MEDICAL INSURANCE COST PREDICTION

In [67]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

In [68]:
```
df = pd.read_csv('insurance.csv')
```

In [69]:
```
df.head()
```

Out[69]:

	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 [70]:
```
df.shape
```

Out[70]:
```
(1338, 7)
```

In [71]:
```
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 [72]:
```
df.isnull().sum()
```

Out[72]:
```
age         0
sex         0
bmi         0
children    0
smoker      0
region      0
charges     0
dtype: int64
```

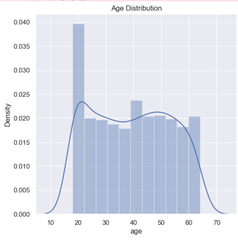
In [73]:
```
df.describe()
```

Out[73]:

	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

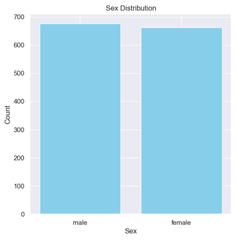
In [74]:
```
sns.set()
plt.figure(figsize=(6,6))
sns.distplot(df['age'])
plt.title("Age Distribution")
plt.show()
```

```
C:\Users\taha\AppData\Local\Temp\ipykernel_16316\2844674647.py:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

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



In [75]:
```
sex_counts = df["sex"].value_counts()
# Plotting
plt.figure(figsize=(6, 6))
plt.bar(sex_counts.index, sex_counts, color='skyblue')

# Add labels and title
plt.xlabel('Sex')
plt.ylabel('Count')
plt.title('Sex Distribution')
```

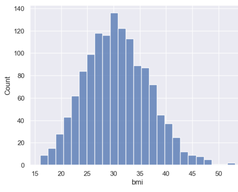
Out[75]:
```
Text(0.5, 1.0, 'Sex Distribution')
```



In [76]:
```
df['sex'].value_counts()
```

Out[76]:
```
sex
male      676
female    662
Name: count, dtype: int64
```

In [77]:
```
sns.histplot(df['bmi'])
plt.show()
```



In [78]:
```
df['region'].value_counts()
```

Out[78]:
```
region
southeast    364
southwest    325
northwest    325
northeast    324
Name: count, dtype: int64
```

In [79]:
```
df.replace({'sex':{'male':0,'female':1}},inplace=True)
```

```
C:\Users\taha\AppData\Local\Temp\ipykernel_16316\209033561.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a future version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  df.replace({'sex':{'male':0,'female':1}},inplace=True)
```

In [80]:
```
df.replace({'smoker':{'yes':0,'no':1}},inplace=True )
```

```
C:\Users\taha\AppData\Local\Temp\ipykernel_16316\2127058004.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a future version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  df.replace({'smoker':{'yes':0,'no':1}},inplace=True )
```

In [81]:
```
df.replace({'region':{'southeast':0,'southwest':1,'northeast':2,'northwest':3}}, inplace=True)
```

```
C:\Users\taha\AppData\Local\Temp\ipykernel_16316\234505671.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a future version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  df.replace({'region':{'southeast':0,'southwest':1,'northeast':2,'northwest':3}}, inplace=True)
```

In [82]:
```
X = df.drop(columns="charges",axis=1)
y = df['charges']
```

In [83]:
```
X
```

Out[83]:

	age	sex	bmi	children	smoker	region
0	19	1	27.900	0	0	1
1	18	0	33.770	1	1	0
2	28	0	33.000	3	1	0
3	33	0	22.705	0	1	3
4	32	0	28.880	0	1	3
...	...	...	...	...	...	...
1333	50	0	30.970	3	1	3
1334	18	1	31.920	0	1	2
1335	18	1	36.850	0	1	0
1336	21	1	25.800	0	1	1
1337	61	1	29.070	0	0	3

1338 rows × 6 columns

In [84]:
```
y
```

Out[84]:
```
0       16884.92400
1        1725.55230
2        4449.46200
3       21984.47061
4        3866.85520
           ...     
1333    10600.54830
1334     2205.98080
1335     1629.83350
1336     2007.94500
1337    29141.36030
Name: charges, Length: 1338, dtype: float64
```

In [85]:
```
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2,random_state=42)
```

In [86]:
```
X_train.shape
```

Out[86]:
```
(1070, 6)
```

In [87]:
```
X_test.shape
```

Out[87]:
```
(268, 6)
```

In [88]:
```
model = LinearRegression()
```

In [89]:
```
model.fit(X_train,y_train)
```

Out[89]:
```
LinearRegression()
```

In [90]:
```
training_data_prediction = model.predict(X_train)
```

In [91]:
```
r2_train = metrics.r2_score(y_train, training_data_prediction)
```

In [92]:
```
r2_train
```

Out[92]:
```
0.7413131194887537
```

In [93]:
```
test_data_prediction = model.predict(X_test)
```

In [94]:
```
metrics.r2_score(y_test, test_data_prediction)
```

Out[94]:
```
0.7830215871622344
```

In [95]:
```
sample_input_data = (30,1,22.7,0,1,0)
```

In [96]:
```
input_data_as_numpy_array = np.asarray(sample_input_data)
```

In [97]:
```
input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)
```

In [98]:
```
prediction = model.predict(input_data_reshaped)
```

```
C:\Users\taha\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\base.py:493: UserWarning: X does not have valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

In [99]:
```
print("The insurance cost is ",prediction)
```

```
The insurance cost is  [2741.67607076]
```

In [ ]:
```

```

In [ ]: