Importing the Dependencies

```
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
```

Data Collection & Analysis

```
# loading the data from csv file to a Pandas DataFrame
insurance_dataset = pd.read_csv('/content/insurance.csv')
# first 5 rows of the dataframe
insurance_dataset.head()
```

1 to 5 of 5 entries Filter

index	age	sex	bmi	children	smoker	region	charges
0	19	female	27.9	0	yes	southwest	16884.924
1	18	male	33.77	1	no	southeast	1725.5523
2	28	male	33.0	3	no	southeast	4449.462
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.88	0	no	northwest	3866.8552

Show 25 per page

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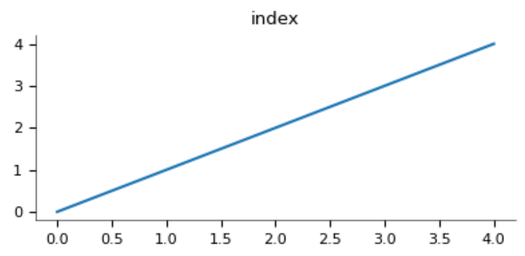
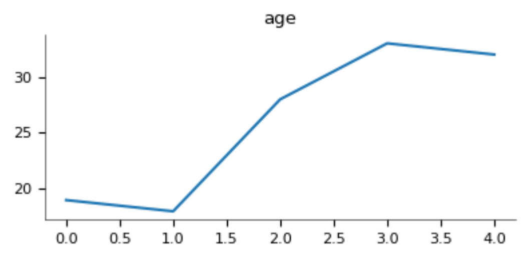
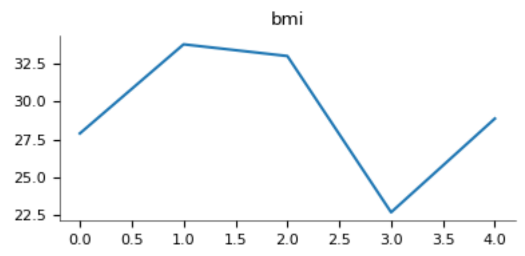
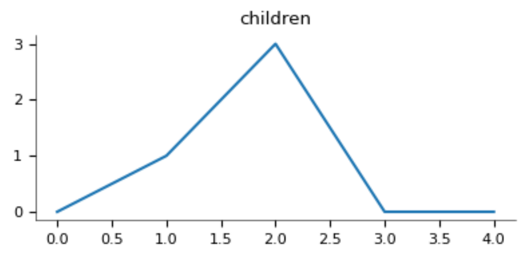
Values

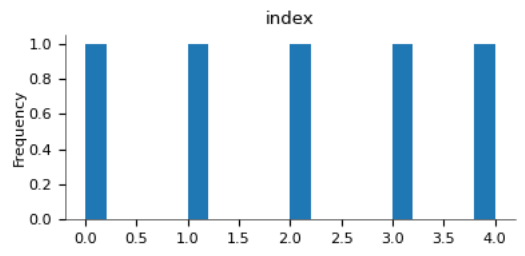


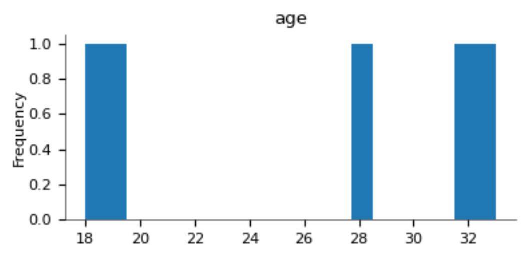


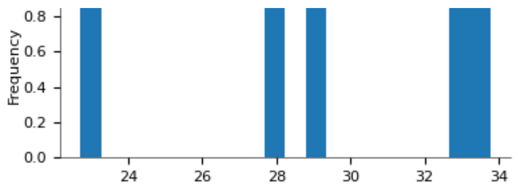


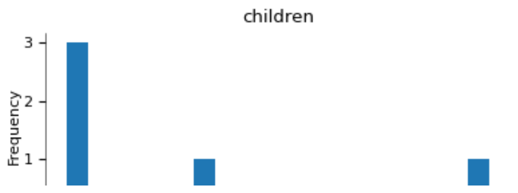


Distributions









```
# number of rows and columns
insurance_dataset.shape
```

```
(1338, 7)
```

```
# getting some informations about the dataset
insurance_dataset.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
```

Categorical Features:

- Sex
- Smoker
- Region

```
# checking for missing values
insurance_dataset.isnull().sum()
```

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

Data Analysis

```
# statistical Measures of the dataset
insurance_dataset.describe()
```

