PROBLEM STATEMENT:Which model is suitable for the insurance dataset

1.DATA COLLECTION

In [24]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt,seaborn as sns
from sklearn import preprocessing, svm
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```

In [25]:

```
df=pd.read_csv(r"C:\Users\Teju\Downloads\insurance.csv")
df
```

Out[25]:

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520
...	...	...	...	...	...	...	...
1333	50	male	30.970	3	no	northwest	10600.54830
1334	18	female	31.920	0	no	northeast	2205.98080
1335	18	female	36.850	0	no	southeast	1629.83350
1336	21	female	25.800	0	no	southwest	2007.94500
1337	61	female	29.070	0	yes	northwest	29141.36030

1338 rows × 7 columns

2.DATA CLEANING AND PREPROCESSING

In [26]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1338 non-null   int64  
 1   sex       1338 non-null   object 
 2   bmi       1338 non-null   float64
 3   children  1338 non-null   int64  
 4   smoker    1338 non-null   object 
 5   region    1338 non-null   object 
 6   charges   1338 non-null   float64
dtypes: float64(2), int64(2), object(3)
memory usage: 73.3+ KB
```

In [27]:

```
df.head()
```

Out[27]:

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520

In [28]:

```
df.tail()
```

Out[28]:

	age	sex	bmi	children	smoker	region	charges
1333	50	male	30.97	3	no	northwest	10600.5483
1334	18	female	31.92	0	no	northeast	2205.9808
1335	18	female	36.85	0	no	southeast	1629.8335
1336	21	female	25.80	0	no	southwest	2007.9450
1337	61	female	29.07	0	yes	northwest	29141.3603

In [29]:

```
df.columns
```

Out[29]:

```
Index(['age', 'sex', 'bmi', 'children', 'smoker', 'region', 'charges'], dt
ype='object')
```

In [30]:

```
df.describe()
```

Out[30]:

	age	bmi	children	charges
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.663397	1.094918	13270.422265
std	14.049960	6.098187	1.205493	12110.011237
min	18.000000	15.960000	0.000000	1121.873900
25%	27.000000	26.296250	0.000000	4740.287150
50%	39.000000	30.400000	1.000000	9382.033000
75%	51.000000	34.693750	2.000000	16639.912515
max	64.000000	53.130000	5.000000	63770.428010

In [31]:

```
df.shape
```

Out[31]:

```
(1338, 7)
```

To Find The Null Values

In [32]:

```
df.isnull().sum()
```

Out[32]:

```
age         0
sex         0
bmi         0
children    0
smoker      0
region      0
charges     0
dtype: int64
```

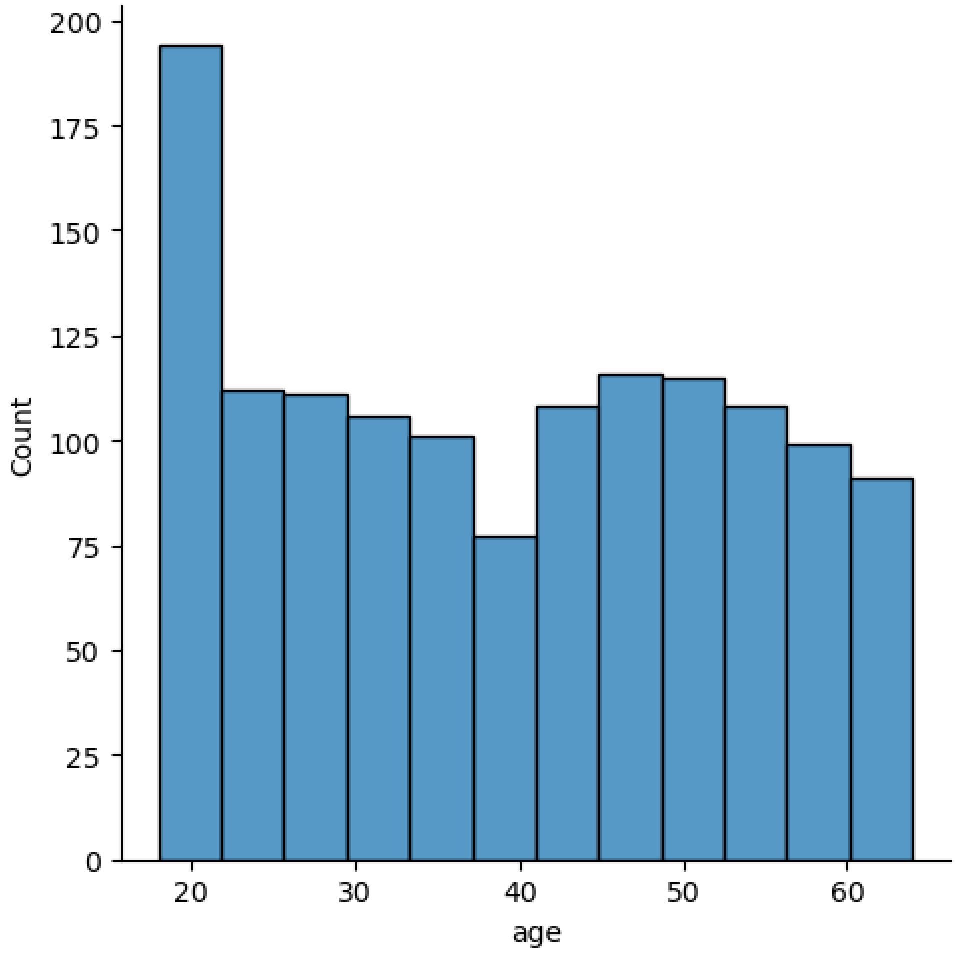
Data Visualization

In [33]:

