

In [1]:

```
1 import pandas as pd
2 import numpy as np
3 import matplotlib.pyplot as plt
4 %matplotlib inline
5 import seaborn as sns
6 from IPython import get_ipython
7 import warnings
8 warnings.filterwarnings("ignore")
```

In [2]:

```
1 data = pd.read_csv('lung_cancer_data.csv')
```

In [3]:

```
1 data.head()
```

Out[3]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	CHRONIC DISEASE	FATIGUE	AI
0	M	69	1	2	2	1	1	2	
1	M	74	2	1	1	1	2	2	
2	F	59	1	1	1	2	1	2	
3	M	63	2	2	2	1	1	1	
4	F	63	1	2	1	1	1	1	

In [4]:

```
1 data.tail()
```

Out[4]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	CHRONIC DISEASE	FATIGUE	
304	F	56	1	1	1	2	2	2	
305	M	70	2	1	1	1	1	2	
306	M	58	2	1	1	1	1	1	
307	M	67	2	1	2	1	1	2	
308	M	62	1	1	1	2	1	2	

In [5]:



```
1 data.shape
```

Out[5]:

```
(309, 16)
```

In [6]:



```
1 data.columns
```

Out[6]:

```
Index(['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY',  
      'PEER_PRESSURE', 'CHRONIC DISEASE', 'FATIGUE ', 'ALLERGY ', 'WHEEZI  
NG',  
      'ALCOHOL CONSUMING', 'COUGHING', 'SHORTNESS OF BREATH',  
      'SWALLOWING DIFFICULTY', 'CHEST PAIN', 'LUNG_CANCER'],  
      dtype='object')
```

In [7]:



```
1 data.duplicated().sum()
```

Out[7]:

```
33
```

In [9]:



```
1 data = data.drop_duplicates()
```

In [10]:



```
1 data.isnull().sum()
```

Out[10]:

```
GENDER          0  
AGE             0  
SMOKING         0  
YELLOW_FINGERS  0  
ANXIETY         0  
PEER_PRESSURE   0  
CHRONIC DISEASE 0  
FATIGUE         0  
ALLERGY         0  
WHEEZING        0  
ALCOHOL CONSUMING 0  
COUGHING        0  
SHORTNESS OF BREATH 0  
SWALLOWING DIFFICULTY 0  
CHEST PAIN      0  
LUNG_CANCER     0  
dtype: int64
```

In [11]:

```
1 data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 276 entries, 0 to 283
Data columns (total 16 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   GENDER                                276 non-null    object
1   AGE                                  276 non-null    int64
2   SMOKING                              276 non-null    int64
3   YELLOW_FINGERS                       276 non-null    int64
4   ANXIETY                              276 non-null    int64
5   PEER_PRESSURE                        276 non-null    int64
6   CHRONIC_DISEASE                      276 non-null    int64
7   FATIGUE                             276 non-null    int64
8   ALLERGY                              276 non-null    int64
9   WHEEZING                             276 non-null    int64
10  ALCOHOL_CONSUMING                    276 non-null    int64
11  COUGHING                             276 non-null    int64
12  SHORTNESS_OF_BREATH                  276 non-null    int64
13  SWALLOWING_DIFFICULTY                276 non-null    int64
14  CHEST_PAIN                           276 non-null    int64
15  LUNG_CANCER                          276 non-null    object
dtypes: int64(14), object(2)
memory usage: 36.7+ KB
```

In [12]:

```
1 data.describe()
```

Out[12]:

	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	CHRONIC_DISEASE	
count	276.000000	276.000000	276.000000	276.000000	276.000000	276.000000	27
mean	62.909420	1.543478	1.576087	1.496377	1.507246	1.521739	
std	8.379355	0.499011	0.495075	0.500895	0.500856	0.500435	
min	21.000000	1.000000	1.000000	1.000000	1.000000	1.000000	
25%	57.750000	1.000000	1.000000	1.000000	1.000000	1.000000	
50%	62.500000	2.000000	2.000000	1.000000	2.000000	2.000000	
75%	69.000000	2.000000	2.000000	2.000000	2.000000	2.000000	
max	87.000000	2.000000	2.000000	2.000000	2.000000	2.000000	

In [13]:

```
1 from sklearn import preprocessing
```

In [14]:

```
1 label_encoder = preprocessing.LabelEncoder()
```

In [15]:

```
1 data['GENDER'] = label_encoder.fit_transform(data['GENDER'])
2 data['LUNG_CANCER'] = label_encoder.fit_transform(data['LUNG_CANCER'])
```

In [17]:

```
1 data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 276 entries, 0 to 283
Data columns (total 16 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   GENDER                                276 non-null    int32
1   AGE                                   276 non-null    int64
2   SMOKING                              276 non-null    int64
3   YELLOW_FINGERS                       276 non-null    int64
4   ANXIETY                              276 non-null    int64
5   PEER_PRESSURE                        276 non-null    int64
6   CHRONIC DISEASE                      276 non-null    int64
7   FATIGUE                              276 non-null    int64
8   ALLERGY                              276 non-null    int64
9   WHEEZING                             276 non-null    int64
10  ALCOHOL CONSUMING                    276 non-null    int64
11  COUGHING                             276 non-null    int64
12  SHORTNESS OF BREATH                  276 non-null    int64
13  SWALLOWING DIFFICULTY                276 non-null    int64
14  CHEST PAIN                           276 non-null    int64
15  LUNG_CANCER                          276 non-null    int32
dtypes: int32(2), int64(14)
memory usage: 34.5 KB
```

In [16]:

```
1 data.head()
```

Out[16]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	CHRONIC DISEASE	FATIGUE	AI
0	1	69	1	2	2	1	1	2	
1	1	74	2	1	1	1	2	2	
2	0	59	1	1	1	2	1	2	
3	1	63	2	2	2	1	1	1	
4	0	63	1	2	1	1	1	1	

In [18]:



```
1 data.nunique()
```

Out[18]:

```
GENDER          2
AGE             39
SMOKING          2
YELLOW_FINGERS   2
ANXIETY          2
PEER_PRESSURE    2
CHRONIC DISEASE  2
FATIGUE          2
ALLERGY          2
WHEEZING         2
ALCOHOL CONSUMING 2
COUGHING         2
SHORTNESS OF BREATH 2
SWALLOWING DIFFICULTY 2
CHEST PAIN       2
LUNG_CANCER      2
dtype: int64
```

In [19]:



```
1 data.columns
```

Out[19]:

```
Index(['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY',
      'PEER_PRESSURE', 'CHRONIC DISEASE', 'FATIGUE ', 'ALLERGY ', 'WHEEZI
NG',
      'ALCOHOL CONSUMING', 'COUGHING', 'SHORTNESS OF BREATH',
      'SWALLOWING DIFFICULTY', 'CHEST PAIN', 'LUNG_CANCER'],
      dtype='object')
```

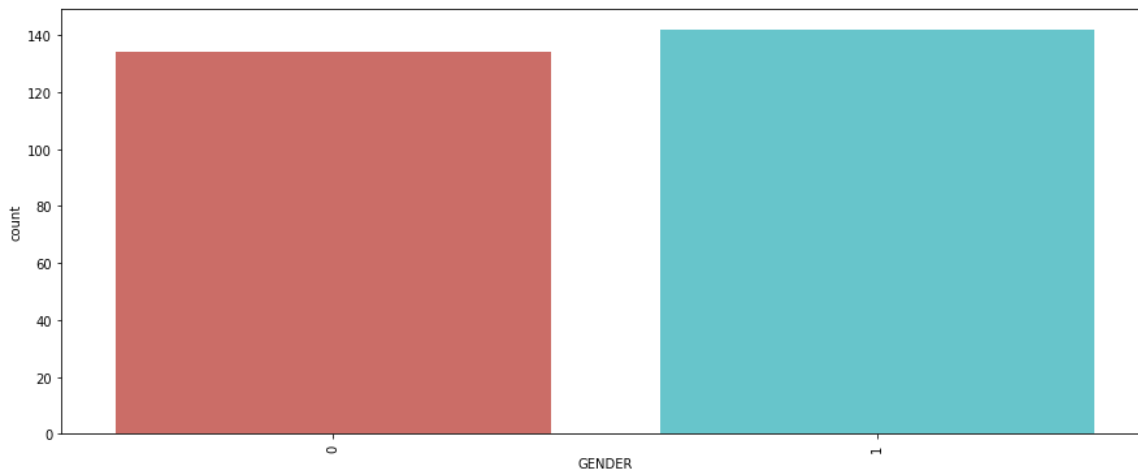
In [20]:



```
1 data_new = data[['GENDER', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY',
2                  'PEER_PRESSURE', 'CHRONIC DISEASE', 'FATIGUE ', 'ALLERGY ', 'WHEEZING',
3                  'ALCOHOL CONSUMING', 'COUGHING', 'SHORTNESS OF BREATH',
4                  'SWALLOWING DIFFICULTY', 'CHEST PAIN', 'LUNG_CANCER']]
```

In [21]:

```
1 for i in data_new.columns:
2     plt.figure(figsize=(15,6))
3     sns.countplot(data_new[i], data = data_new,
4                   palette = 'hls')
5     plt.xticks(rotation = 90)
6     plt.show()
```



In [22]:

```
1 for i in data_new.columns:
2     data_new[i].value_counts().plot(kind='pie',
3                                     figsize=(8, 8),
4                                     autopct='%1.1f%%')
5     plt.xticks(rotation = 90)
6     plt.show()
```

In [23]:

```
1 data_new['LUNG_CANCER'].unique()
```

Out[23]:

```
array([1, 0])
```

In [24]:

```
1 data_new['LUNG_CANCER'].value_counts()
```

Out[24]:

```
1    238
0     38
Name: LUNG_CANCER, dtype: int64
```

In [26]:

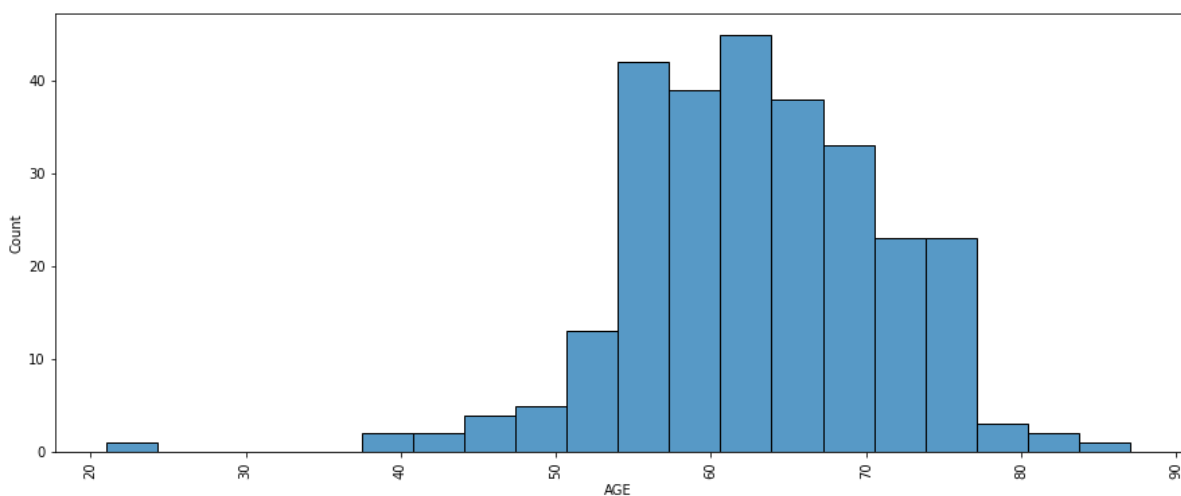
```
100. * 1data_new.LUNG_CANCER.value_counts() / len(data_new.LUNG_CANCER)
```

Out[26]:

```
1    86.231884
0    13.768116
Name: LUNG_CANCER, dtype: float64
```

In [29]:

```
1 plt.figure(figsize=(15,6))
2 sns.histplot(data['AGE'])
3 plt.xticks(rotation = 90)
4 plt.show()
```



In [31]:

```
1 data_new['GENDER'].unique()
```

Out[31]:

```
array([1, 0])
```

In [30]:

```
1 data_new['GENDER'].value_counts()
```

Out[30]:

```
1    142
```

```
0    134
```

```
Name: GENDER, dtype: int64
```

In [32]:

```
1 100. * data_new.GENDER.value_counts() / len(data_new.GENDER)
```

Out[32]:

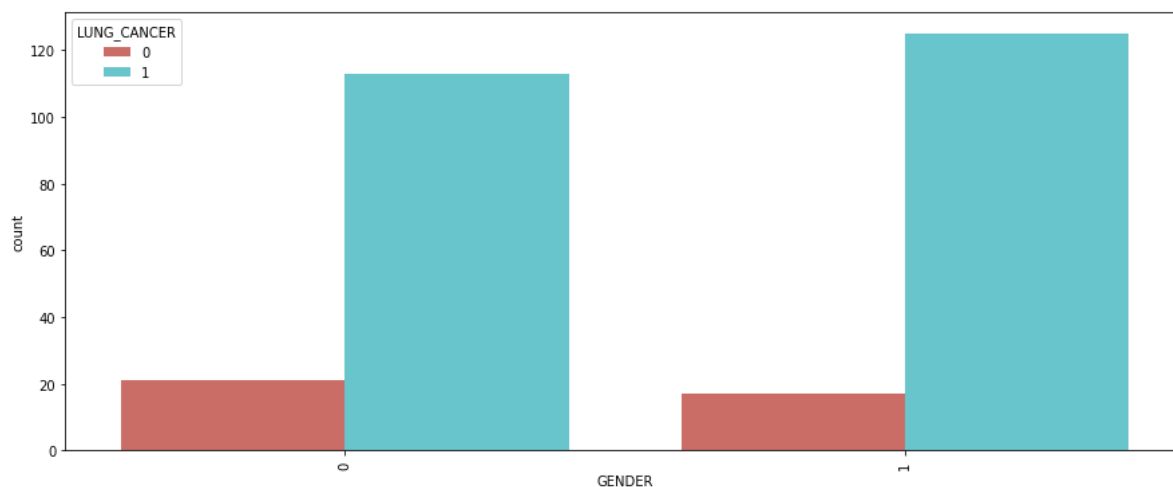
```
1    51.449275
```

```
0    48.550725
```

```
Name: GENDER, dtype: float64
```

In [33]:

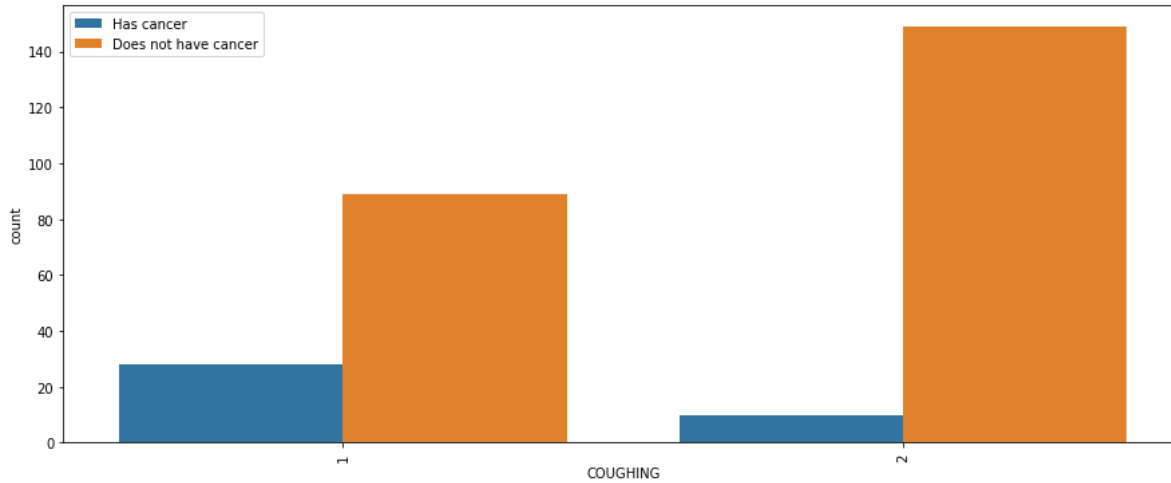
```
1 plt.figure(figsize=(15,6))
2 sns.countplot('GENDER', data = data_new, hue = 'LUNG_CANCER',
3               palette = 'hls')
4 plt.xticks(rotation = 90)
5 plt.show()
```



In [35]:



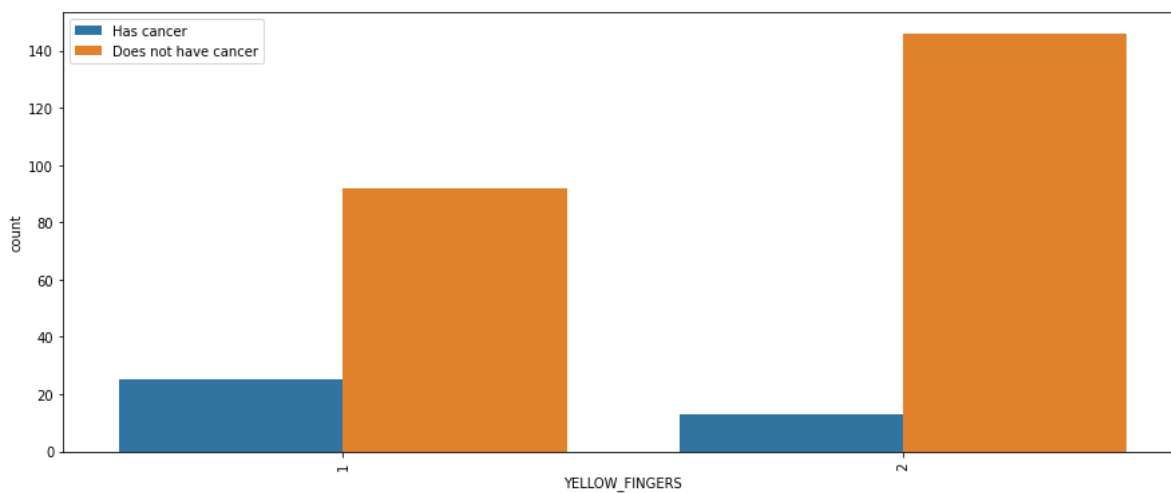
```
1 plt.figure(figsize=(15,6))
2 sns.countplot(data=data_new,x='COUGHING',hue='LUNG_CANCER')
3 plt.legend(["Has cancer", 'Does not have cancer'])
4 plt.xticks(rotation = 90)
5 plt.show()
```



In [36]:



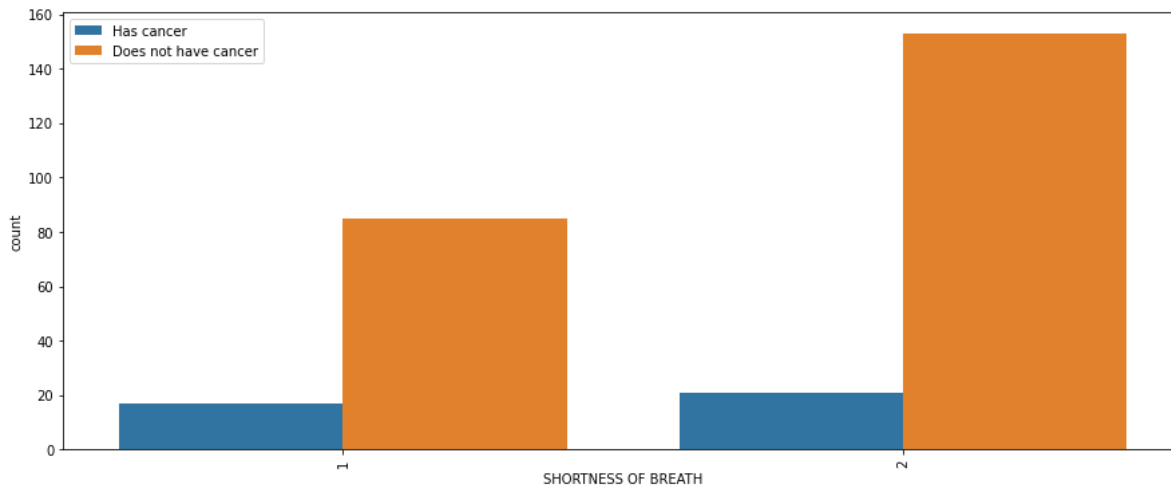
```
1 plt.figure(figsize=(15,6))
2 sns.countplot(data=data_new,x='YELLOW_FINGERS',hue='LUNG_CANCER')
3 plt.legend(["Has cancer", 'Does not have cancer'])
4 plt.xticks(rotation = 90)
5 plt.show()
```



In [37]:



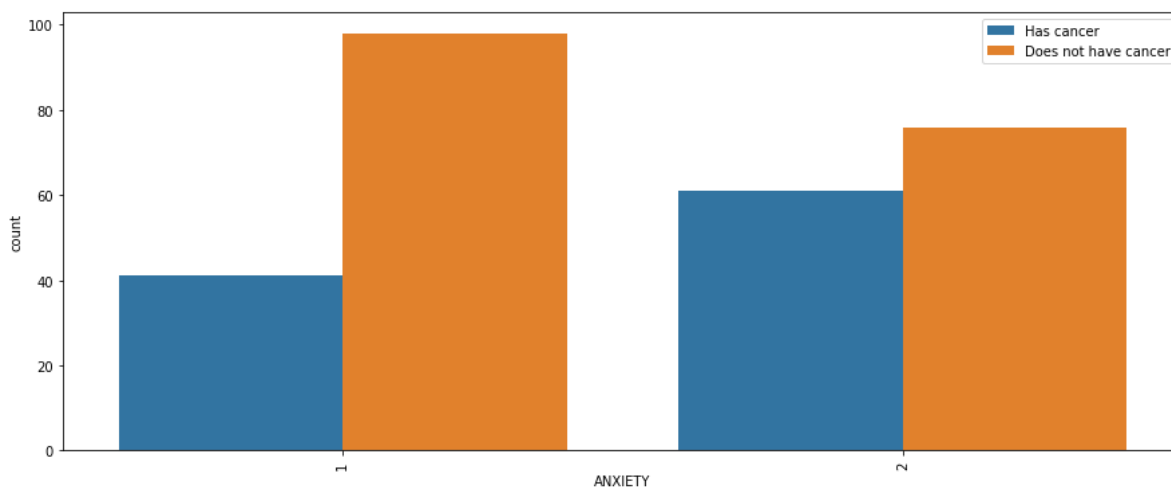
```
1 plt.figure(figsize=(15,6))
2 sns.countplot(data=data_new,x='SHORTNESS OF BREATH',hue='LUNG_CANCER')
3 plt.legend(["Has cancer", 'Does not have cancer'])
4 plt.xticks(rotation = 90)
5 plt.show()
```



In [38]:



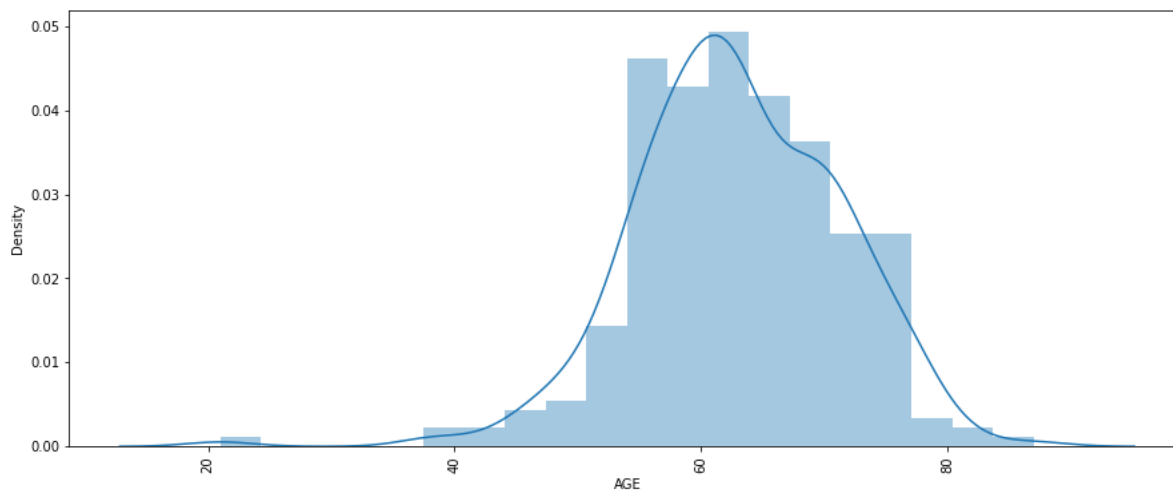
```
1 plt.figure(figsize=(15,6))
2 sns.countplot(data=data_new,x='ANXIETY',hue='SHORTNESS OF BREATH')
3 plt.legend(["Has cancer", 'Does not have cancer'])
4 plt.xticks(rotation = 90)
5 plt.show()
```



In [40]:



```
1 plt.figure(figsize=(15,6))
2 sns.distplot(data['AGE'])
3 plt.xticks(rotation = 90)
4 plt.show()
```

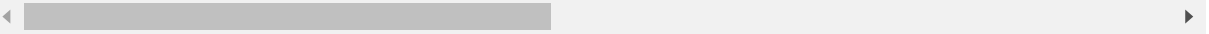


In [41]:

```
1 corrmat = data_new.corr()  
2 corrmat
```

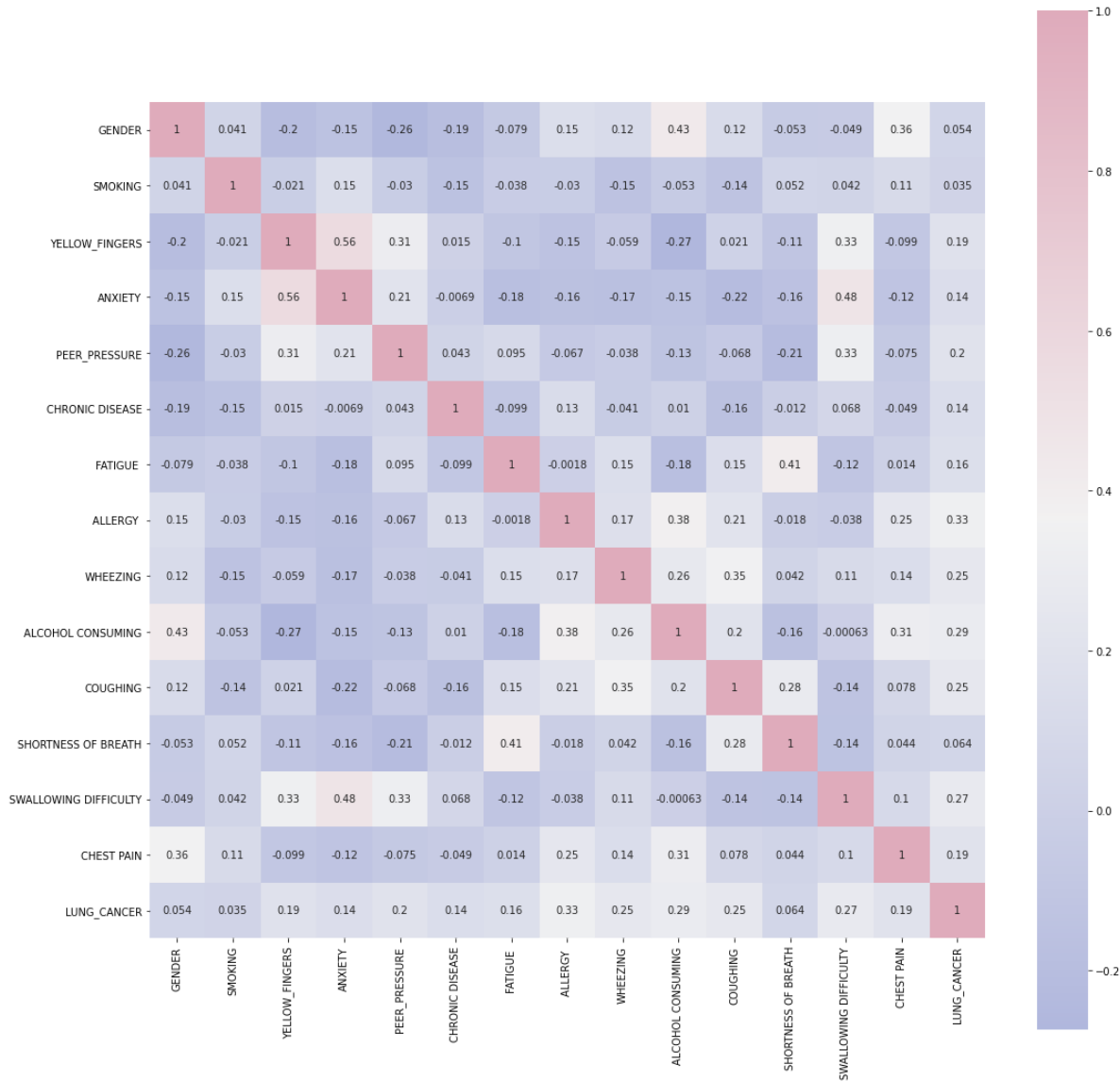
Out[41]:

	GENDER	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	CHRONI DISEAS
GENDER	1.000000	0.041131	-0.202506	-0.152032	-0.261427	-0.18992
SMOKING	0.041131	1.000000	-0.020799	0.153389	-0.030364	-0.14941
YELLOW_FINGERS	-0.202506	-0.020799	1.000000	0.558344	0.313067	0.01531
ANXIETY	-0.152032	0.153389	0.558344	1.000000	0.210278	-0.00693
PEER_PRESSURE	-0.261427	-0.030364	0.313067	0.210278	1.000000	0.04289
CHRONIC DISEASE	-0.189925	-0.149415	0.015316	-0.006938	0.042893	1.00000
FATIGUE	-0.079020	-0.037803	-0.099644	-0.181474	0.094661	-0.09941
ALLERGY	0.150174	-0.030179	-0.147130	-0.159451	-0.066887	0.13430
WHEEZING	0.121047	-0.147081	-0.058756	-0.174009	-0.037769	-0.04054
ALCOHOL CONSUMING	0.434264	-0.052771	-0.273643	-0.152228	-0.132603	0.01014
COUGHING	0.120228	-0.138553	0.020803	-0.218843	-0.068224	-0.16081
SHORTNESS OF BREATH	-0.052893	0.051761	-0.109959	-0.155678	-0.214115	-0.01176
SWALLOWING DIFFICULTY	-0.048959	0.042152	0.333349	0.478820	0.327764	0.06826
CHEST PAIN	0.361547	0.106984	-0.099169	-0.123182	-0.074655	-0.04889
LUNG_CANCER	0.053666	0.034878	0.189192	0.144322	0.195086	0.14369



In [42]:

```
1 cmap = sns.diverging_palette(260,-10,s=50, l=75, n=6,  
2                               as_cmap=True)  
3 plt.subplots(figsize=(18,18))  
4 sns.heatmap(corrmat,cmap= cmap,annot=True, square=True)  
5 plt.show()
```



In [43]:

```
1 x = data_new.drop('LUNG_CANCER', axis = 1)
2 y = data_new['LUNG_CANCER']
```

In [44]:

```
1 from sklearn.model_selection import train_test_split
2 x_train, x_test, y_train, y_test= train_test_split(x, y,
3                                                    test_size= 0.25,
4                                                    random_state=0)
```

In [45]:

```
1 from sklearn.linear_model import LogisticRegression
2 classifier= LogisticRegression(random_state=0)
3 classifier.fit(x_train, y_train)
```

Out[45]:

LogisticRegression(random_state=0)

In [46]:

```
1 y_pred= classifier.predict(x_test)
```

In [47]:

```
1 from sklearn.metrics import accuracy_score, mean_absolute_error , mean_squared_error
```

In [48]:

```
1 from sklearn.metrics import plot_roc_curve
```

In [50]:

```
1 print("Mean absolute error is ",( mean_absolute_error(y_test,y_pred)))
2 print("Mean squared error is " , mean_squared_error(y_test,y_pred))
3 print("Median absolute error is " ,median_absolute_error(y_test,y_pred))
4 print("Accuracy is " , round(accuracy_score(y_test,y_pred)*100,2),"%")
5 print("F1 score: " , round(f1_score(y_test,y_pred, average='weighted')*100,2),"%")
```

Mean absolute error is 0.10144927536231885

Mean squared error is 0.10144927536231885

Median absolute error is 0.0

Accuracy is 89.86 %

F1 score: 90.08 %

In [51]:



```
1 matrix = confusion_matrix(y_test, y_pred, labels=[1,0])
2 print('Confusion matrix : \n',matrix)
3
4 tp, fn, fp, tn = confusion_matrix(y_test,y_pred,labels=[1,0]).reshape(-1)
5 print('Outcome values : \n', tp, fn, fp, tn)
6
7 matrix = classification_report(y_test,y_pred,labels=[1,0])
8 print('Classification report : \n',matrix)
```

Confusion matrix :

```
[[56  4]
 [ 3  6]]
```

Outcome values :

56 4 3 6

Classification report :

	precision	recall	f1-score	support
1	0.95	0.93	0.94	60
0	0.60	0.67	0.63	9
accuracy			0.90	69
macro avg	0.77	0.80	0.79	69
weighted avg	0.90	0.90	0.90	69