In [5]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [6]:

```
data=pd.read_csv("haberman1.csv")
```

In [7]:

```
data
```

Out[7]:

	Age	op_year	axil_node	surv_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
5	33	58	10	1
6	33	60	0	1
7	34	59	0	2
8	34	66	9	2
9	34	58	30	1
10	34	60	1	1
11	34	61	10	1
12	34	67	7	1
13	34	60	0	1
14	35	64	13	1
15	35	63	0	1
16	36	60	1	1
17	36	69	0	1
18	37	60	0	1
19	37	63	0	1
20	37	58	0	1
21	37	59	6	1
22	37	60	15	1
23	37	63	0	1
24	38	69	21	2
25	38	59	2	1
26	38	60	0	1
27	38	60	0	1
28	38	62	3	1
29	38	64	1	1
...	...	...	...	...

	Age	op_year	axil_node	surv_stat
276	67	66	0	1
277	67	61	0	1
278	67	65	0	1
279	68	67	0	1
280	68	68	0	1
281	69	67	8	2
282	69	60	0	1
283	69	65	0	1
284	69	66	0	1
285	70	58	0	2
286	70	58	4	2
287	70	66	14	1
288	70	67	0	1
289	70	68	0	1
290	70	59	8	1
291	70	63	0	1
292	71	68	2	1
293	72	63	0	2
294	72	58	0	1
295	72	64	0	1
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

306 rows × 4 columns

In [30]:

```
# #Total Classes in our dataset
data.columns
```

Out[30]:

```
Index(['Age', 'op_year', 'axil_node', 'surv_stat'], dtype='object')
```

In [33]:

```
#How many data points are there (Total rows and columns)
data.shape
```

Out[33]:

```
(306, 4)
```

In [34]:

```
# shows the total people survived from Breast cancer are denoted by 1 else 2
data["surv_stat"].value_counts()
```

Out[34]:

```
1    225
2     81
Name: surv_stat, dtype: int64
```

In [13]:

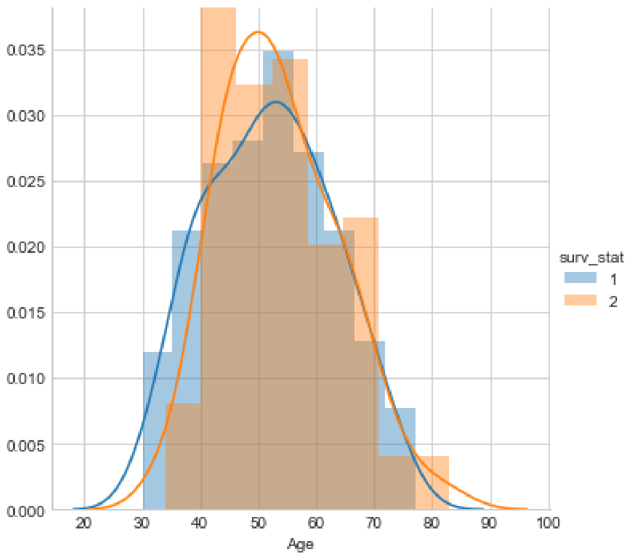
```
#Getting mean,median,std  of our data set
data.describe()
```

Out[13]:

	Age	op_year	axil_node	surv_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 [79]:

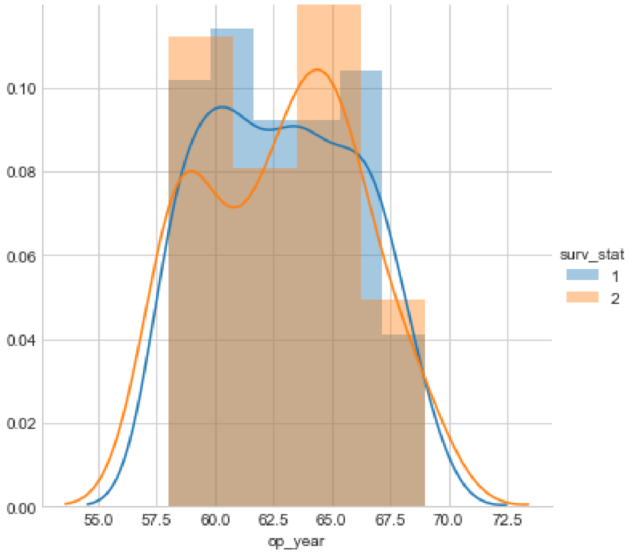
```
#           OBJECTIVE-
# ** To Predict whether the patient will survive or not depends upon the patient's age,
##    year of treatment and the number of positive lymph nodes **

# Univariate analysis
import warnings
warnings.filterwarnings("ignore")
sns.FacetGrid(data,hue="surv_stat",size=5)\
   .map(sns.distplot,"Age")\
.add_legend();
plt.show();
```



