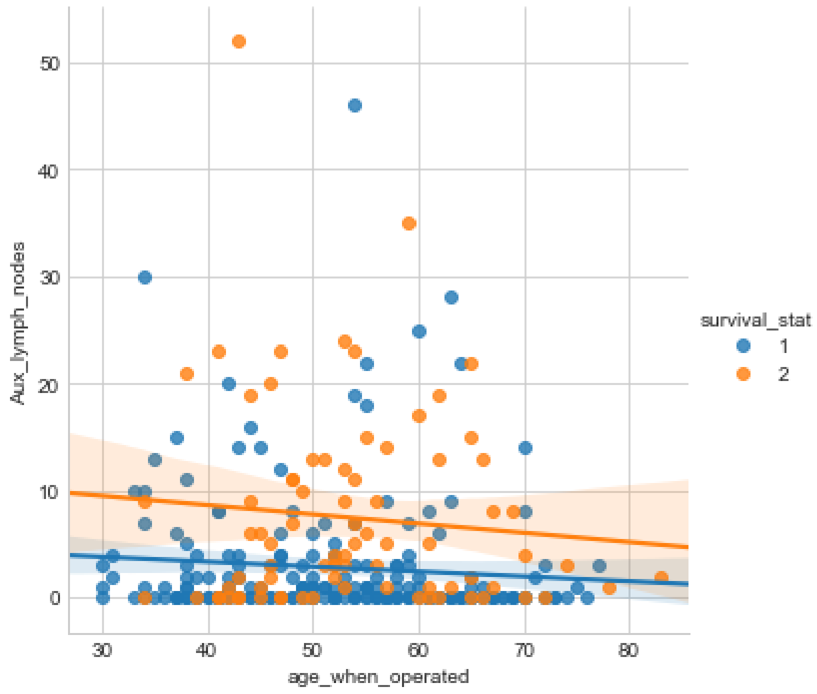
Out[144]:

	age_when_operated	year_of_operation	Aux_lymph_nodes	survival_stat
age_when_operated	1.000000	0.089529	-0.063176	0.067950
year_of_operation	0.089529	1.000000	-0.003764	-0.004768
Aux_lymph_nodes	-0.063176	-0.003764	1.000000	0.286768
survival_stat	0.067950	-0.004768	0.286768	1.000000

```
In [ ]:
```

```
In [6]: sns.lmplot(x='age_when_operated', y='Aux_lymph_nodes', data=canc_patnt, hue='surv

        #observation:
        #1.couldnt conclude after having seen linear module plot.
```

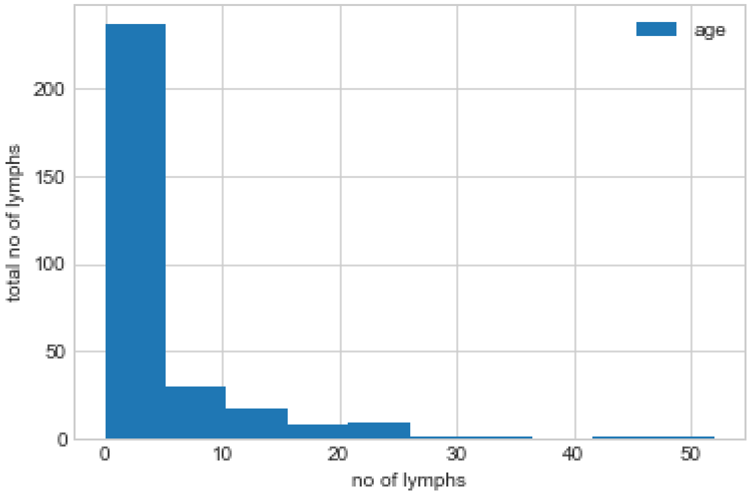
```
Out[6]: <seaborn.axisgrid.FacetGrid at 0xd57ce90>
```