```
sns.displot(df['age'])
```

Out[33]:

```
<seaborn.axisgrid.FacetGrid at 0x25576883e50>
```

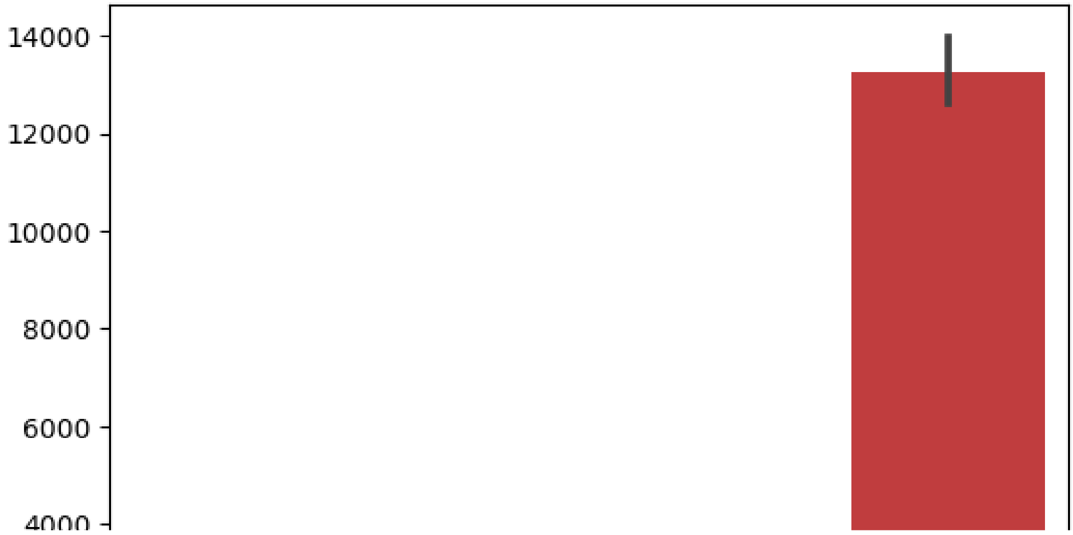


In [34]:

```
sns.barplot(df)
```

Out[34]:

```
<Axes: >
```

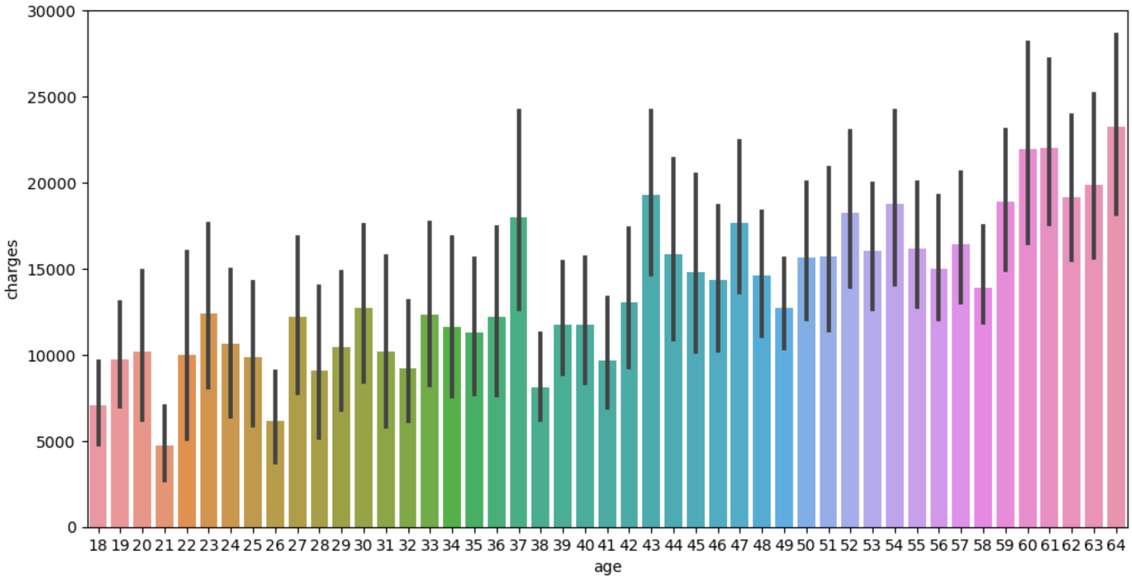


In [57]:

```
plt.figure(figsize=(12,6))
sns.barplot(x='age',y='charges',data=df)
```

Out[57]:

```
<Axes: xlabel='age', ylabel='charges'>
```

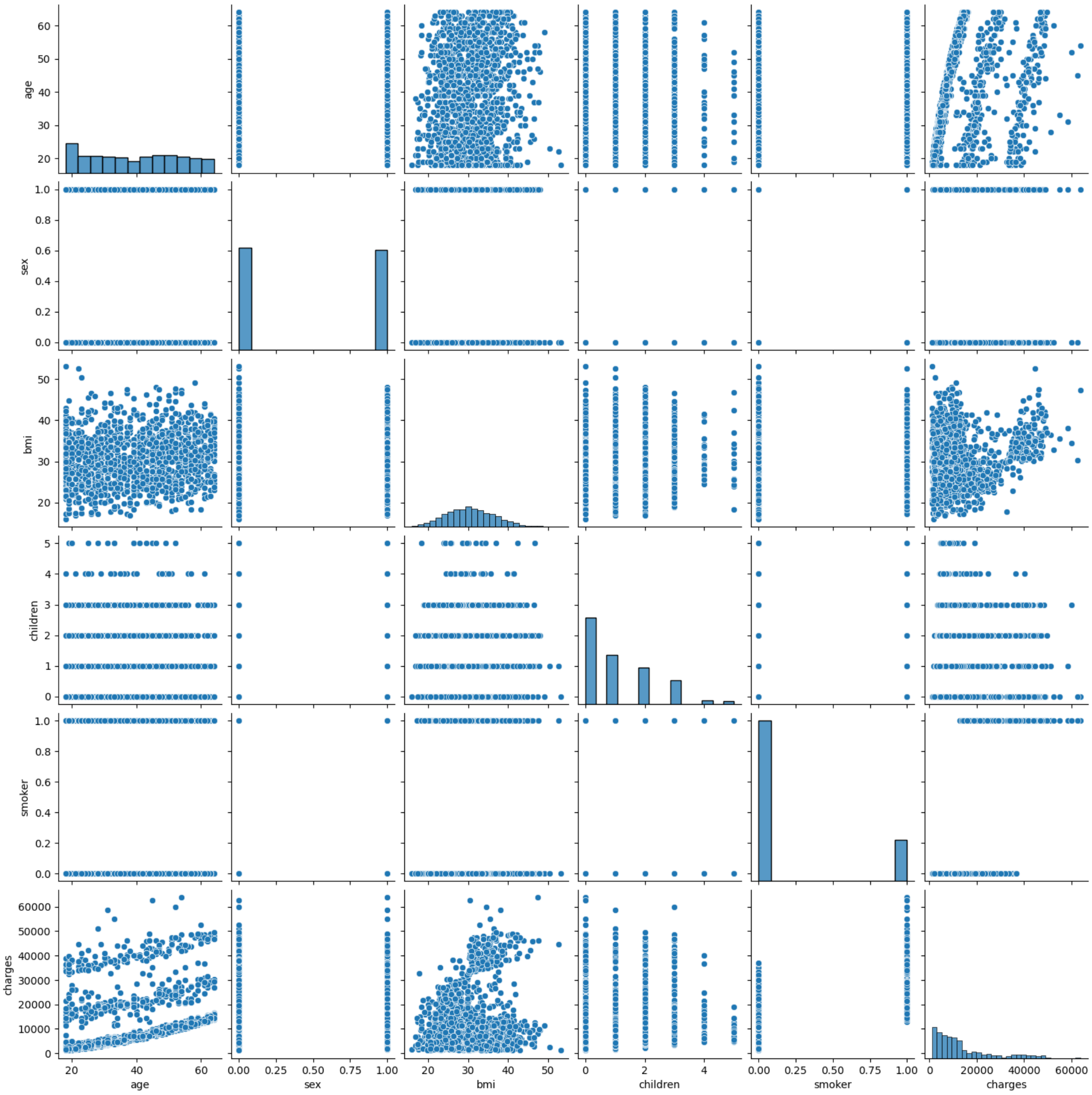


In [58]:

```
sns.pairplot(df)
```

Out[58]:

```
<seaborn.axisgrid.PairGrid at 0x255785f72b0>
```



In [35]:

```
convert={'sex':{"female":1,"male":0}}
df=df.replace(convert)
df
```

Out[35]:

	age	sex	bmi	children	smoker	region	charges
0	19	1	27.900	0	yes	southwest	16884.92400
1	18	0	33.770	1	no	southeast	1725.55230
2	28	0	33.000	3	no	southeast	4449.46200
3	33	0	22.705	0	no	northwest	21984.47061
4	32	0	28.880	0	no	northwest	3866.85520
...	...	...	...	...	...	...	...
1333	50	0	30.970	3	no	northwest	10600.54830
1334	18	1	31.920	0	no	northeast	2205.98080
1335	18	1	36.850	0	no	southeast	1629.83350
1336	21	1	25.800	0	no	southwest	2007.94500
1337	61	1	29.070	0	yes	northwest	29141.36030

1338 rows × 7 columns

In [36]:

```
convert={'smoker':{"yes":1,"no":0}}
df=df.replace(convert)
df
```

Out[36]:

	age	sex	bmi	children	smoker	region	charges
0	19	1	27.900	0	1	southwest	16884.92400
1	18	0	33.770	1	0	southeast	1725.55230
2	28	0	33.000	3	0	southeast	4449.46200
3	33	0	22.705	0	0	northwest	21984.47061
4	32	0	28.880	0	0	northwest	3866.85520
...	...	...	...	...	...	...	...
1333	50	0	30.970	3	0	northwest	10600.54830
1334	18	1	31.920	0	0	northeast	2205.98080
1335	18	1	36.850	0	0	southeast	1629.83350
1336	21	1	25.800	0	0	southwest	2007.94500
1337	61	1	29.070	0	1	northwest	29141.36030

1338 rows × 7 columns

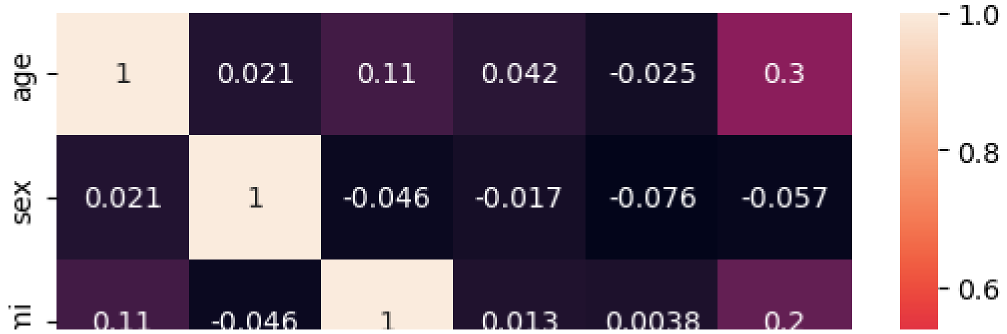
In [37]:

```
Ins=df[['age', 'sex', 'bmi', 'children', 'smoker', 'region', 'charges']]
sns.heatmap(Ins.corr(),annot=True)
```

```
C:\Users\Teju\AppData\Local\Temp\ipykernel_1680\3993229711.py:2: Future
Warning: The default value of numeric_only in DataFrame.corr is depreca
ted. In a future version, it will default to False. Select only valid c
olumns or specify the value of numeric_only to silence this warning.
  sns.heatmap(Ins.corr(),annot=True)
```

Out[37]:

```
<Axes: >
```



Feature Scaling- To split the data into training and test data

In [38]:

```
x=Ins[['age', 'sex', 'bmi', 'children', 'smoker']]
y=df['charges']
```

Linear Regression

In [39]:

```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=42)
ln=LinearRegression()
ln.fit(x_train,y_train)
```

Out[39]:

```
LinearRegression()
```

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In [40]:

```
print(ln.intercept_)
score=ln.score(x_test,y_test)
score
```

```
-12401.788652269326
```

Out[40]:

```
0.7680881643600721
```

By using Linear Regression we didn't the accuracy for this model. So we will use Logistic Regression

Logistic Regression

In [41]:

```
from sklearn.linear_model import LogisticRegression
from sklearn.preprocessing import StandardScaler
```

In [44]:

```
x=np.array(df['smoker']).reshape(-1,1)
x=np.array(df['age']).reshape(-1,1)
df.dropna(inplace=True)
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=42)
lr=LogisticRegression(max_iter=10000)
```

In [45]:

```
lr.fit(x_train,y_train)
```

Out[45]:

```
LogisticRegression(max_iter=10000)
```

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In [46]:

```
score=lr.score(x_test,y_test)
score
```

Out[46]:

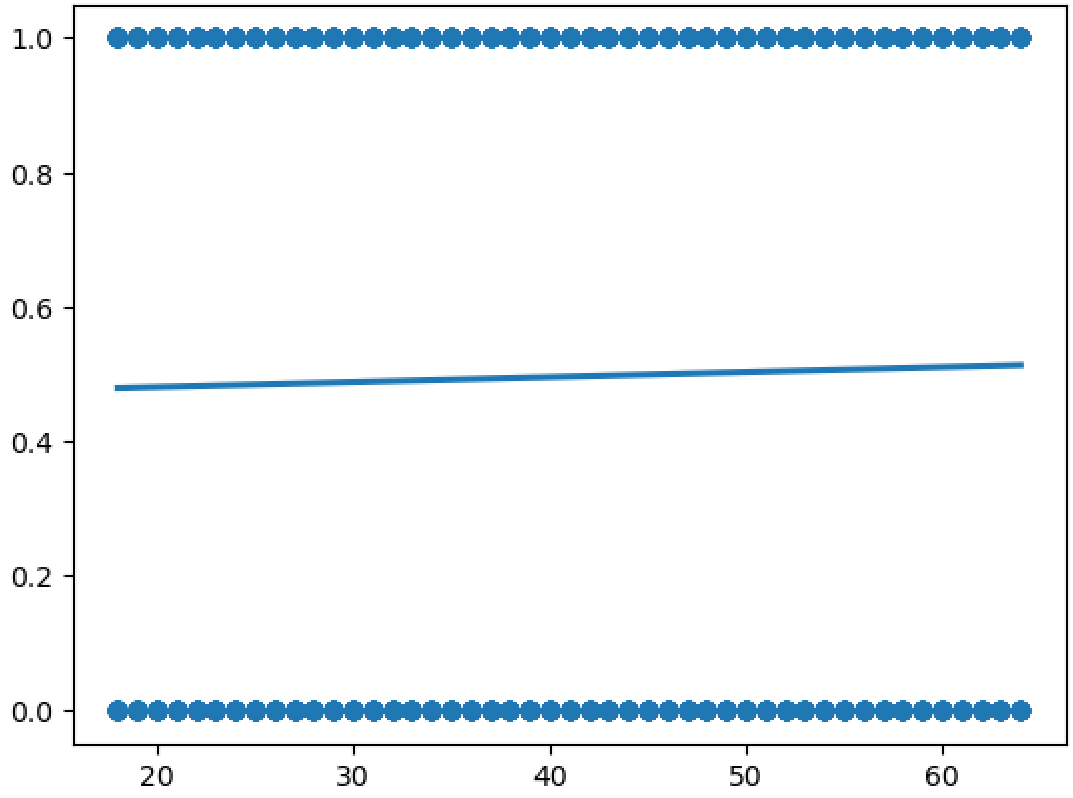
```
0.48756218905472637
```

In [47]:

```
sns.scatter(x=x,y=y,data=df,logistic=True,ci=None)
```

Out[47]:

```
<Axes: >
```

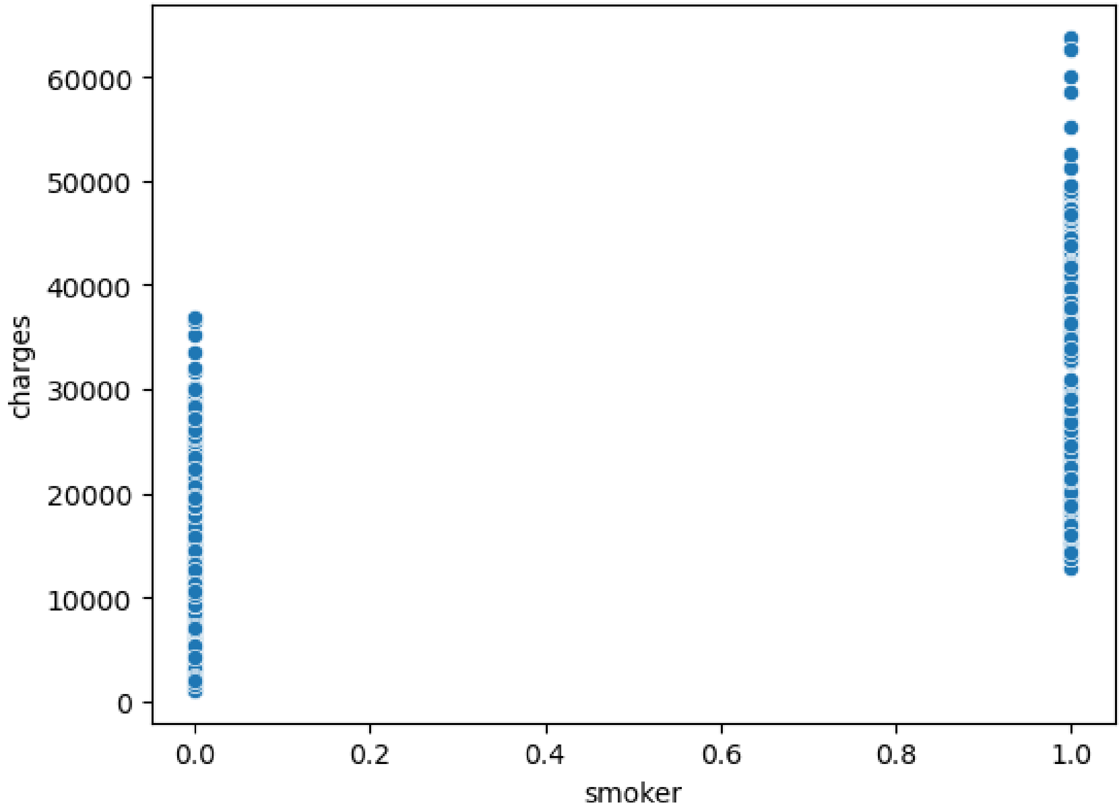


In [48]:

```
sns.scatterplot(data=df,x='smoker',y='charges')
```

Out[48]:

```
<Axes: xlabel='smoker', ylabel='charges'>
```



Decision Tree

In [49]:

```
from sklearn.tree import DecisionTreeClassifier
dtc=DecisionTreeClassifier()
dtc.fit(x_train,y_train)
```

Out[49]:

```
DecisionTreeClassifier()
```

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In [50]:

```
dtc.score(x_test,y_test)
```

Out[50]:

```
0.3880597014925373
```

Random Forest

In [51]:

```
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

Out[51]:

```
RandomForestClassifier()
```

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In [52]:

```
params={'max_depth':[2,3,5,10,20],
'min_samples_leaf':[5,10,20,50,100,200],
'n_estimators':[10,25,30,50,100,200]}
```

In [53]:

```
from sklearn.model_selection import GridSearchCV
grid_search=GridSearchCV(estimator=rfc,param_grid=params,cv=2,scoring="accuracy")
```

In [54]:

```
grid_search.fit(x_train,y_train)
```

Out[54]:

```
GridSearchCV(cv=2, estimator=RandomForestClassifier(),
             param_grid={'max_depth': [2, 3, 5, 10, 20],
                         'min_samples_leaf': [5, 10, 20, 50, 100, 200],
                         'n_estimators': [10, 25, 30, 50, 100, 200]},
             scoring='accuracy')
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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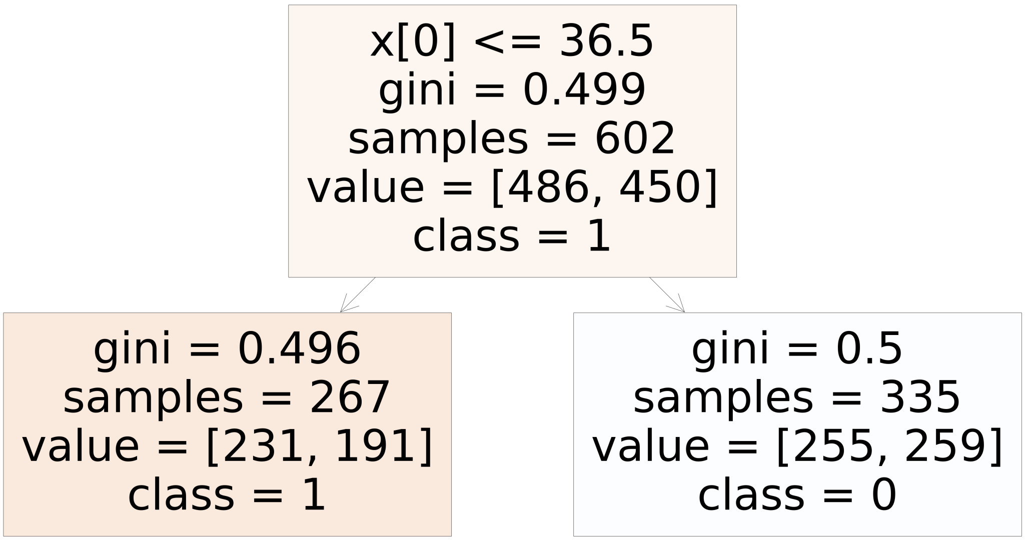
In [62]:

```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(grid_search.best_estimator_.estimators_[4],class_names=['1','0'],filled=True);
```



In [55]:

```
grid_search.best_score_
```

Out[55]:

```
0.5128205128205128
```

In [56]:

```
grid_search.best_estimator_
```

Out[56]:

```
RandomForestClassifier(max_depth=2, min_samples_leaf=200, n_estimators=10)
```

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Conclusion:

Based on accuracy of all models we can conclude that Logistic Regression is the best model for given dataset

In [ ]:

```

```