In [65]:

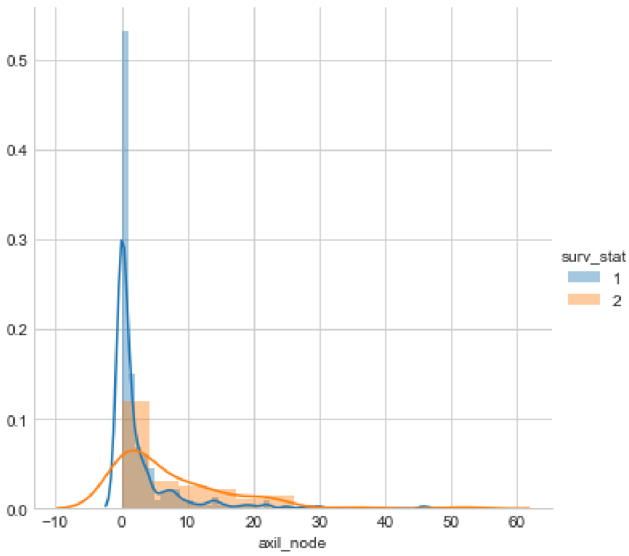
```
import warnings
warnings.filterwarnings("ignore")
```

```
sns.FacetGrid(data,hue="surv_stat",size=5)\
   .map(sns.distplot,"op_year")\
   .add_legend();
plt.show();
```



In [66]:

```
import warnings
warnings.filterwarnings("ignore")
sns.FacetGrid(data,hue="surv_stat",size=5)\
   .map(sns.distplot,"axil_node")\
     .add_legend();
plt.show();
```



In [28]:

```
# 1)the above op_year and Age are overlapping with each other  compare to axil_node so axil_node
# 2)axil_node is the best feature to predict Survivval rate
# 3)at age 55 there is the less number of people survived
# 4)till axil node 5 large number of people survived
```

In [17]:

```
#PDF and CDF

Survived=data.loc[data['surv_stat']==1]
not_Survived=data.loc[data['surv_stat']==2]
```

In [55]:

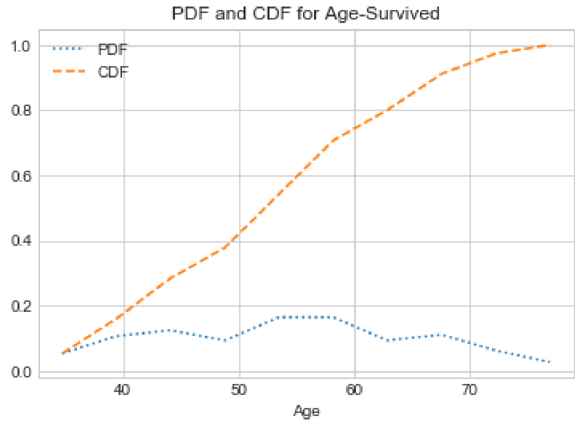
```
  #PDF and CDF for Age Survived
```

```
#PDF and CDF for Age Survived
counts,bin_edges=np.histogram(Survived['Age'],bins=10,density=True)
pdf=counts/sum(counts)
print(pdf);
print(bin_edges);
cdf=np.cumsum(pdf);
plt.plot(bin_edges[1:],pdf,ls='dotted',label='PDF')
plt.plot(bin_edges[1:],cdf,ls='--',label='CDF')
plt.xlabel("Age")
plt.legend();
plt.title('PDF and CDF for Age-Survived')
```

```
[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. ]
```

Out[55]:

```
Text(0.5,1,'PDF and CDF for Age-Survived')
```



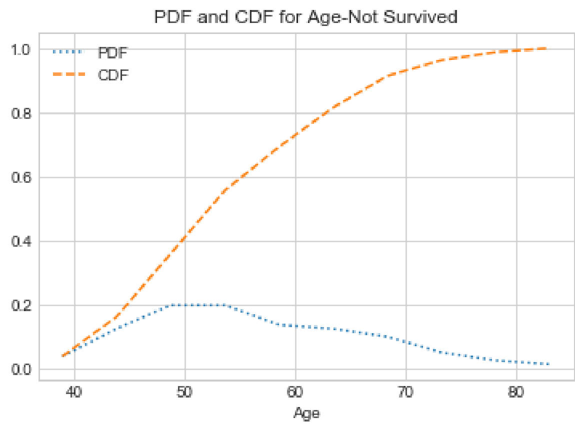
In [56]:

```
#PDF and CDF for Age Not survived
counts,bin_edges=np.histogram(not_Survived['Age'],bins=10,density=True)
pdf=counts/sum(counts)
print(pdf);
print(bin_edges);
cdf=np.cumsum(pdf);
plt.plot(bin_edges[1:],pdf,ls='dotted',label='PDF')
plt.plot(bin_edges[1:],cdf,ls='--',label='CDF')
plt.xlabel("Age")
plt.legend();
plt.title('PDF and CDF for Age-Not Survived')
```

```
[0.03703704 0.12345679 0.19753086 0.19753086 0.13580247 0.12345679
 0.09876543 0.04938272 0.02469136 0.01234568]
[34.  38.9 43.8 48.7 53.6 58.5 63.4 68.3 73.2 78.1 83. ]
```

Out[56]:

```
Text(0.5,1,'PDF and CDF for Age-Not Survived')
```



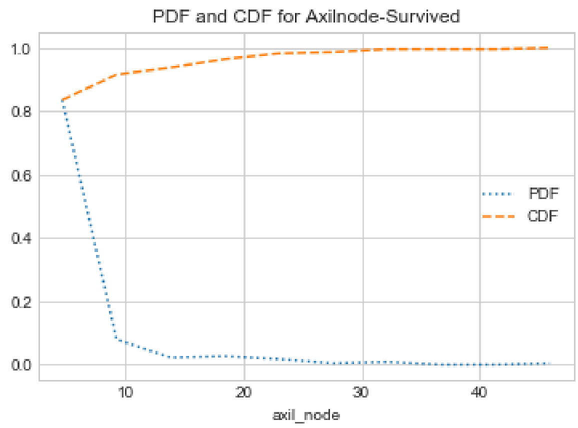
In [57]:

```
#PDF and CDF for Axil_node Survived

counts,bin_edges=np.histogram(Survived['axil_node'],bins=10,density=True)
pdf=counts/sum(counts);
print(pdf);
print(bin_edges)
cdf=np.cumsum(pdf)
plt.xlabel("axil_node")
plt.plot(bin_edges[1:],pdf,ls='dotted',label='PDF')
plt.plot(bin_edges[1:],cdf,ls='--',label='CDF')
plt.legend();
plt.title('PDF and CDF for Axilnode-Survived')
```

```
[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. ]
```

Out[57]:

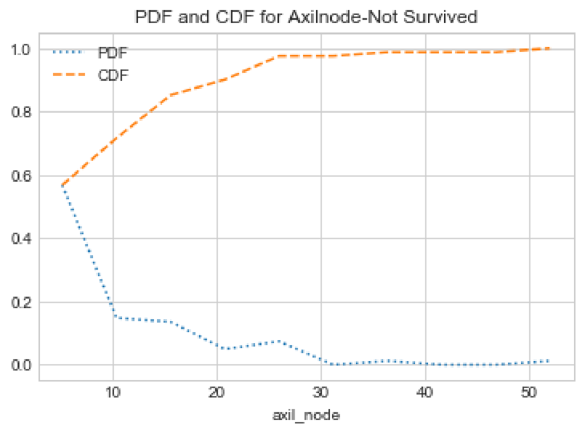
```
Text(0.5,1,'PDF and CDF for Axilnode-Survived')
```



In [58]:

```
#PDF and CDF for Axil_node not_Survived
counts,bin_edges=np.histogram(not_Survived['axil_node'],bins=10,density=True)
pdf=counts/sum(counts)
print(pdf);
cdf=np.cumsum(pdf);
plt.plot(bin_edges[1:],pdf,ls='dotted',label='PDF')
plt.plot(bin_edges[1:],cdf,ls='--',label='CDF')
plt.xlabel("axil_node")
plt.legend();
plt.title('PDF and CDF for Axilnode-Not Survived')
plt.show()
```

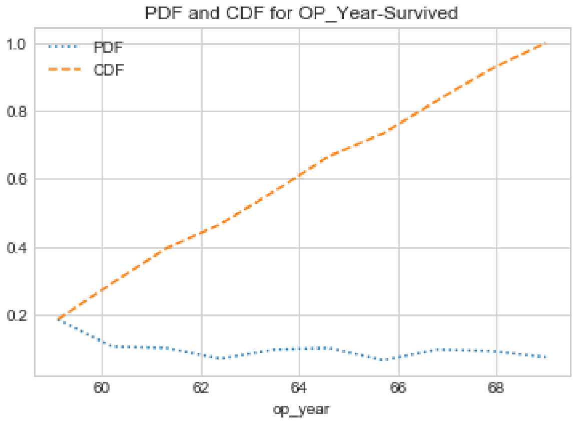
```
[0.56790123 0.14814815 0.13580247 0.04938272 0.07407407 0.
 0.01234568 0.         0.         0.01234568]
```



In [59]:

```
#PDF and CDF for OP_Year Survived
counts,bin_edges=np.histogram(Survived['op_year'],bins=10,density=True)
pdf=counts/sum(counts);
print(pdf);
cdf=np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf,ls='dotted',label='PDF')
plt.plot(bin_edges[1:],cdf,ls='--',label='CDF')
plt.xlabel("op_year")
plt.legend();
plt.title('PDF and CDF for OP_Year-Survived')
plt.show()
```

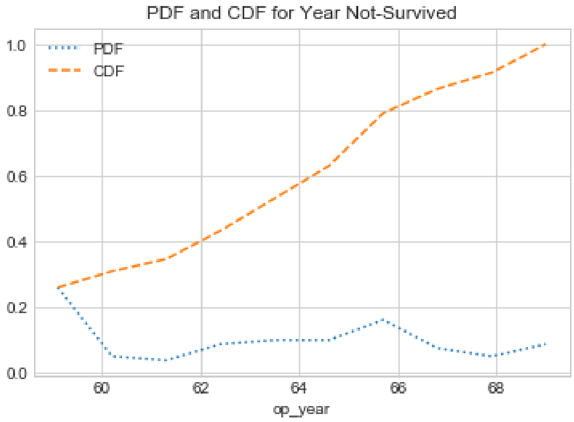
```
[0.18666667 0.10666667 0.10222222 0.07111111 0.09777778 0.10222222
 0.06666667 0.09777778 0.09333333 0.07555556]
```



In [60]:

```
#PDF and CDF for OP_Year not survived
counts,bin_edges=np.histogram(not_Survived['op_year'],bins=10,density=True)
pdf=counts/sum(counts);
print(pdf);
cdf=np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf,ls='dotted',label='PDF')
plt.plot(bin_edges[1:],cdf,ls='--',label='CDF')
plt.xlabel("op_year")
plt.legend();
plt.title('PDF and CDF for Year Not-Survived')
plt.show()
```

```
[0.25925926 0.04938272 0.03703704 0.08641975 0.09876543 0.09876543
 0.16049383 0.07407407 0.04938272 0.08641975]
```