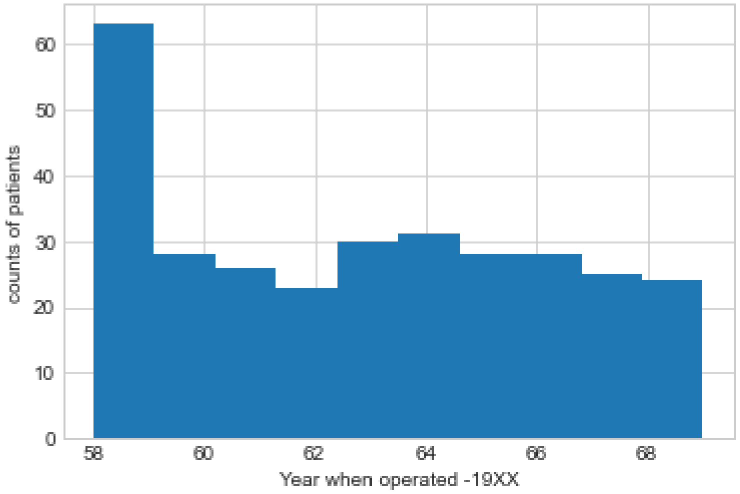
```
In [28]: #1D scatter plot:
         canc_patnt.columns
```

```
Out[28]: Index(['age_when_operated', 'year_of_operation', 'Aux_lymph_nodes',
                'survival_stat'],
               dtype='object')
```

```
In [12]: plt.hist(x='Aux_lymph_nodes', data=canc_patnt, label='age')
         plt.xlabel('no of lymphs')
         plt.ylabel('total no of lymphs')
         plt.legend()

Out[12]: <matplotlib.legend.Legend at 0xe7a5c10>
```



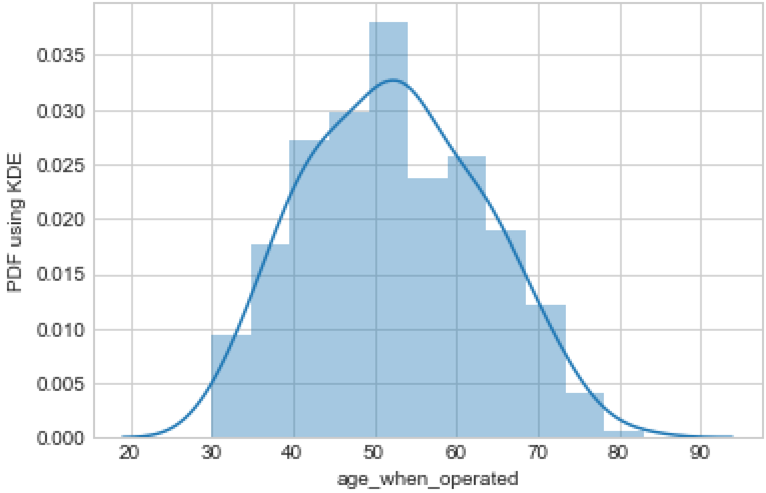
```
In [11]: plt.hist(x='year_of_operation', data=canc_patnt)
         plt.xlabel('Year when operated -19XX')
         plt.ylabel('counts of patients')

Out[11]: <matplotlib.text.Text at 0xe647190>
```



```
In [38]: canc_patnt[canc_patnt['year_of_operation'] == canc_patnt['age_when_operated']]['a

Out[38]: 63    2
         58    2
         62    1
         68    1
         Name: age_when_operated, dtype: int64
```

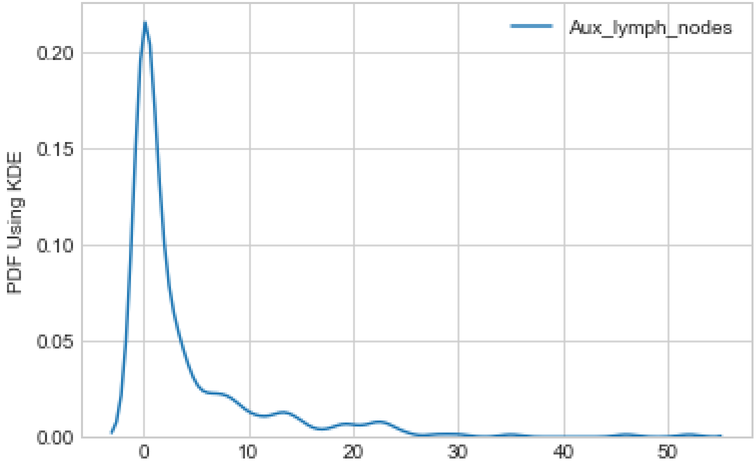
```
In [9]:  sns.distplot(canc_patnt['age_when_operated'])
         plt.ylabel('PDF using KDE')
```

```
Out[9]:  <matplotlib.text.Text at 0xe6f48d0>
```



```
In [10]: sns.kdeplot(canc_patnt['Aux_lymph_nodes'])
         plt.ylabel('PDF Using KDE')
```

```
Out[10]: <matplotlib.text.Text at 0xe5192f0>
```



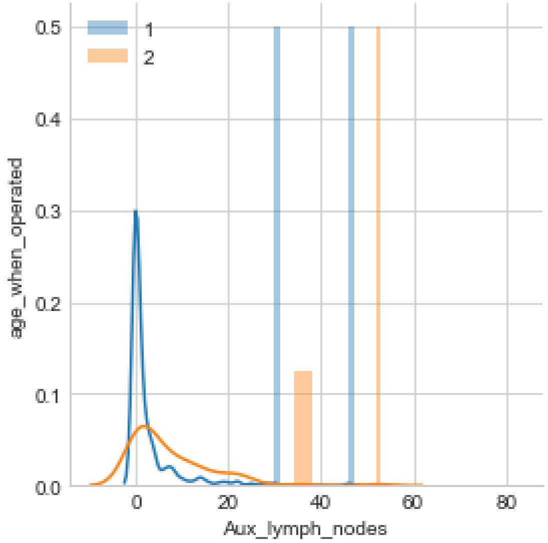
In [48]:

```
sns.set_style("whitegrid")
g = sns.FacetGrid(canc_patnt, hue="survival_stat", size=4)
g.map(sns.distplot, 'Aux_lymph_nodes', 'age_when_operated')
plt.legend()
#observation:patents couldnt suvive more had more wider of spread of lymphs as cor
```

```
E:\anaconda\lib\site-packages\matplotlib\axes\_axes.py:6201: RuntimeWarning: in
valid value encountered in true_divide
  m = (m.astype(float) / db) / m.sum()
```

Out[48]:

```
<matplotlib.legend.Legend at 0xfd40e10>
```

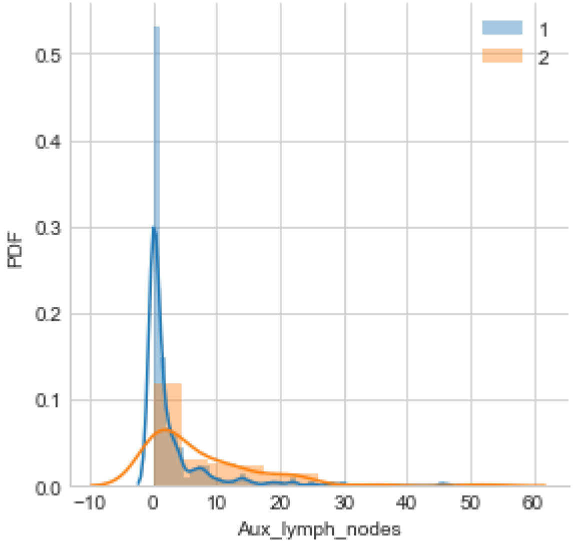


In [7]:

```
sns.set_style("whitegrid")
g = sns.FacetGrid(canc_patnt, hue="survival_stat", size=4)
g.map(sns.distplot, 'Aux_lymph_nodes')
plt.ylabel('PDF')
plt.legend()

#observation: comparing three univarete distribution plots , graphs Aux_lymph_node
```

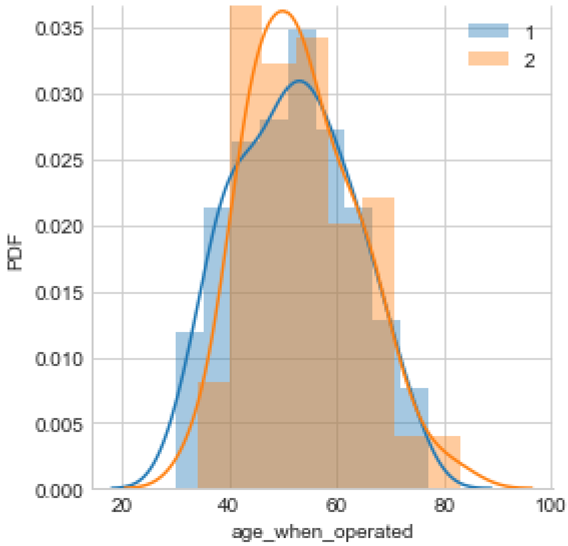
Out[7]:

```
<matplotlib.legend.Legend at 0xe576890>
```



In [8]:
```
sns.set_style("whitegrid")
g = sns.FacetGrid(canc_patnt, hue="survival_stat", size=4)
g.map(sns.distplot, 'age_when_operated')
plt.ylabel('PDF')
plt.legend()
```

Out[8]:
```
<matplotlib.legend.Legend at 0xe2142f0>
```



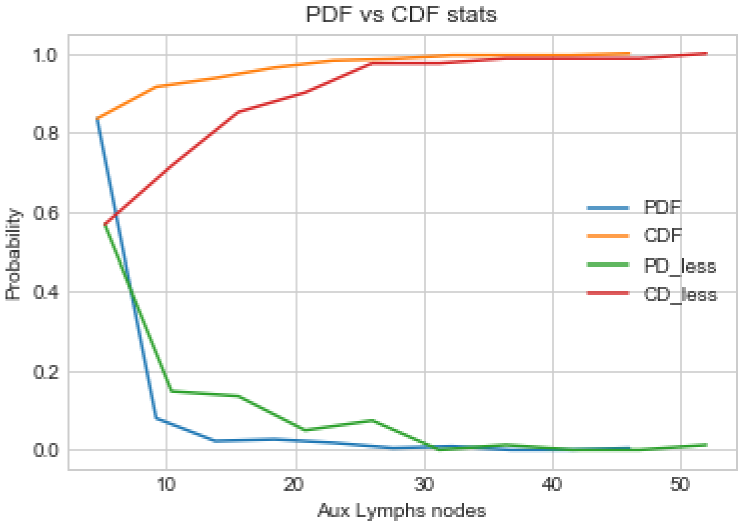
In [15]:

```
fig = plt.Figure(figsize=(10,10), dpi=400)

survived_more = canc_patnt[canc_patnt['survival_stat'] == 1]
survived_less = canc_patnt[canc_patnt['survival_stat'] == 2]

counts, bin_edges = np.histogram(survived_more['Aux_lymph_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([])
plt.title('PDF vs CDF stats')
plt.xlabel('Aux Lymphs nodes')



counts, bin_edges = np.histogram(survived_less['Aux_lymph_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.title('PDF vs CDF stats')
plt.xlabel('Aux Lymphs nodes')
plt.ylabel('Probability')
plt.legend(['PDF', 'CDF','PD_less', 'CD_less'])
```

```
[ 0.83555556  0.08        0.02222222  0.02666667  0.01777778  0.00444444
  0.00888889  0.          0.          0.00444444]
[  0.    4.6   9.2  13.8  18.4  23.   27.6  32.2  36.8  41.4  46. ]
[ 0.56790123  0.14814815  0.13580247  0.04938272  0.07407407  0.
  0.01234568  0.          0.          0.01234568]
[  0.    5.2  10.4  15.6  20.8  26.   31.2  36.4  41.6  46.8  52. ]
```

Out[15]:

```
<matplotlib.legend.Legend at 0xe9eab90>
```



```
In [83]: cdf
```

```
Out[83]: array([ 0.83555556,  0.91555556,  0.93777778,  0.96444444,  0.98222222,
                 0.98666667,  0.99555556,  0.99555556,  0.99555556,  1.        ])
```

```
In [84]: pdf
```

```
Out[84]: array([ 0.83555556,  0.08      ,  0.02222222,  0.02666667,  0.01777778,
                 0.00444444,  0.00888889,  0.        ,  0.        ,  0.00444444])
```

```
In [89]: k = np.array()
         for i in cdf:
             k =  k + np.array([i + 1])
         print(k)
```

```
[ 2.]
```

```
In [76]: survived_less.head()
```

Out[76]:

	age_when_operated	year_of_operation	Aux_lymph_nodes	survival_stat
7	34	59	0	2
8	34	66	9	2
24	38	69	21	2
34	39	66	0	2
43	41	60	23	2

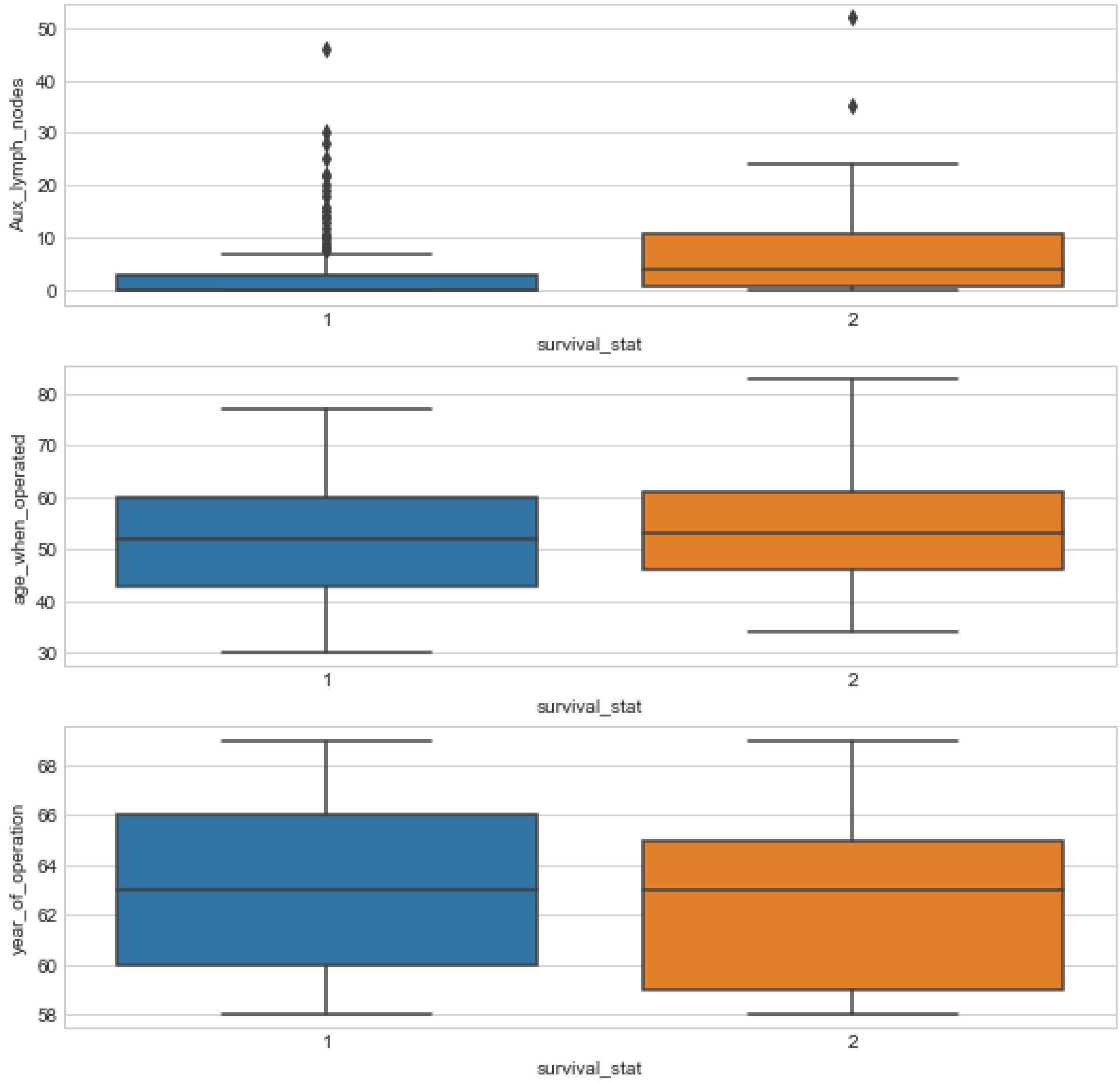
In [77]:
```
survived_more.head()
```

Out[77]:

	age_when_operated	year_of_operation	Aux_lymph_nodes	survival_stat
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

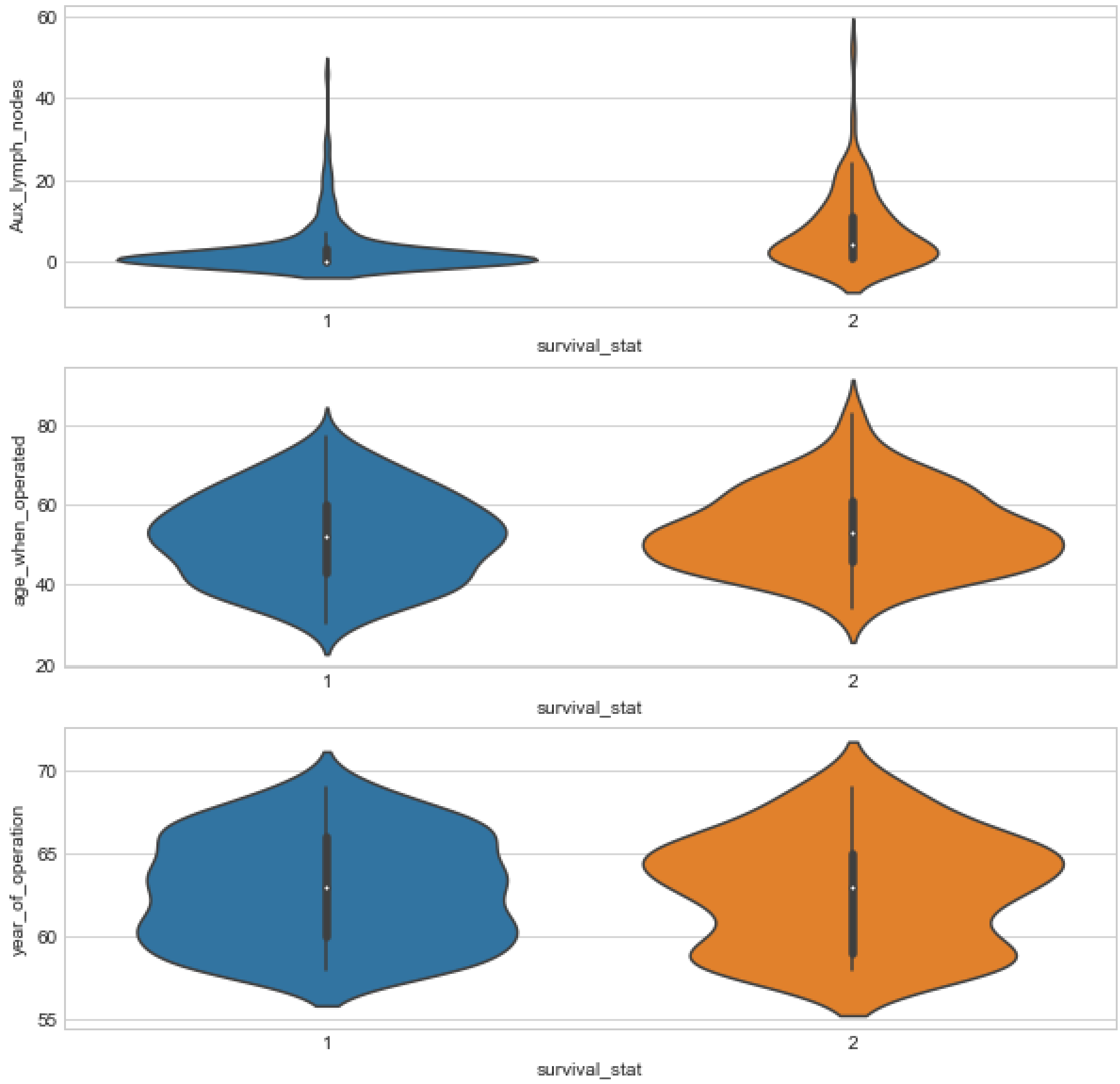
```
In [125]: #boxplot to get the value of 25/50 75 percentile value
          fig = plt.figure(figsize=(10,10))
          plt.subplot(3,1,1)
          sns.boxplot(x='survival_stat', y='Aux_lymph_nodes', data=canc_patnt)

          plt.subplot(3,1,2)
          sns.boxplot(x='survival_stat', y='age_when_operated', data=canc_patnt)

          plt.subplot(3,1,3)
          sns.boxplot(x='survival_stat', y='year_of_operation', data=canc_patnt)

          #observation:
          #1. min and 25% quantile have same value
          #2. all the patients had 0 Aux_lymph_nodes survived more(1)
          #3. those who were operated before 1960 , couldnt live more.
```

```
Out[125]: <matplotlib.axes._subplots.AxesSubplot at 0x12eda7b0>
```