1 to 8 of 8 entries Filter

index	age	bmi	children	charges
count	1338.0	1338.0	1338.0	1338.0
mean	39.20702541106129	30.66339686098655	1.0949177877429	13270.422265141257
std	14.049960379216154	6.098186911679014	1.205492739781914	12110.011236694001
min	18.0	15.96	0.0	1121.8739
25%	27.0	26.29625	0.0	4740.28715
50%	39.0	30.4	1.0	9382.033
75%	51.0	34.69375	2.0	16639.912515
max	64.0	53.13	5.0	63770.42801

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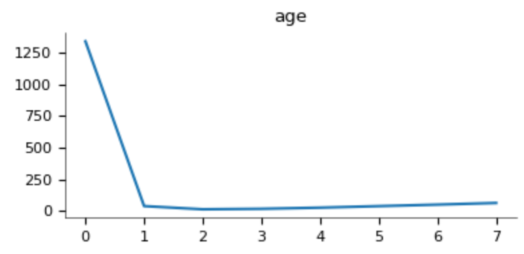
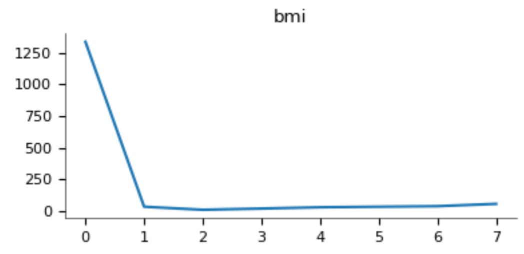
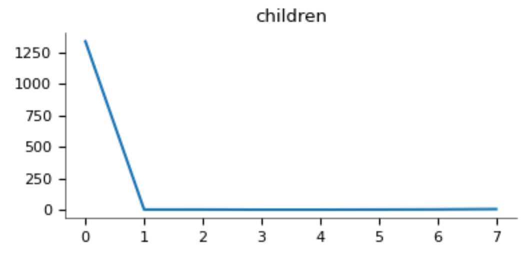
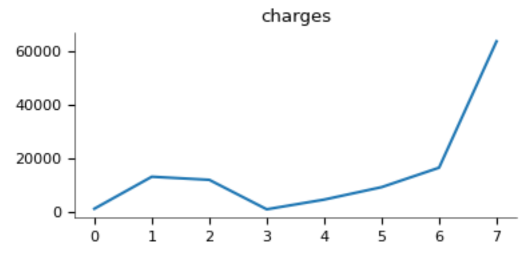
Values

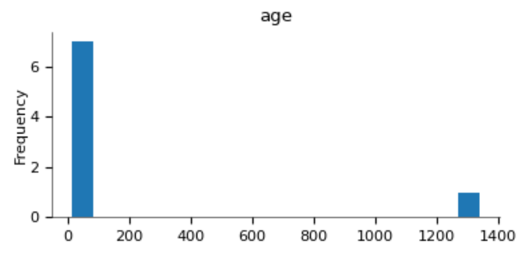


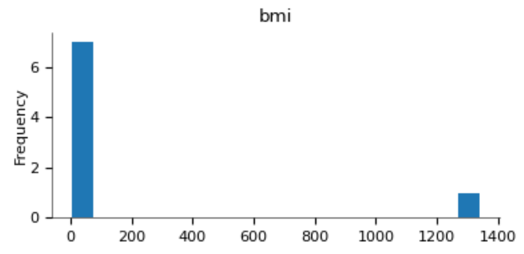


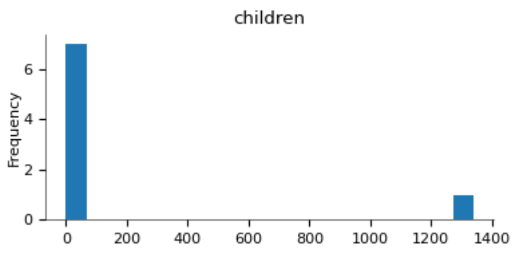


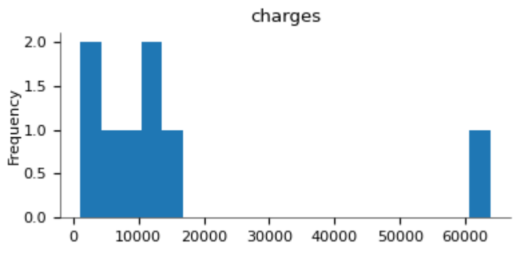


Distributions

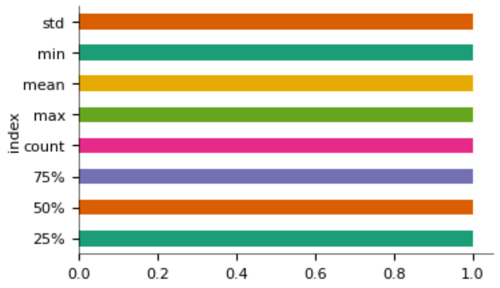




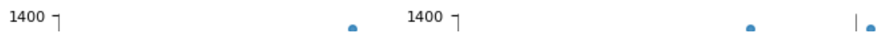




Categorical distributions



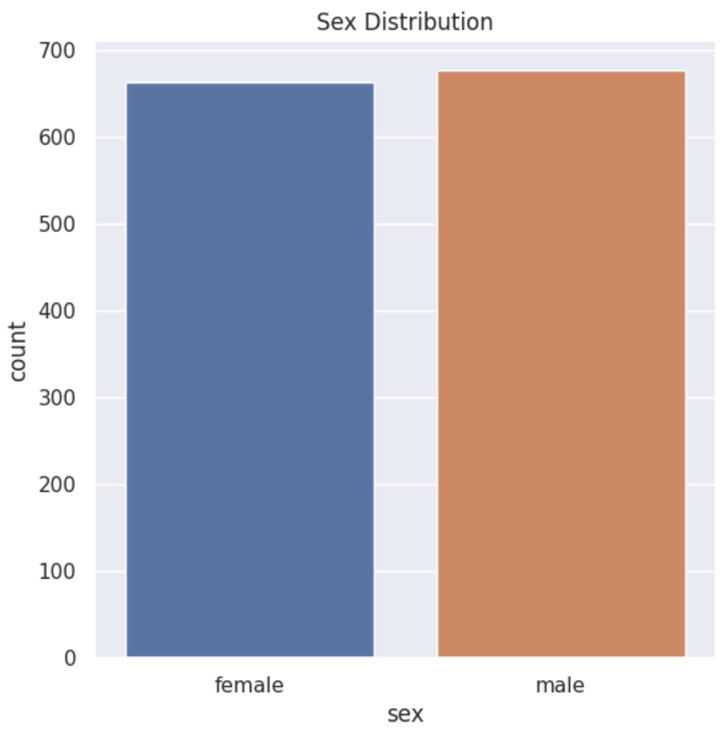
2-d distributions



```
# distribution of age value
sns.set()
plt.figure(figsize=(6,6))
sns.distplot(insurance_dataset['age'])
plt.title('Age Distribution')
plt.show()
```

```
    <ipython-input-14-28228e9c3528>:4: UserWarning:

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

```
# Gender column
plt.figure(figsize=(6,6))
sns.countplot(x='sex', data=insurance_dataset)
plt.title('Sex Distribution')
plt.show()
```



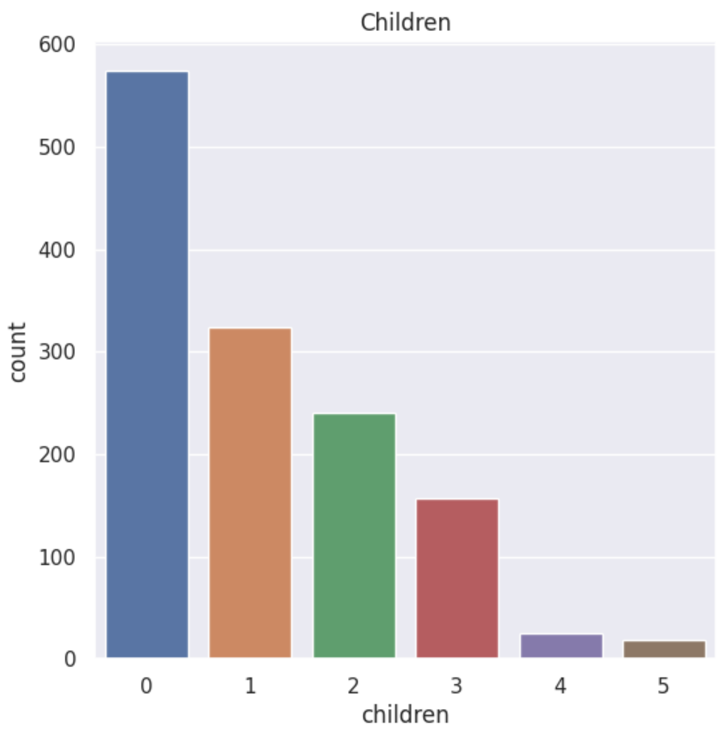
```
insurance_dataset['sex'].value_counts()

    male      676
    female    662
    Name: sex, dtype: int64
```

```
# bmi distribution
plt.figure(figsize=(6,6))
sns.distplot(insurance_dataset['bmi'])
plt.title('BMI Distribution')
plt.show()
```

