In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
from IPython import get_ipython
import warnings
warnings.filterwarnings("ignore")
```

In [2]:

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

In [3]:

```
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]:

```
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]:

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

In [15]:

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

In [17]:

```
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]:

```
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]:

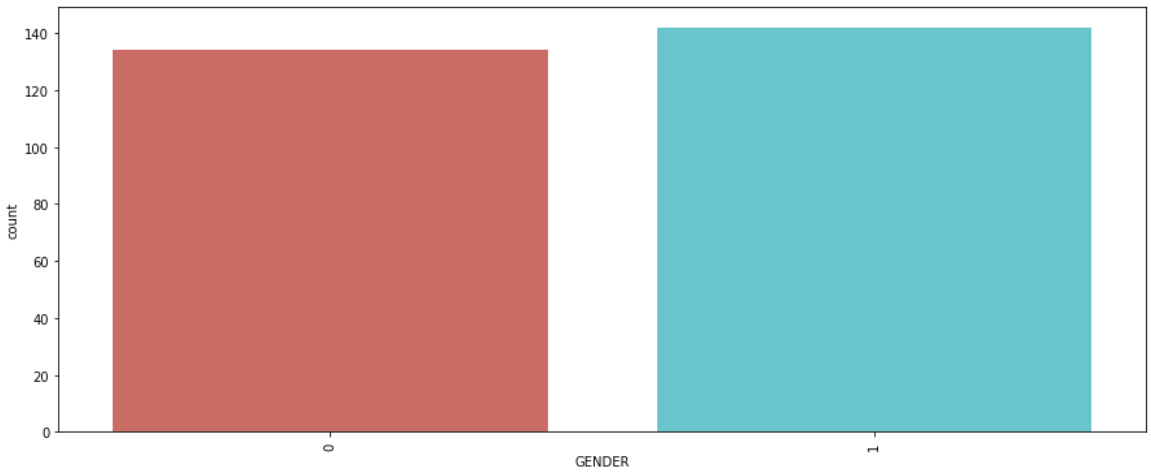
```
Index(['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY',
       'PEER_PRESSURE', 'CHRONIC DISEASE', 'FATIGUE ', 'ALLERGY ', 'WHEEZI
NG',
       'ALCOHOL CONSUMING', 'COUGHING', 'SHORTNESS OF BREATH',
       'SWALLOWING DIFFICULTY', 'CHEST PAIN', 'LUNG_CANCER'],
      dtype='object')
```

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]:

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



In [22]:

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

In [23]:

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

Out[23]:

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

In [24]:

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

Out[24]:

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

In [26]:

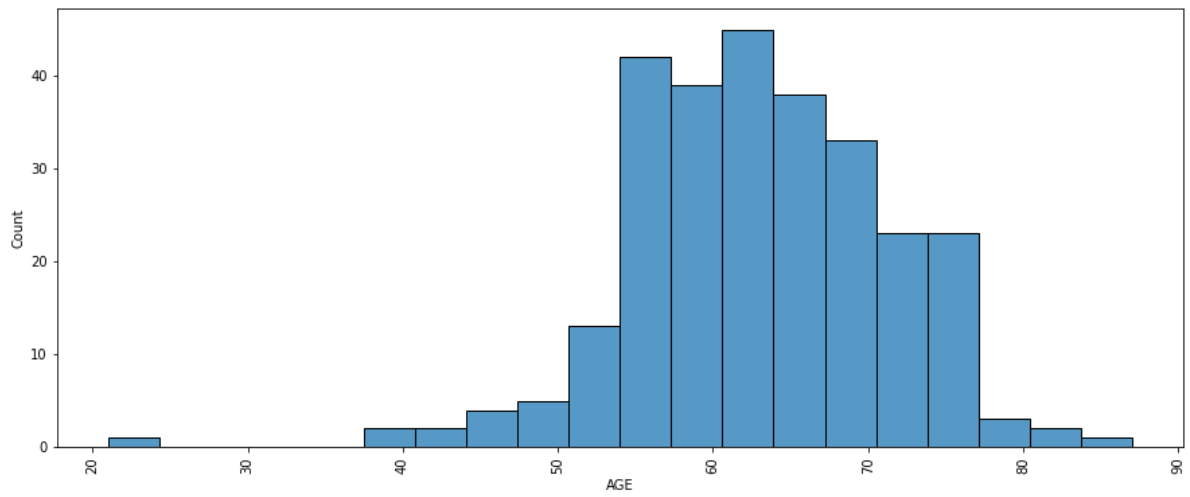
```
100. *1data_new.LUNG_CANCER.value_counts() / len(data_new.LUNG_CANCER)
```

Out[26]:

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

In [29]:

```
plt.figure(figsize=(15,6))
sns.histplot(data['AGE'])
plt.xticks(rotation = 90)
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]:

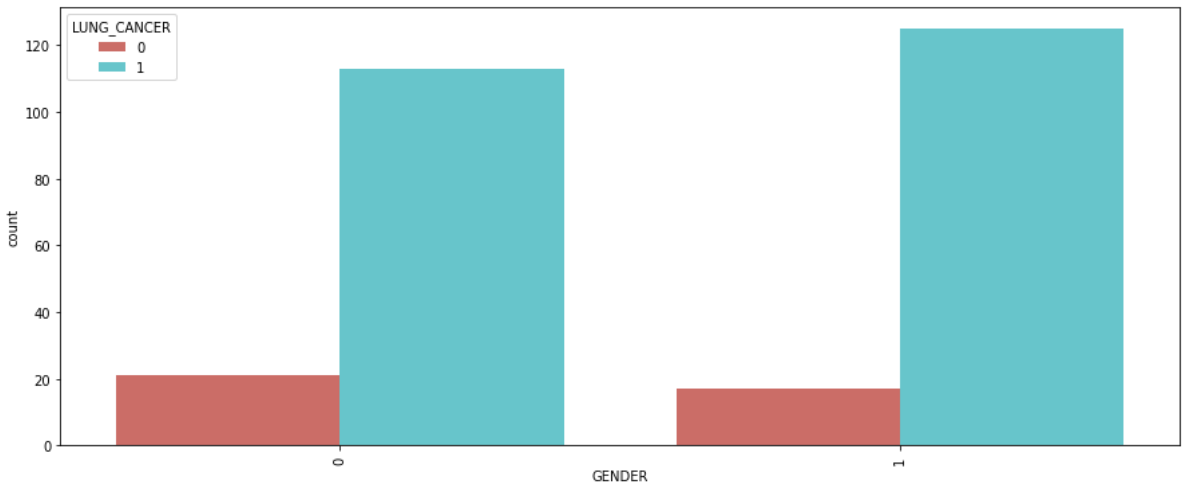
```
1 100. * data_new.GENDER.value_counts() / len(data_new.GENDER)
```

Out[32]:

```
1    51.449275
0    48.550725
Name: GENDER, dtype: float64
```

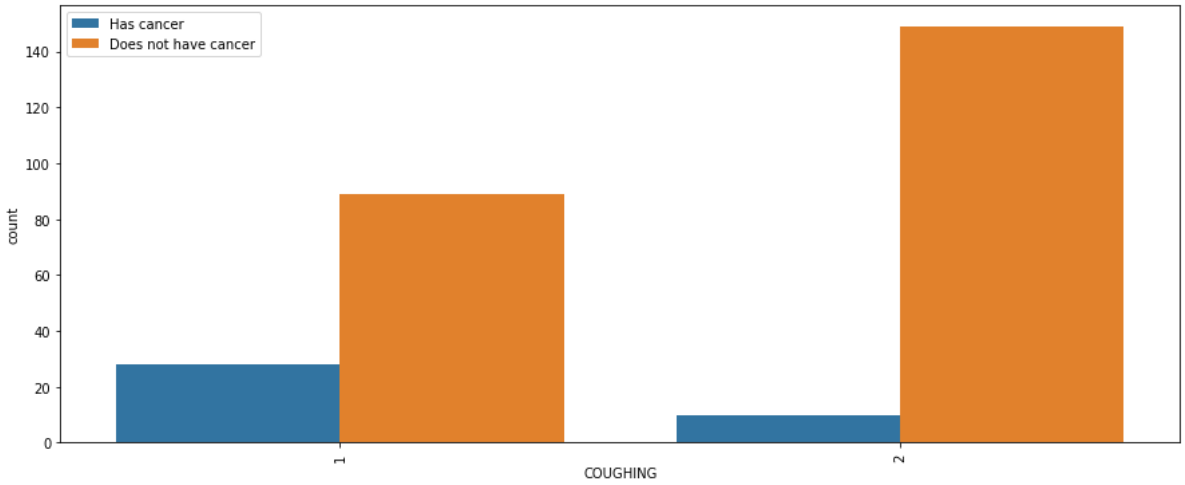
In [33]:

```
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()
```



