In [13]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
df = pd.read_csv("haberman.csv",names=col)
```

In [14]:
```
#checking the number of datapoints in the dataset
df.shape
```

Out[14]:
```
(306, 4)
```

In [15]:
```
col = ['Patient_Age','Year_of_operation','positive_auxillary_nodes','status']
df = pd.read_csv("haberman.csv",names=col)
```

In [24]:
```
df.head()
```

Out[24]:

	Patient_Age	Year_of_operation	positive_auxillary_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

In [17]:
```
#Checking for balanced and imbalanced dataset
df["status"].value_counts()
```

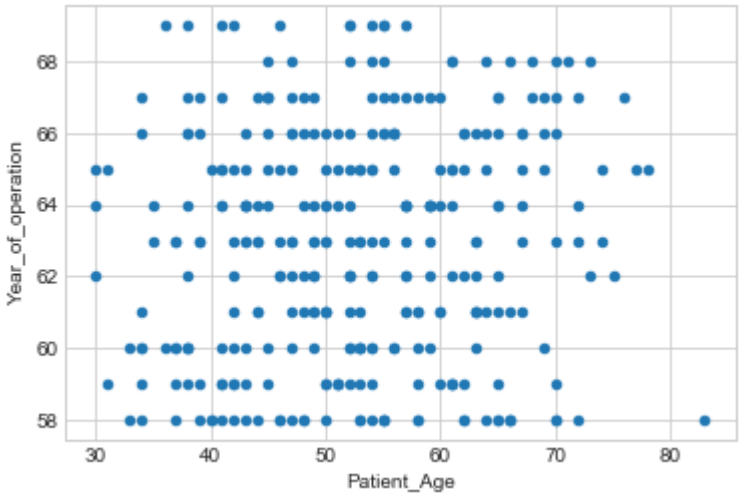
Out[17]:
```
1    225
2     81
Name: status, dtype: int64
```

```
**Observations:**

1)225 people survived more than or equal to 5 years .

2)81 people died within 5 years.
```

In [9]:
```
print(df.columns)
```

```
Index(['Patient_Age', 'Year_of_operation', 'positive_auxillary_nodes',
       'status'],
      dtype='object')
```

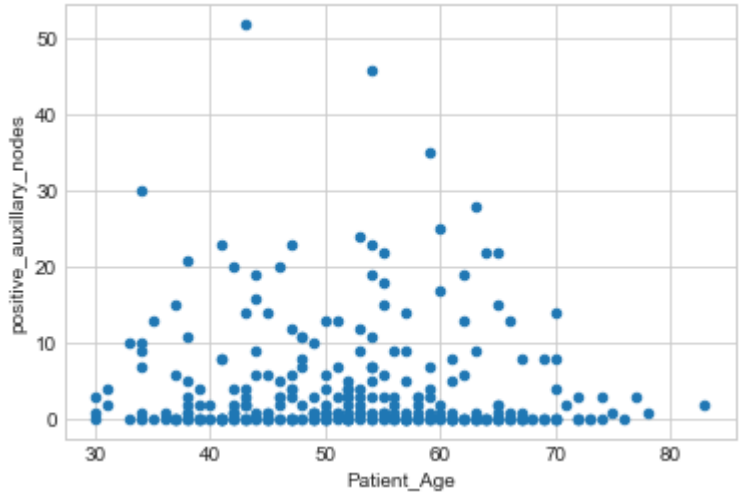
In [25]:
```
df.plot(kind='scatter', x='Patient_Age', y= 'Year_of_operation' ) ;
plt.show()
```



Observation:

1)It can be roughly said from the above plot mainly patients between the age 40 to 65 have the more number of operations.

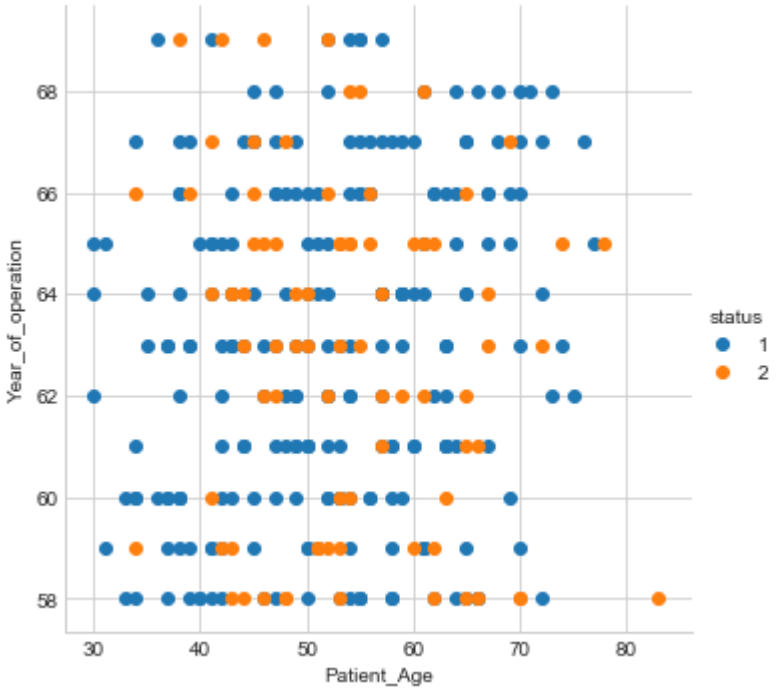
In [24]:
```
df.plot(kind='scatter', x='Patient_Age', y= 'positive_auxillary_nodes' ) ;
plt.show()
```



Observation:

1)It can be roughly said that people between the age 35 to 70 has highest number of positive auxillary nodes.

In [26]:
```
sns.set_style("whitegrid");
sns.FacetGrid(df, hue="status", size=5) \
   .map(plt.scatter, "Patient_Age", "Year_of_operation") \
   .add_legend();
plt.show();
```

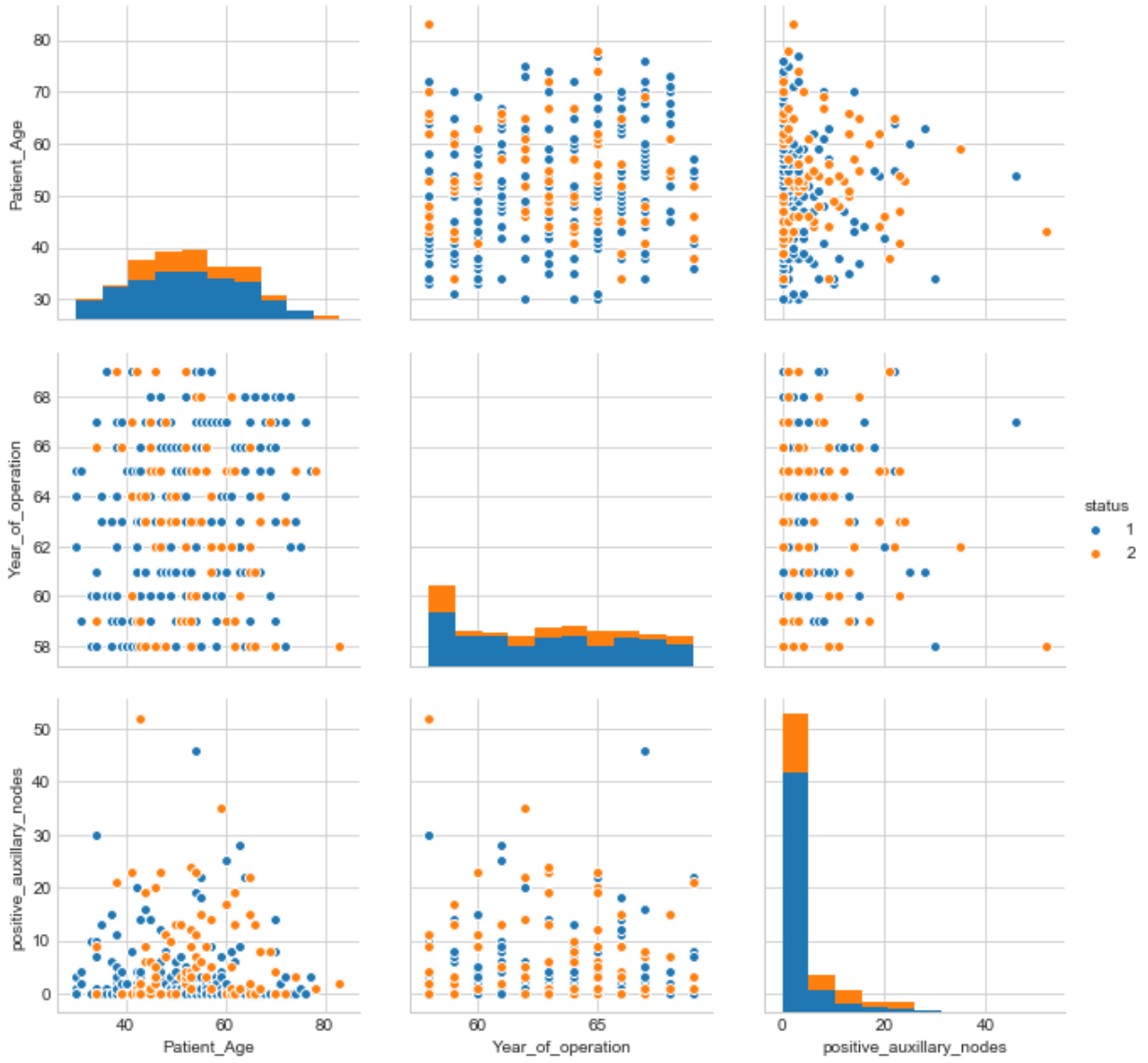


observation:

From the plot it can be roughly said that patients who survived less than 5 years are more between the age 42 to 62.

pair plot

In [28]:
```
plt.close()
sns.set_style("whitegrid")
sns.pairplot(df,hue="status", vars = ["Patient_Age", "Year_of_operation", "positi
plt.show()
```



Histogram, PDF, CDF

In [19]:
```
sns.FacetGrid(df, hue="status", size=5) \
   .map(sns.distplot, "Patient_Age") \
   .add_legend();
plt.show();
```

```
C:\Users\Yagnapooja\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462:
UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'de
nsity' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
C:\Users\Yagnapooja\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462:
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```

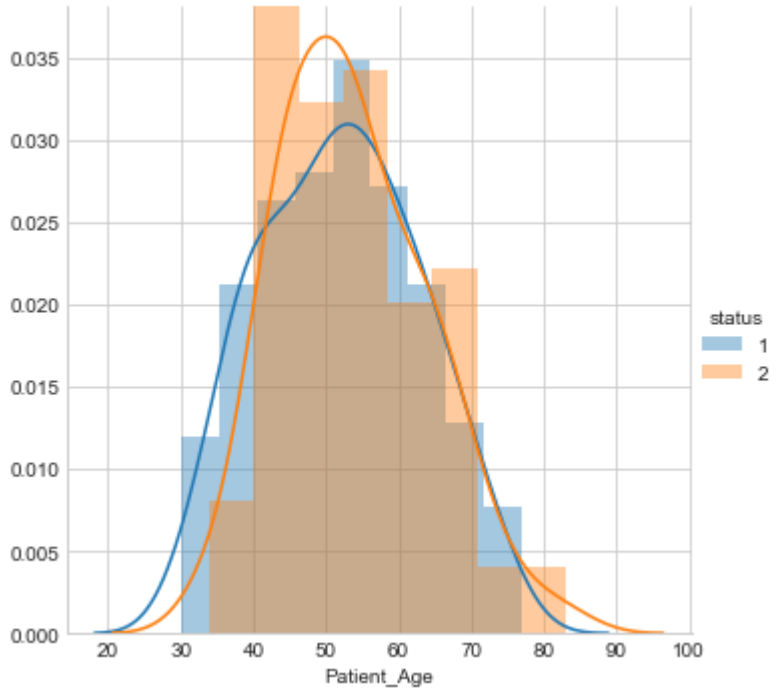

****Observation:****

1)In the given dataset people in age from 40 to 50 survived the least.

In [28]:
```
print("Mean age of patients survived:",round(np.mean(df[df['status']==1]['Patient
print("Mean age of patients not survived:",round(np.mean(df[df['status']==2]['Pat
```

```
Mean age of patients survived: 52
Mean age of patients not survived: 54
```

In [21]:
```
sns.FacetGrid(df, hue="status", size=5) \
   .map(sns.distplot, "Year_of_operation") \
   .add_legend();
plt.show();
```

```
C:\Users\Yagnapooja\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462:
UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'de
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```

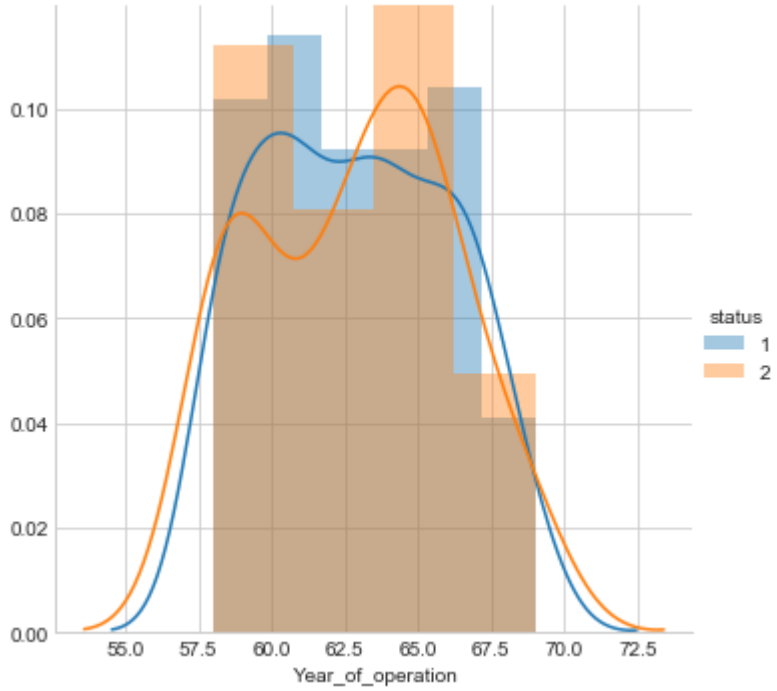

Observation:

1)Patients operated between the year 1963 and 1967 survived are less.

In [22]:
```
sns.FacetGrid(df, hue="status", size=5) \
   .map(sns.distplot, "positive_auxillary_nodes") \
   .add_legend();
plt.show();
```

```
C:\Users\Yagnapooja\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462:
UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'de
nsity' kwarg.
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
C:\Users\Yagnapooja\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462:
UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'de
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  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```
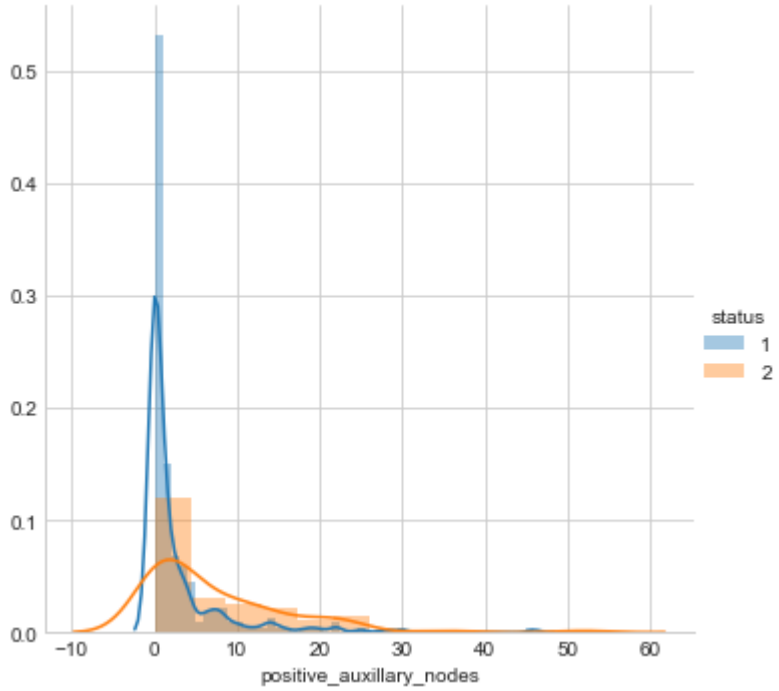
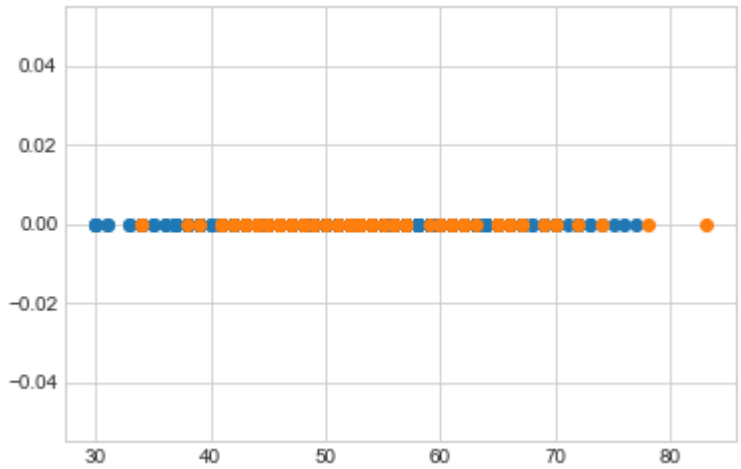



Observation:

1)It can be clearly seen that people with less number of nodes lived for more than 5 years.

In [54]:
```
survival = df[df['status']==1]
notsurvival = df[df['status']==2]
plt.plot(survival["Patient_Age"], np.zeros_like(survival['Patient_Age']), 'o')
plt.plot(notsurvival["Patient_Age"], np.zeros_like(notsurvival['Patient_Age']), '
```

Out[54]:
```
[<matplotlib.lines.Line2D at 0xbc48819b0>]
```

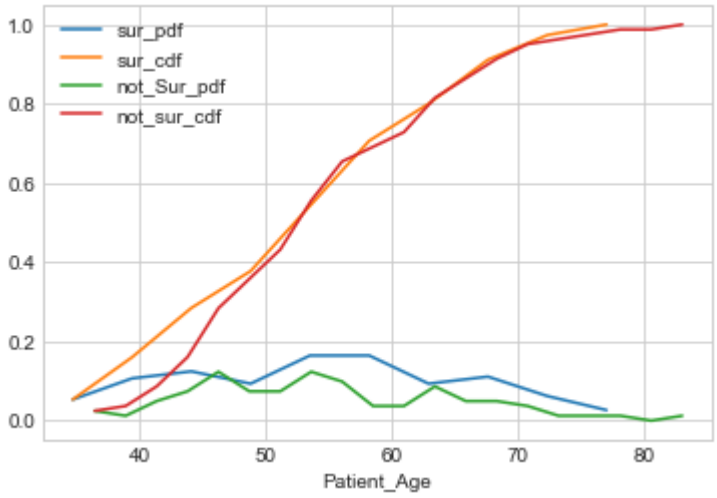


Observation:

1)From the plot the patients between the age 30 to 36 survived for more than 5 years.

In [55]:
```
counts, bin_edges = np.histogram(survival['Patient_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)


counts, bin_edges = np.histogram(notsurvival['Patient_Age'], bins=20,
                                 density = True)
pdf = counts/(sum(counts))
cdf = np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf);
plt.plot(bin_edges[1:], cdf);
plt.legend(['sur_pdf','sur_cdf','not_Sur_pdf','not_sur_cdf'])
plt.xlabel('Patient_Age')
plt.show();
```

```
[0.05333333 0.10666667 0.12444444 0.09333333 0.16444444 0.16444444
 0.09333333 0.11111111 0.06222222 0.02666667]
[30.  34.7 39.4 44.1 48.8 53.5 58.2 62.9 67.6 72.3 77. ]
```

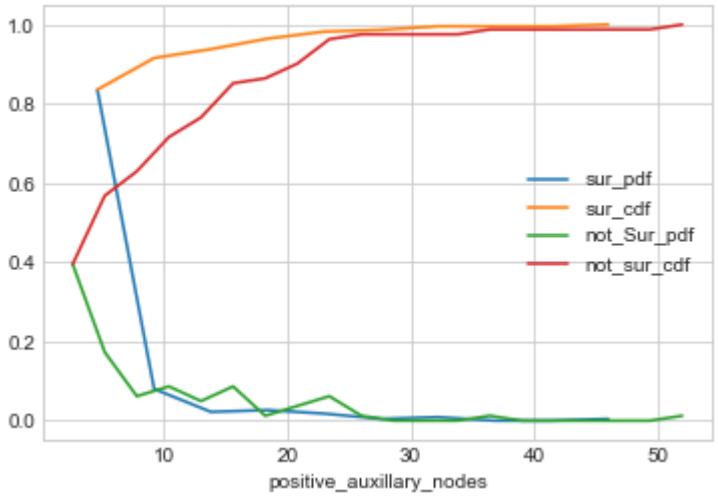


Observation:

1)patients who are having age above 75 are not survived.

In [53]:
```
counts, bin_edges = np.histogram(survival['positive_auxillary_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)


counts, bin_edges = np.histogram(notsurvival['positive_auxillary_nodes'], bins=20
                                 density = True)
pdf = counts/(sum(counts))
cdf = np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf);
plt.plot(bin_edges[1:], cdf);
plt.legend(['sur_pdf','sur_cdf','not_Sur_pdf','not_sur_cdf'])
plt.xlabel('positive_auxillary_nodes')
plt.show();
```

```
[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. ]
```



Observation:

1)Patients who are having auxilary nodes more than 45 are not survived.

In [39]:
```
survival.describe()
```

Out[39]:

	Patient_Age	Year_of_operation	positive_auxillary_nodes	status
count	225.000000	225.000000	225.000000	225.0
mean	52.017778	62.862222	2.791111	1.0
std	11.012154	3.222915	5.870318	0.0
min	30.000000	58.000000	0.000000	1.0
25%	43.000000	60.000000	0.000000	1.0
50%	52.000000	63.000000	0.000000	1.0
75%	60.000000	66.000000	3.000000	1.0
max	77.000000	69.000000	46.000000	1.0

In [40]:
```
notsurvival.describe()
```

Out[40]:

	Patient_Age	Year_of_operation	positive_auxillary_nodes	status
count	81.000000	81.000000	81.000000	81.0
mean	53.679012	62.827160	7.456790	2.0
std	10.167137	3.342118	9.185654	0.0
min	34.000000	58.000000	0.000000	2.0
25%	46.000000	59.000000	1.000000	2.0
50%	53.000000	63.000000	4.000000	2.0
75%	61.000000	65.000000	11.000000	2.0
max	83.000000	69.000000	52.000000	2.0

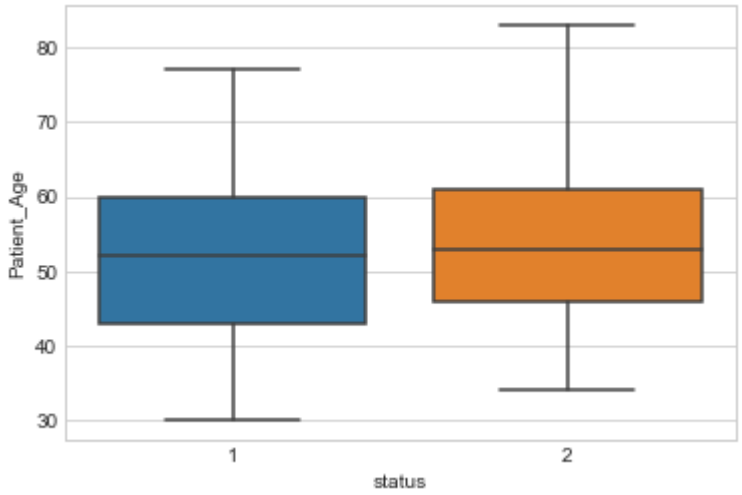
In [57]:
```
#Median, Quantiles, Percentiles, IQR.
print("For Patient age")

print("\nMedians:")
print(np.median(survival["Patient_Age"]))
print(np.median(notsurvival["Patient_Age"]))

print("\nQuantiles:")
print(np.percentile(survival["Patient_Age"],np.arange(0, 100, 25)))
print(np.percentile(notsurvival["Patient_Age"],np.arange(0, 100, 25)))

print("\n90th Percentiles:")
print(np.percentile(survival["Patient_Age"],90))
print(np.percentile(notsurvival["Patient_Age"],90))

from statsmodels import robust
print ("\nMedian Absolute Deviation")
print(robust.mad(survival["Patient_Age"]))
print(robust.mad(notsurvival["Patient_Age"]))
```

```
For Patient age

Medians:
52.0
53.0

Quantiles:
[30. 43. 52. 60.]
[34. 46. 53. 61.]

90th Percentiles:
67.0
67.0

Median Absolute Deviation
13.343419966550417
11.860817748044816
```

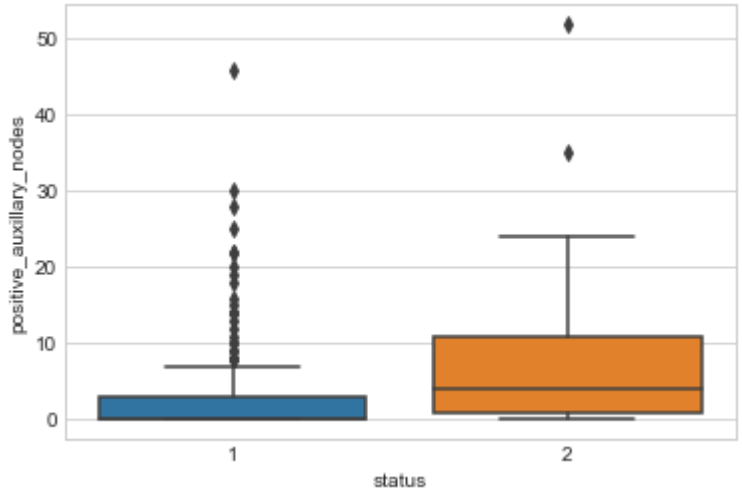
In [62]:
```
#Median, Quantiles, Percentiles, IQR.
print("For positive_auxillary_nodes")

print("\nMedians:")
print(np.median(survival["positive_auxillary_nodes"]))
print(np.median(notsurvival["positive_auxillary_nodes"]))

print("\nQuantiles:")
print(np.percentile(survival["positive_auxillary_nodes"],np.arange(0, 100, 25)))
print(np.percentile(notsurvival["positive_auxillary_nodes"],np.arange(0, 100, 25)

print("\n90th Percentiles:")
print(np.percentile(survival["positive_auxillary_nodes"],90))
print(np.percentile(notsurvival["positive_auxillary_nodes"],90))

from statsmodels import robust
print ("\nMedian Absolute Deviation")
print(robust.mad(survival["positive_auxillary_nodes"]))
print(robust.mad(notsurvival["positive_auxillary_nodes"]))
```

```
For positive_auxillary_nodes

Medians:
0.0
4.0

Quantiles:
[0. 0. 0. 3.]
[ 0.  1.  4. 11.]

90th Percentiles:
8.0
20.0

Median Absolute Deviation
0.0
5.930408874022408
```