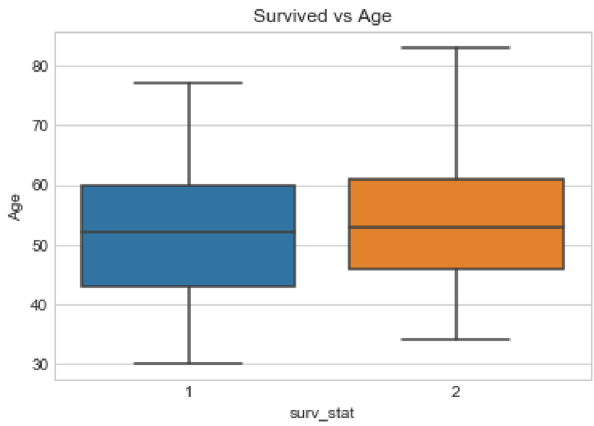


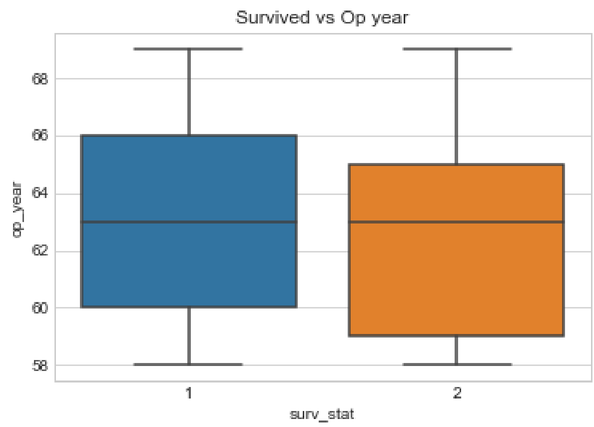
In [94]:

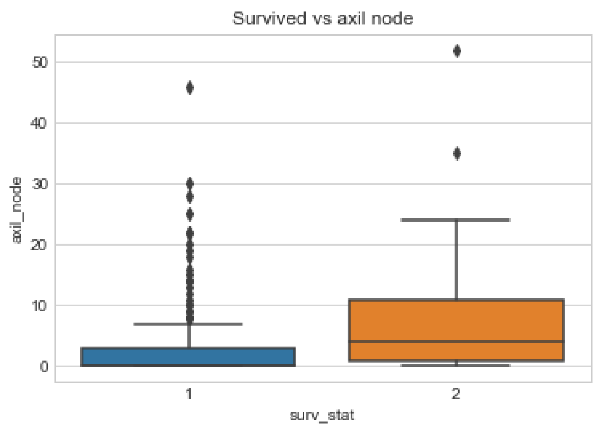
```
                    ##Observations From univariate analysis ##
#1)From above cdf Year of operation plays a least importance for classification
#2)if axillary nodes increases there is less probability of survival rate
#3)About 80% of the patients have less than 5 nodes
#4)The patients treated between 1964-1966 have most probably high survival rate
```

In [61]:

```
#Boxplot
sns.boxplot(x='surv_stat',y='Age',data=data)
plt.title("Survived vs Age")
plt.show()
sns.boxplot(x='surv_stat',y='op_year',data=data)
plt.title('Survived vs Op year')
plt.show()
sns.boxplot(x='surv_stat',y='axil_node',data=data)
plt.title("Survived vs axil node")
plt.show()
```



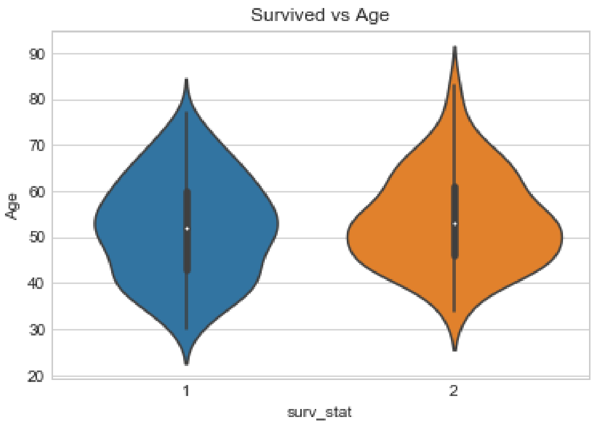


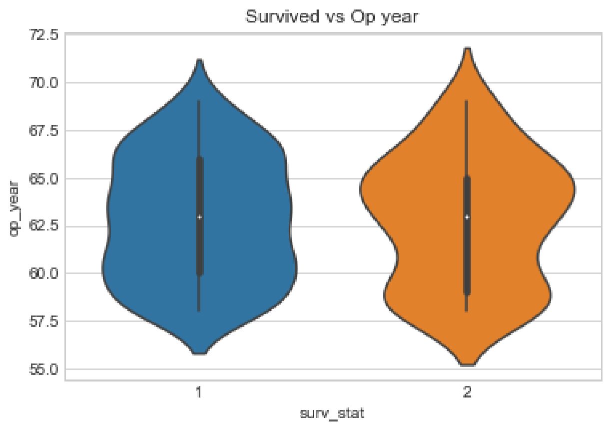


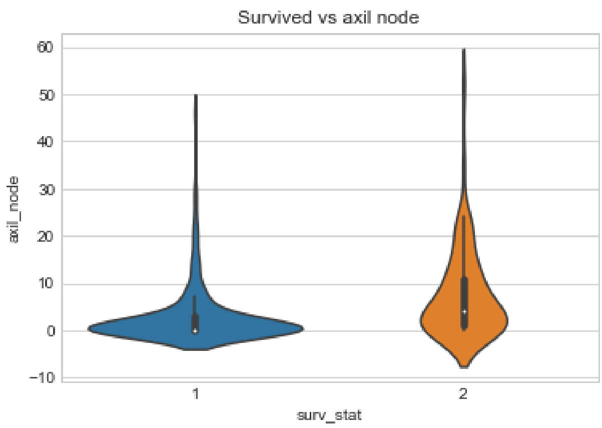
In [62]:

```
    ## observations from Boxplot##
## 1)75% of the patients have less than 5 axil nodes
  #2)The age of operation year of 75% of the patients are between 64-66

    #violinplot
sns.violinplot(x='surv_stat',y='Age',data=data)
plt.title("Survived vs Age")
plt.show()
sns.violinplot(x='surv_stat',y='op_year',data=data)
```

```
plt.title('Survived vs Op year')
plt.show()
sns.violinplot(x='surv_stat',y='axil_node',data=data)
plt.title("Survived vs axil node")
plt.show()
```

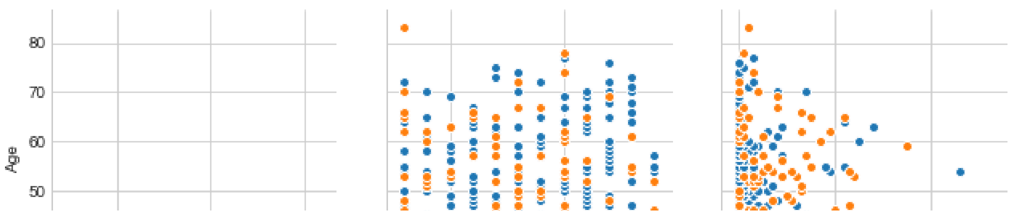






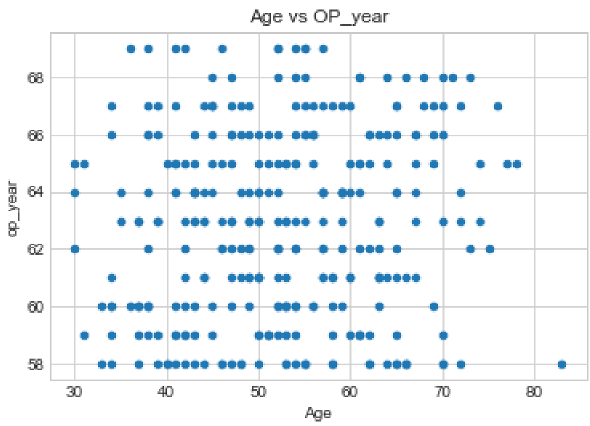
In [78]:

```
#Multivariate Analysis

sns.set_style("whitegrid")
sns.pairplot(data,
             x_vars=['Age','op_year','axil_node'],
             y_vars=['Age','op_year','axil_node'],
                     hue='surv_stat',size=3)
plt.title('Pairplot')
plt.show()
```



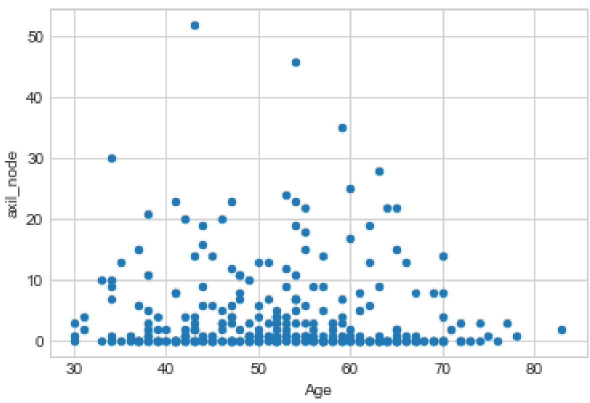
In [76]:

```
data.plot(kind='scatter',x='Age',y='op_year')
plt.title('Age vs OP_year')
plt.show()
```