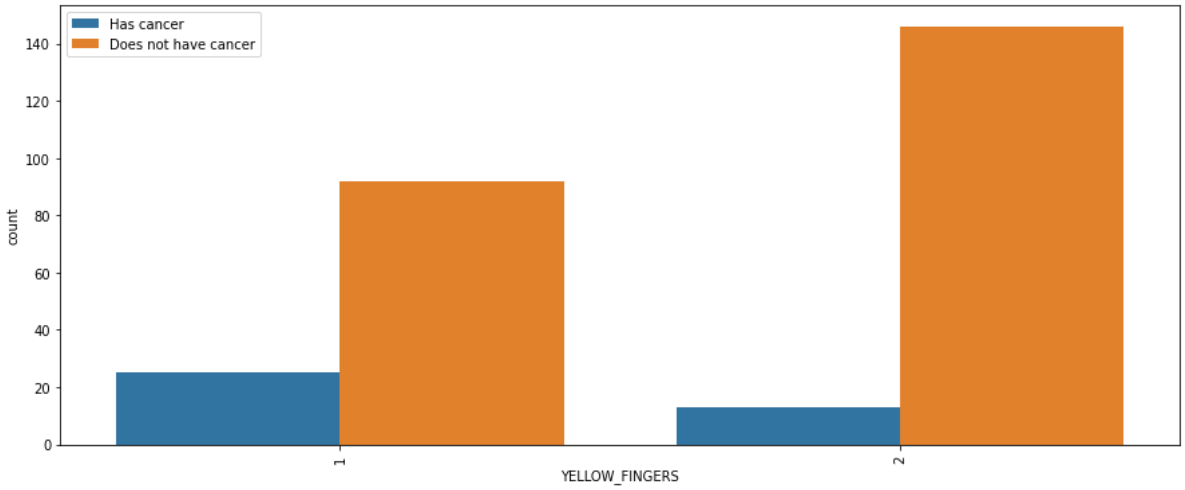
In [35]:

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



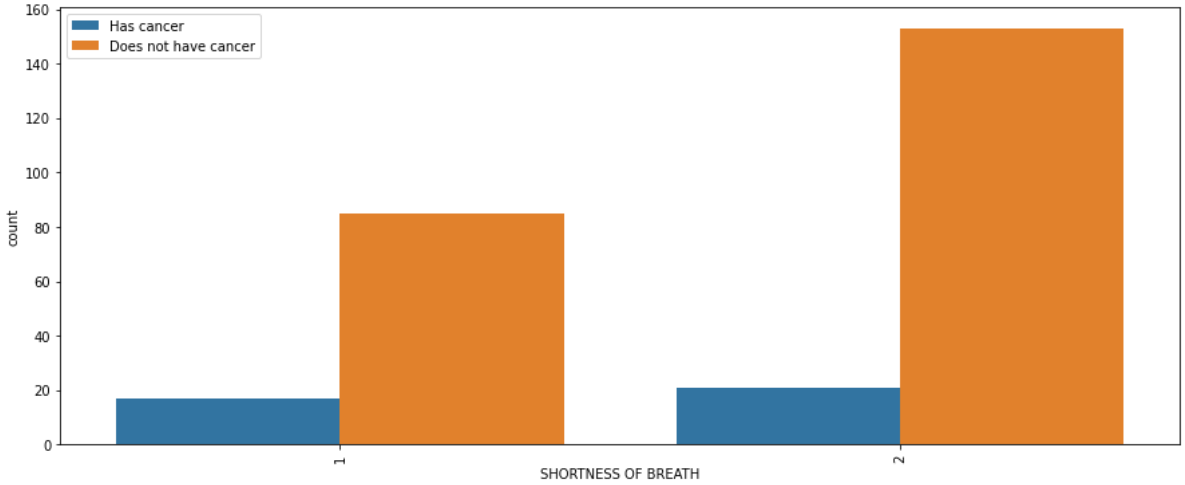
In [36]:

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



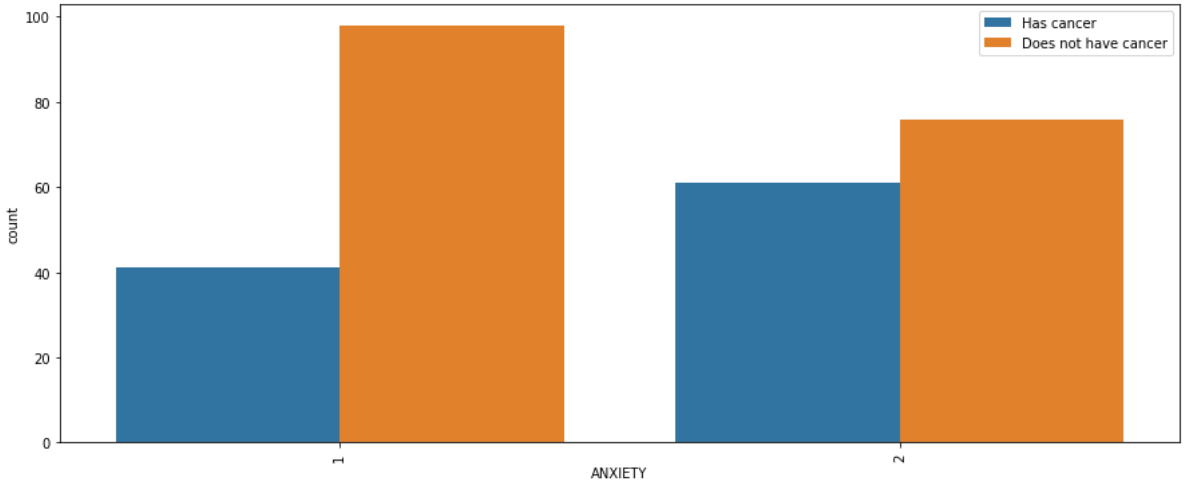
In [37]:

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



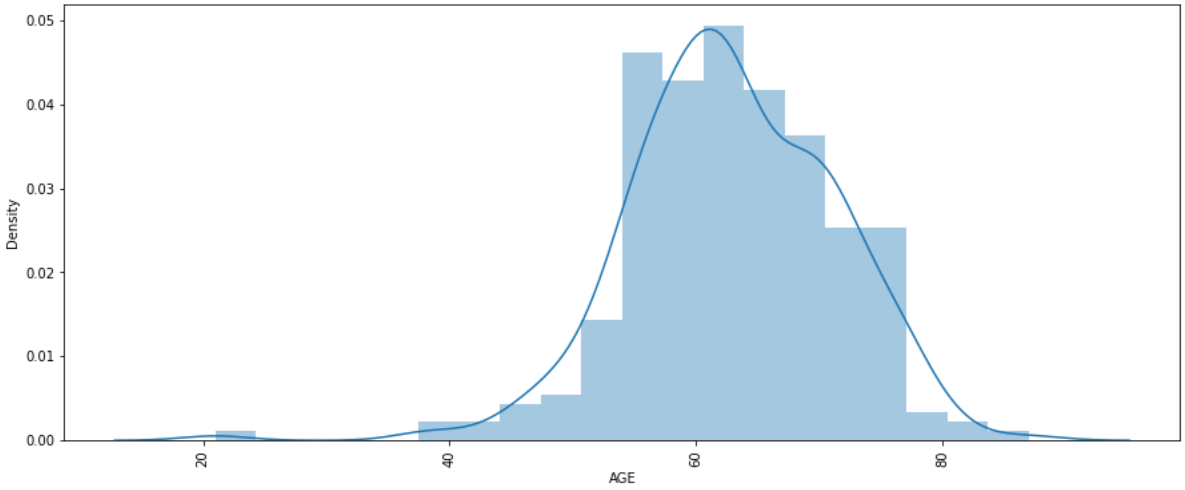
In [38]:

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



In [40]:

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



In [41]:

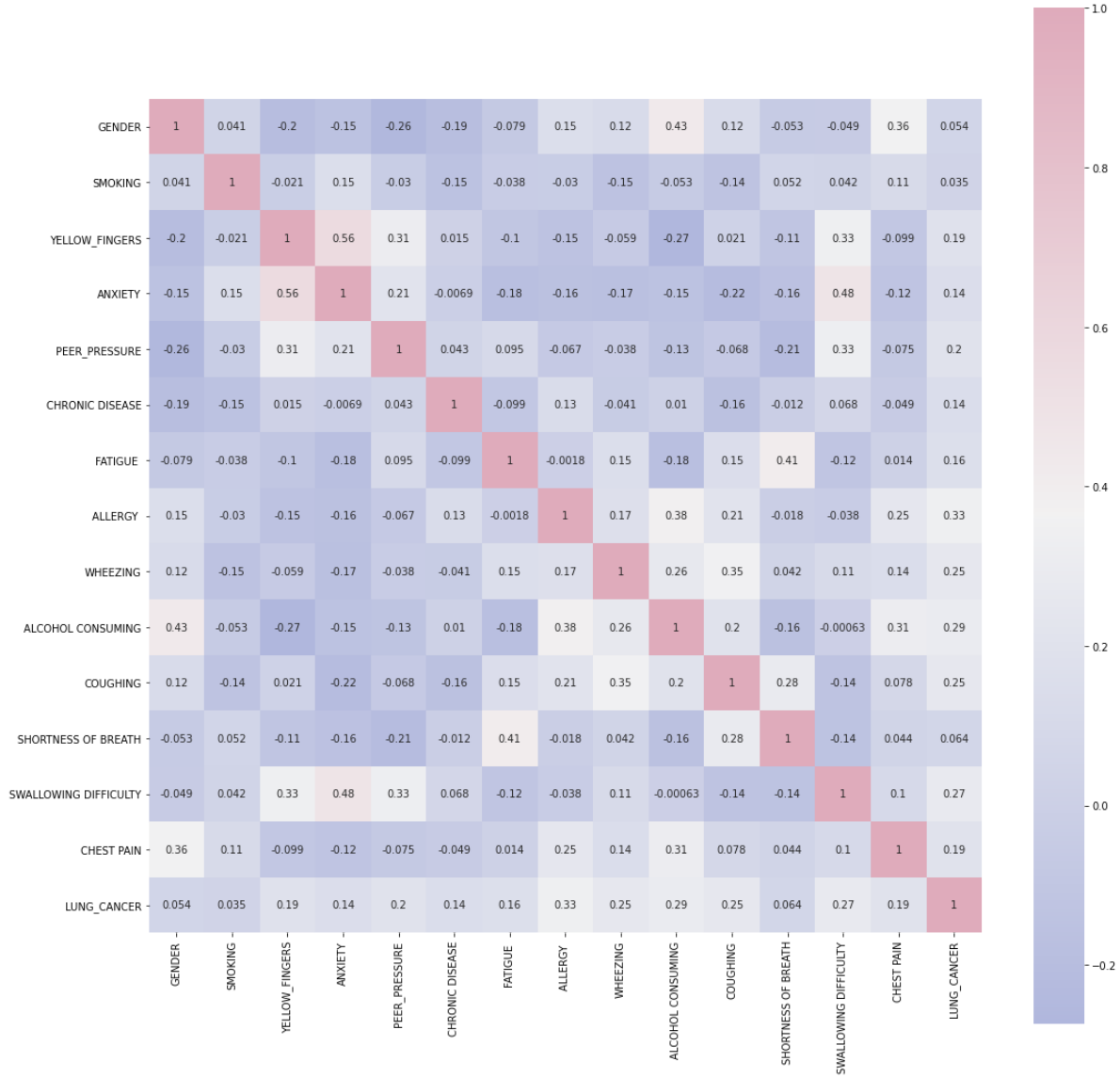
```
corrmat = data_new.corr()
corrmat
```

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]:

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



In [43]:

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

In [44]:

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

In [45]:

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

Out[45]:

```
LogisticRegression(random_state=0)
```

In [46]:

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

In [47]:

```
from sklearn.metrics import accuracy_score, mean_absolute_error , mean_squared_erro
```

In [48]:

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

In [50]:

```
print("Mean absolute error is ",( mean_absolute_error(y_test,y_pred)))
print("Mean squared  error is " , mean_squared_error(y_test,y_pred))
print("Median absolute error is " ,median_absolute_error(y_test,y_pred))
print("Accuracy is " , round(accuracy_score(y_test,y_pred)*100,2),"%")
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]:

```
matrix = confusion_matrix(y_test, y_pred, labels=[1,0])
print('Confusion matrix : \n',matrix)

tp, fn, fp, tn = confusion_matrix(y_test,y_pred,labels=[1,0]).reshape(-1)
print('Outcome values : \n', tp, fn, fp, tn)

matrix = classification_report(y_test,y_pred,labels=[1,0])
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
```