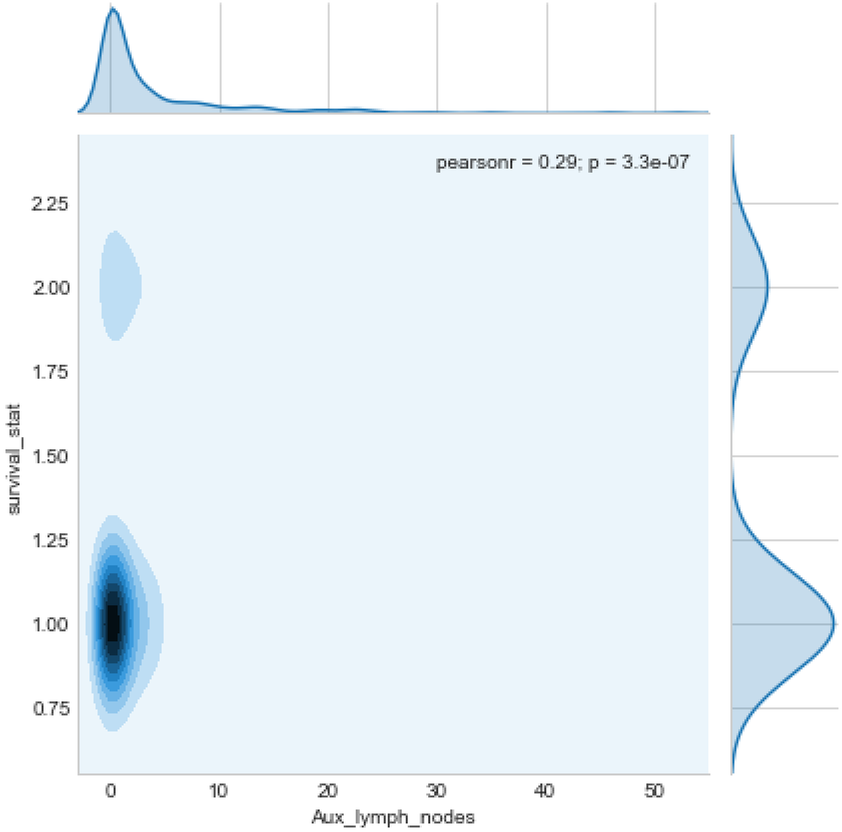
```
In [128]: fig = plt.figure(figsize=(10,10))
          plt.subplot(3,1,1)
          sns.violinplot(x='survival_stat', y='Aux_lymph_nodes', data=canc_patnt)

          plt.subplot(3,1,2)
          sns.violinplot(x='survival_stat', y='age_when_operated', data=canc_patnt)

          plt.subplot(3,1,3)
          sns.violinplot(x='survival_stat', y='year_of_operation', data=canc_patnt)
```

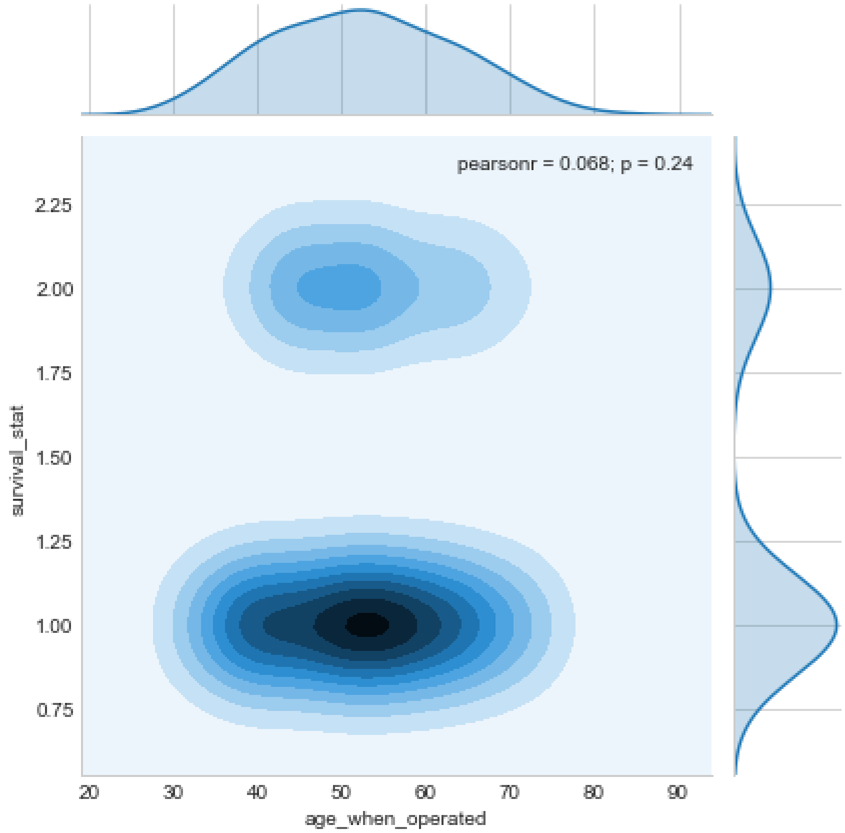
```
Out[128]: <matplotlib.axes._subplots.AxesSubplot at 0x13480270>
```