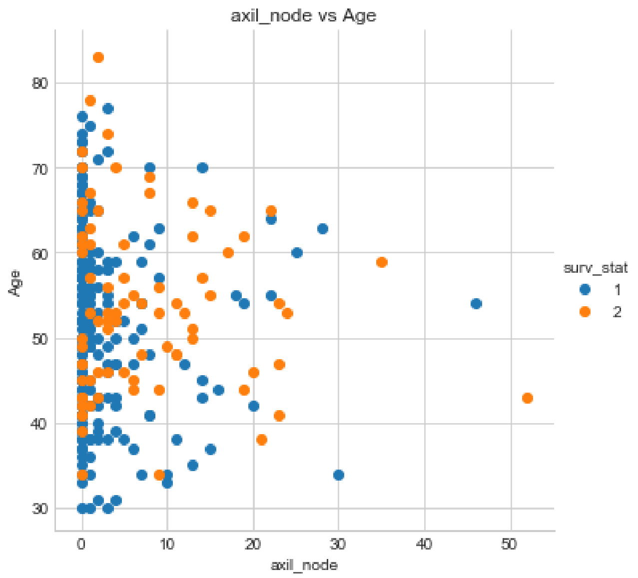
In [110]:

```
data.plot(kind='scatter',x='Age',y='axil_node')
plt.show()
```



In [75]:

```
sns.set_style("whitegrid");
sns.FacetGrid(data,hue="surv_stat",size=5)\
.map(plt.scatter,"axil_node","Age")\
.add_legend();
plt.title('axil_node vs Age')
plt.show();
```

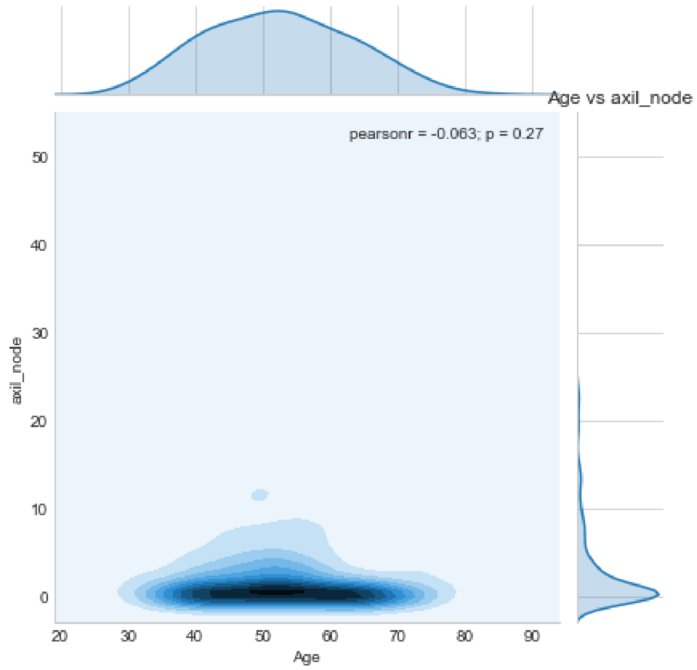


In [116]:

```
#From above Box plot people who are having less number of axil_nodes are having high Survivalrate
#So axil node is one of the important feature`
#So the person with zero axil_node are having high Survival rate
#Year of operation is not having any importance in classification
#Most survival rate is between the age of 46-60
```

In [73]:

```
sns.jointplot(x="Age",y="axil_node",data=data,kind="kde")
plt.title('Age vs axil_node')
plt.show();
```



In [121]:

```
#maximum people who are having the less axil node are between the age of 45-65
```

In [ ]:

```
# observations from bivariate analysis ##
# Axil node and op_year can help us to classify better
#Maximum people who are having the less axil nodes are between the age of45-65
```