ProblemStatement: Which model is suitable for the given dataset

In [ ]:

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

Data collection

In [2]:

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

Out[2]:

	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

Data preprocessing

In [3]:

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

Out[3]:

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

In [4]:

```
1 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 [5]:

```
1 df.describe()
```

Out[5]:

	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 [6]:

```
df['bmi'].value_counts()
```

Out[6]:

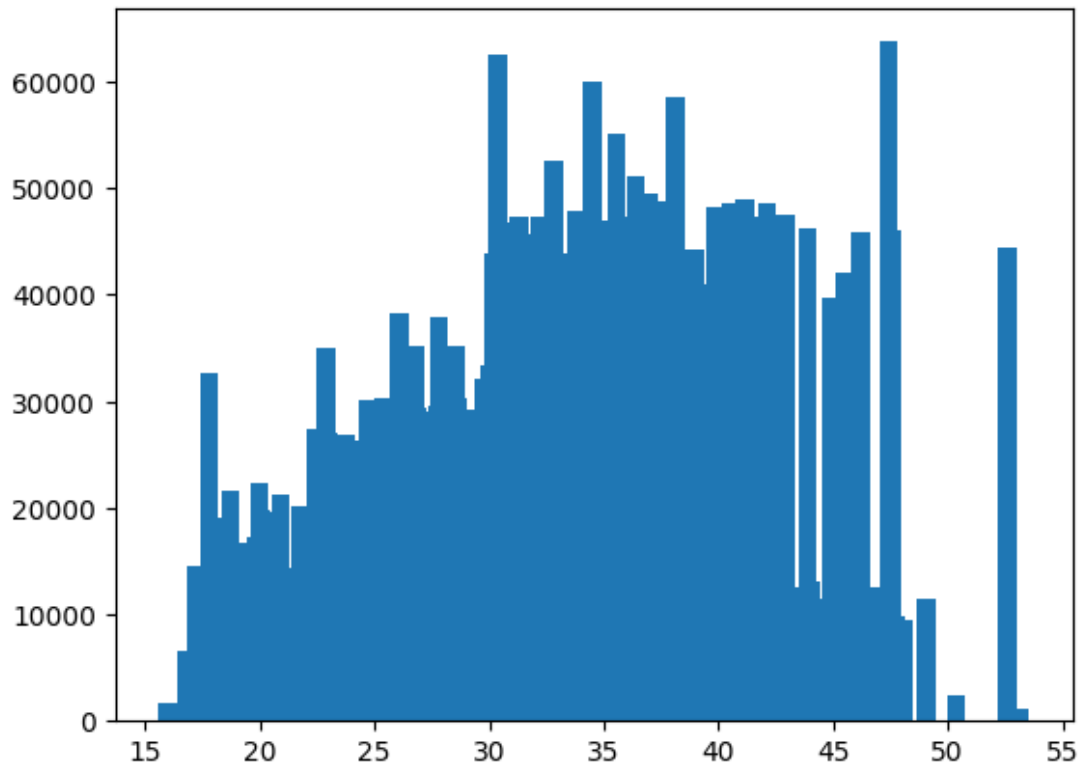
```
bmi
32.300    13
28.310     9
30.495     8
30.875     8
31.350     8
          ..
46.200     1
23.800     1
44.770     1
32.120     1
30.970     1
Name: count, Length: 548, dtype: int64
```

In [62]:

```
x=df['bmi']
y=df['charges']
plt.bar(x,y)
```

Out[62]:

```
<BarContainer object of 1338 artists>
```



In [8]:

```
1 df.columns
```

Out[8]:

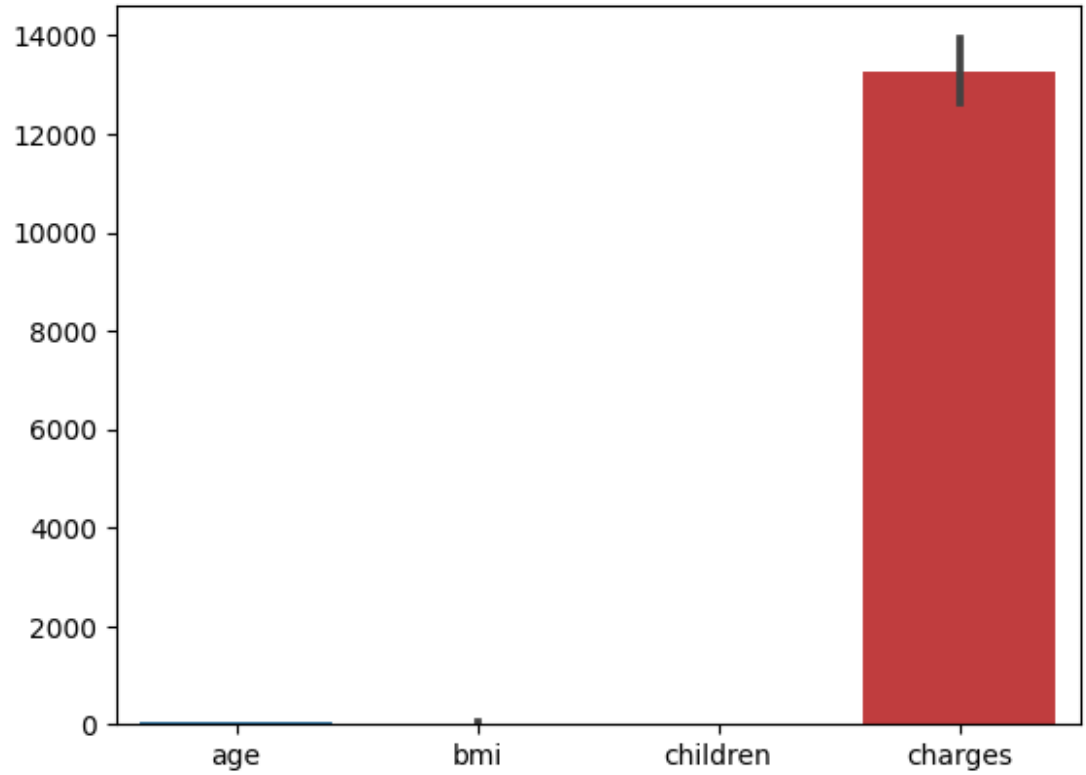
```
Index(['age', 'sex', 'bmi', 'children', 'smoker', 'region', 'charges'],
dtype='object')
```

In [9]:

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

Out[9]:

```
<Axes: >
```



In [10]:

```
1 df.describe()
```

Out[10]:

	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 [11]:

```
1 df.columns
```

Out[11]:

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

In [12]:

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

Out[12]:

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

1338 rows × 7 columns

In [13]:

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

Out[13]:

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

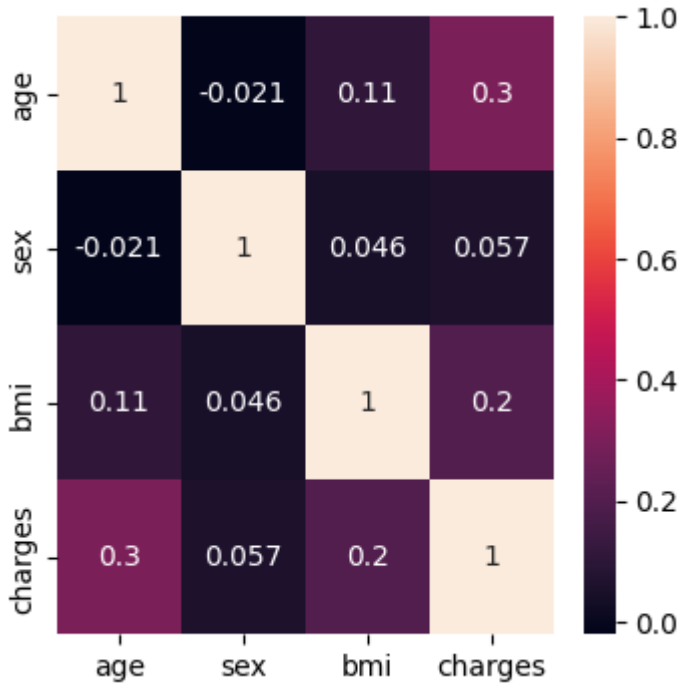
1338 rows × 7 columns

In [14]:

```
idf=df[['age','sex','bmi','charges']]
plt.figure(figsize=(4,4))
sns.heatmap(idf.corr(),annot=True)
```

Out[14]:

<Axes: >



In [20]:

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

LINEAR REGRESSION

In [21]:

```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
lr=LinearRegression()
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=100
```

In [22]:

```
from sklearn.linear_model import LinearRegression
lr=LinearRegression()
lr.fit(x_train,y_train)
print(lr.intercept_)
coeff_df=pd.DataFrame(lr.coef_,x.columns,columns=['coefficient'])
coeff_df
```

```
-10719.483493479494
```

Out[22]:

	coefficient
age	259.757578
sex	18.216925
bmi	277.903898
children	461.169867
smoker	23981.741027

In [24]:

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

```
0.780095696440481
```

In [25]:

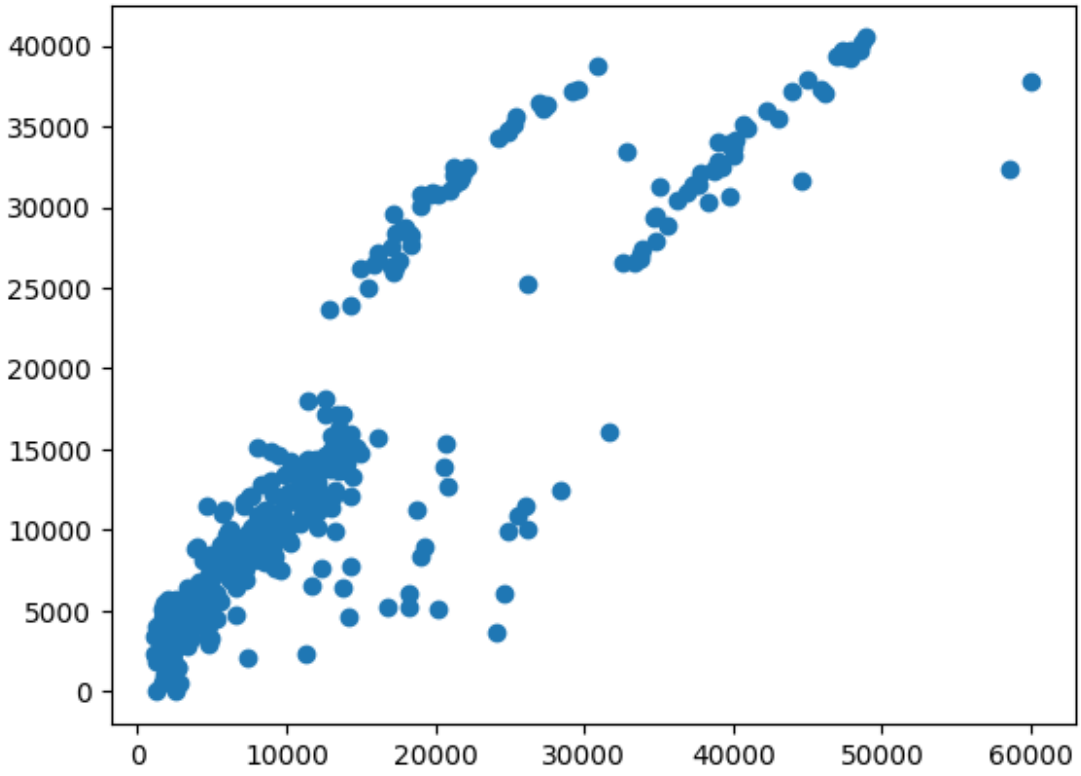
```
predictions=lr.predict(x_test)
```

In [26]:

```
1 plt.scatter(y_test,predictions)
```

Out[26]:

```
<matplotlib.collections.PathCollection at 0x1a3c13ada50>
```



In [27]:

```
1 x=np.array(df['smoker']).reshape(-1,1)
2 y=np.array(df['charges']).reshape(-1,1)
3 df.dropna(inplace=True)
```

In [28]:

```
1 x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=100
2 lr.fit(x_train,y_train)
3 lr.fit(x_train,y_train)
```

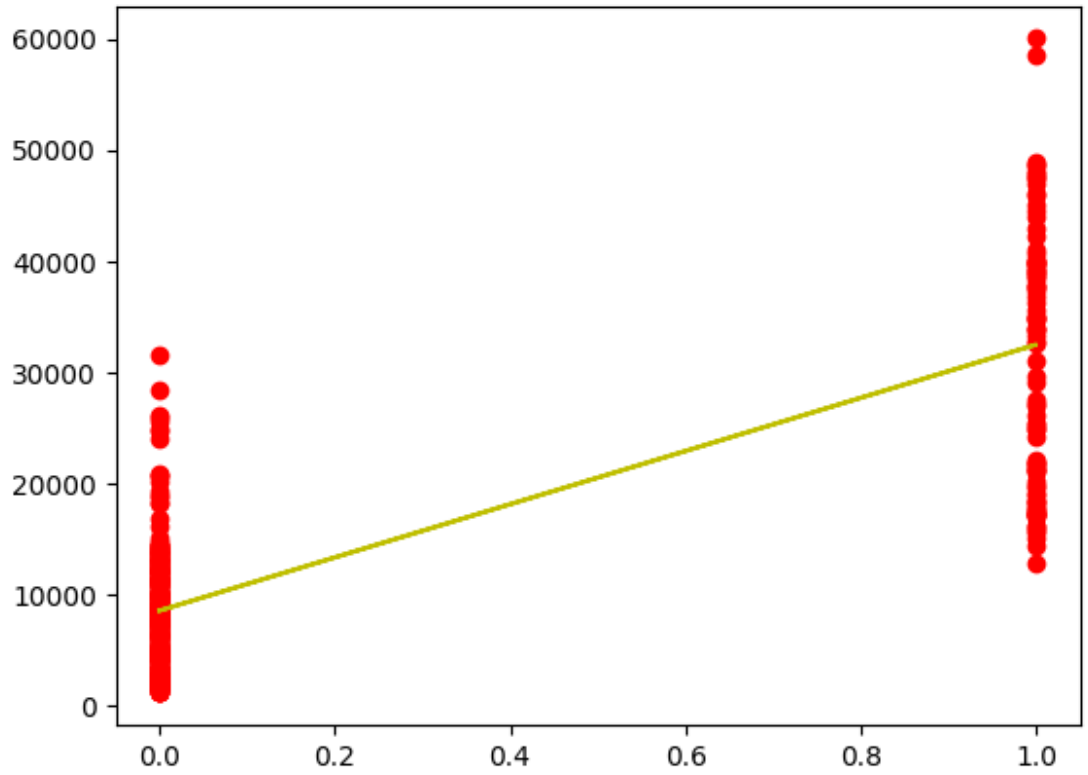
Out[28]:

```
LinearRegression()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [29]:

```
y_pred=lr.predict(x_test)
plt.scatter(x_test,y_test,color='r')
plt.plot(x_test,y_pred,color='y')
plt.show()
```



LOGISTIC REGRESSION

In [43]:

```
from sklearn.linear_model import LogisticRegression
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=100
x=np.array(df['charges']).reshape(-1,1)
y=np.array(df['smoker']).reshape(-1,1)
df.dropna(inplace=True)
lg=LogisticRegression(max_iter=1000)
```

In [44]:

```
1 lg.fit(x_train,y_train)
```

```
C:\Users\magam\AppData\Local\Programs\Python\Python311\Lib\site-package
s\sklearn\utils\validation.py:1143: DataConversionWarning: A column-vec
tor y was passed when a 1d array was expected. Please change the shape
of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[44]:

```
LogisticRegression(max_iter=1000)
```

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In [45]:

```
1 score=lg.score(x_test,y_test)
2 print(score)
```

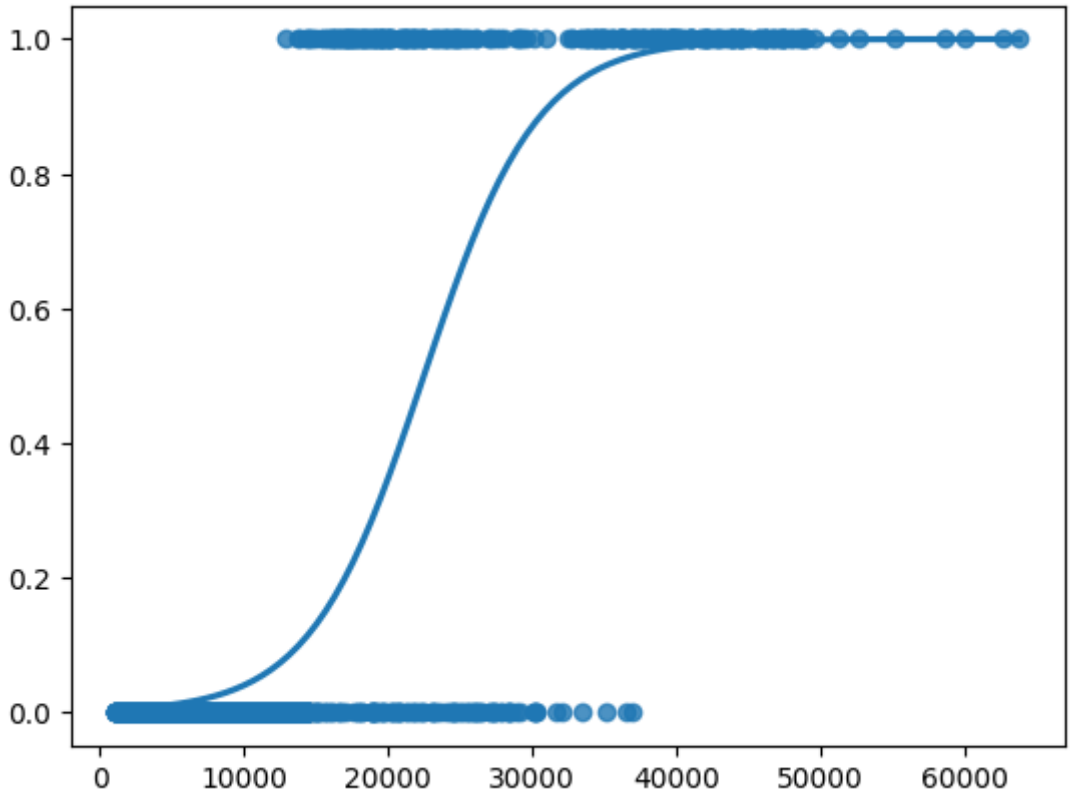
```
0.900497512437811
```

In [46]:

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

Out[46]:

<Axes: >



DECISION TREE

In [49]:

```
from sklearn.tree import DecisionTreeClassifier
clf=DecisionTreeClassifier(random_state=0)
clf.fit(x_train,y_train)
```

Out[49]:

```
DecisionTreeClassifier(random_state=0)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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In [50]:

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

Out[50]:

```
DecisionTreeClassifier(random_state=0)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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In [51]:

```
score=clf.score(x_test,y_test)
print(score)
```

```
0.8955223880597015
```

RANDOM FOREST

In [52]:

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

```
C:\Users\magam\AppData\Local\Temp\ipykernel_920\2210184639.py:3: DataCo
nversionWarning: A column-vector y was passed when a 1d array was expec
ted. Please change the shape of y to (n_samples,), for example using ra
vel().
  rfc.fit(x_train,y_train)
```

Out[52]:

```
RandomForestClassifier()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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In [53]:

```
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 [54]:

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

In [55]:

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

```
C:\Users\magam\AppData\Local\Programs\Python\Python311\Lib\site-pa
ckages\sklearn\model_selection\_validation.py:686: DataConversionW
arning: A column-vector y was passed when a 1d array was expected.
Please change the shape of y to (n_samples,), for example using ra
vel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\magam\AppData\Local\Programs\Python\Python311\Lib\site-pa
ckages\sklearn\model_selection\_validation.py:686: DataConversionW
arning: A column-vector y was passed when a 1d array was expected.
Please change the shape of y to (n_samples,), for example using ra
vel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\magam\AppData\Local\Programs\Python\Python311\Lib\site-pa
ckages\sklearn\model_selection\_validation.py:686: DataConversionW
arning: A column-vector y was passed when a 1d array was expected.
Please change the shape of y to (n_samples,), for example using ra
vel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\magam\AppData\Local\Programs\Python\Python311\Lib\site-pa
```

In [56]:

```
grid_search.best_score_
```

Out[56]:

```
0.9337606837606838
```

In [57]:

```
rf_best=grid_search.best_estimator_
rf_best
```

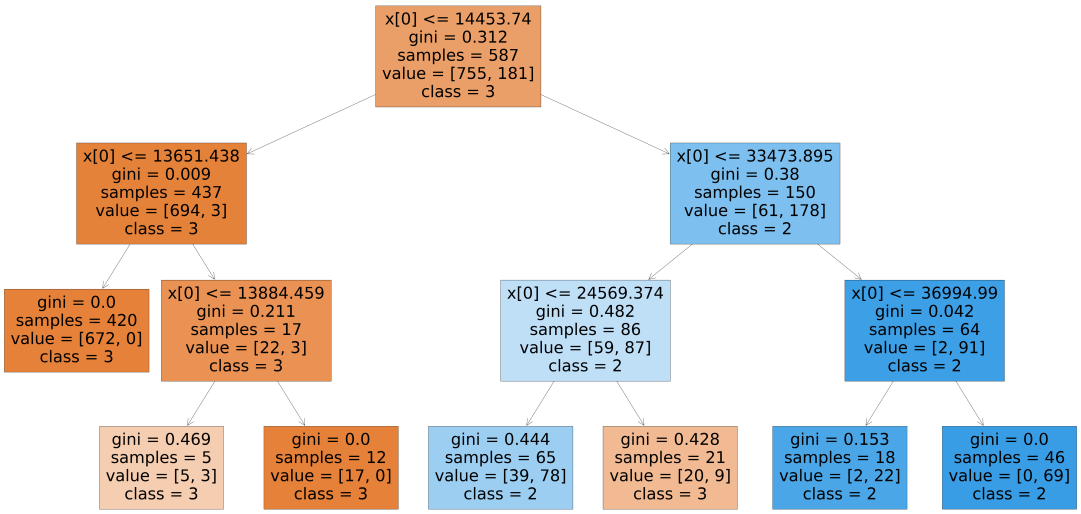
Out[57]:

```
RandomForestClassifier(max_depth=3, min_samples_leaf=5, n_estimators=1
0)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [58]:

```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rf_best.estimators_[4],class_names=['3','2','1','0'],filled=True);
```



In [59]:

```
score=rfc.score(x_test,y_test)
print(score)
```

```
0.8955223880597015
```

CONCLUSION

I analysed the data with LinearRegression, logisticRegression, DecissionTree, RandomForest models. I get 78% for Linear , 90% for Logistic , 89% for DecissionTree and 89% for Randomforest. so, I conclude that LogisticalRegression model is the bestfit model of remaining.

In [ ]:

```

```