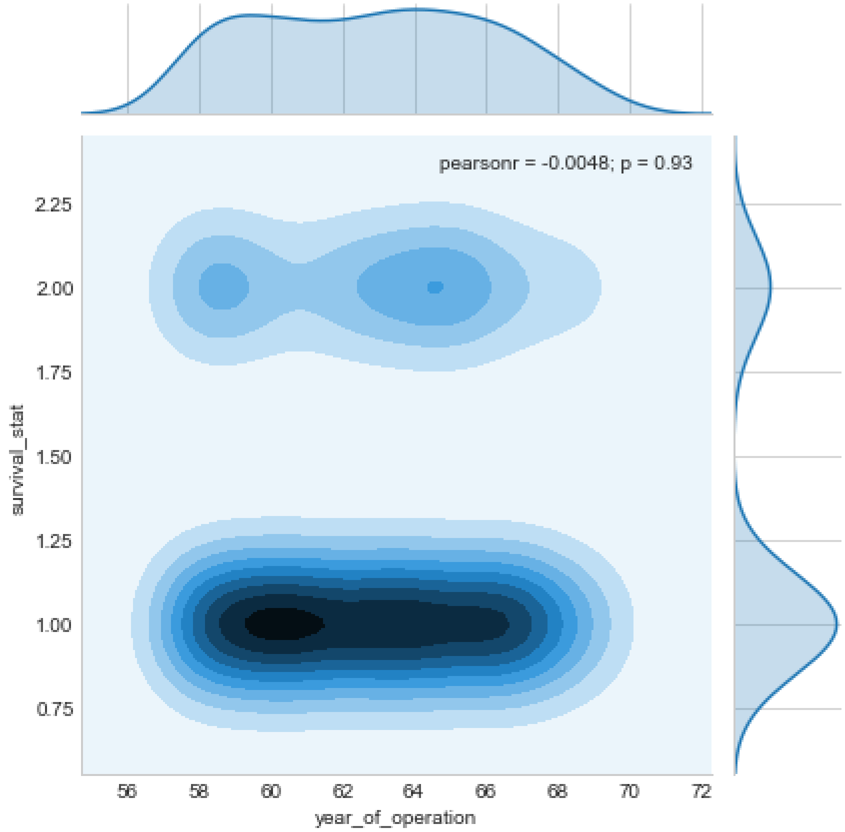


```
In [134]: fig = plt.Figure(figsize=(4,10), dpi=200)

          sns.jointplot(y='survival_stat', x='Aux_lymph_nodes', data=canc_patnt, kind='kde'
          sns.jointplot(y='survival_stat', x='age_when_operated', data=canc_patnt, kind='kd
          sns.jointplot(y='survival_stat', x='year_of_operation', data=canc_patnt, kind='kd

          #observation:
```

```
Out[134]: <seaborn.axisgrid.JointGrid at 0x167dafb0>
```




pearsonr = 0.068; p = 0.24
survival_stat
2.25
2.00
1.75
1.50
1.25
1.00
0.75
20
30
40
50
60
70
80
90
age_when_operated


pearsonr = -0.0048; p = 0.93
survival_stat
2.25
2.00
1.75
1.50
1.25
1.00
0.75
56
58
60
62
64
66
68
70
72
year_of_operation

Conclusion :

1. average age of pateients are ~52.4 2. class label is imbalaced as it has hetregenous count of 1(who survived more) & 2(who couldnt survive more) 3. 81 patients operated upon and who couldnt survived more(2) 4. 225 people were operated upon and could survive more.(1) 5. 306 people were operated upon in totality. 6. 1958 was the year when maximum no of cancer petients were operatoed upon.and 1969 was the year operation was minimum.max age of patients who survived and couldnt survive after battling cancer. 7. average person's age in who survived more and less list are ~52 and ~53 respectively. 8. the avgerage person's age in who survived more had lower no of Aux_lymph_nodes ~ lt 10 9. those who were operated before 1960 , couldnt live more 10. patients had 0 Aux_lymph_nodes survived more(1)

In [ ]:

```
```