In [51]:
```
sns.boxplot(x='status',y='Patient_Age', data=df)
plt.show()
```



In [45]:
```
sns.boxplot(x='status',y='positive_auxillary_nodes', data=df)
plt.show()
```



Observation:

1)From the box plot 'positive auxillary nodes' can be used as a good feature to differentiate status 1 and 2.

In [49]:
```
g = (sns.jointplot("Year_of_operation", "Patient_Age",data=df, color="k").plot_jo
```

```
C:\Users\Yagnapooja\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6462:
UserWarning: The 'normed' kwarg is deprecated, and has been replaced by the 'de
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  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```

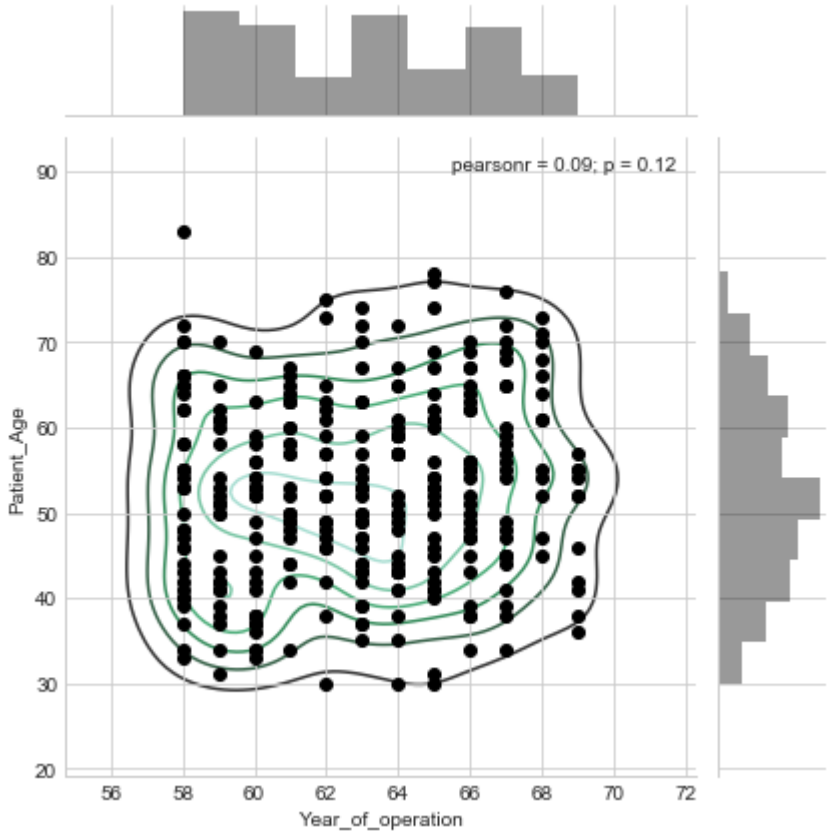

****Observation:****

1)There are more number of people undergone operation during the year 1960 - 1965 period
and between ages 40 - 62.
2)The correlation between the two attributes is very low.