```
<ipython-input-17-81b69896b0d5>: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(insurance_dataset['bmi'])
```

Normal BMI Range --> 18.5 to 24.9

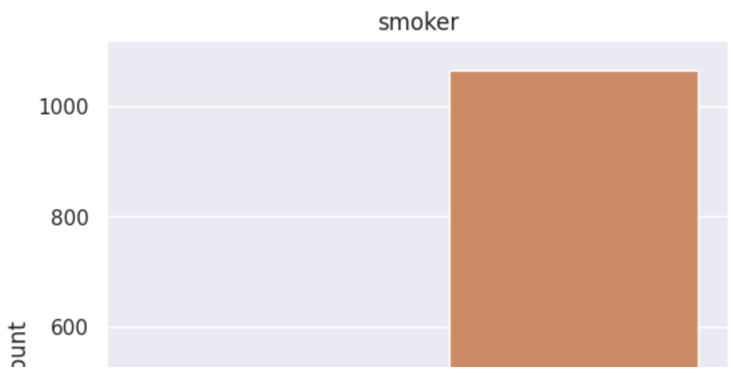
```
# children column
plt.figure(figsize=(6,6))
sns.countplot(x='children', data=insurance_dataset)
plt.title('Children')
plt.show()
```



```
insurance_dataset['children'].value_counts()
```

```
0    574
1    324
2    240
3    157
4     25
5     18
Name: children, dtype: int64
```

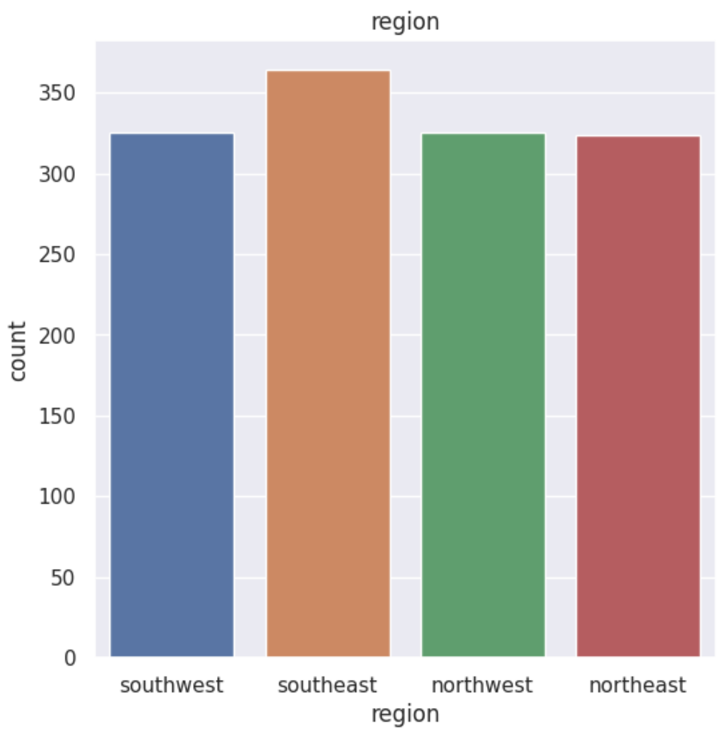
```
# smoker column
plt.figure(figsize=(6,6))
sns.countplot(x='smoker', data=insurance_dataset)
plt.title('smoker')
plt.show()
```



```
insurance_dataset['smoker'].value_counts()
```

```
no     1064
yes     274
Name: smoker, dtype: int64
```

```
# region column
plt.figure(figsize=(6,6))
sns.countplot(x='region', data=insurance_dataset)
plt.title('region')
plt.show()
```

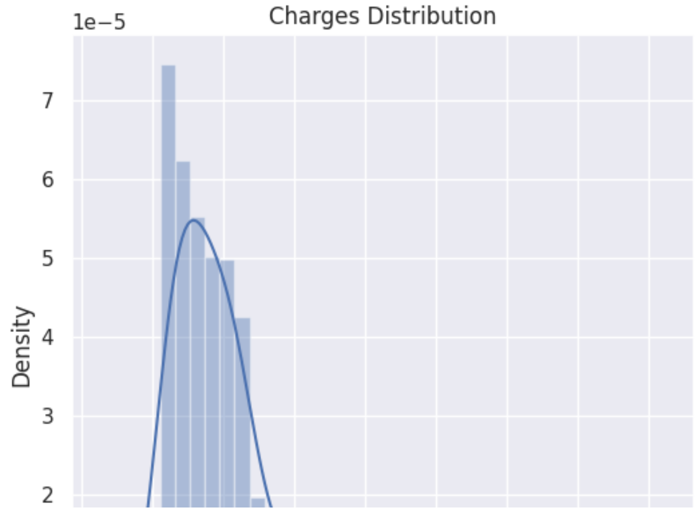


```
insurance_dataset['region'].value_counts()
```

```
southeast    364
southwest    325
northwest    325
northeast    324
Name: region, dtype: int64
```

```
# distribution of charges value
plt.figure(figsize=(6,6))
sns.distplot(insurance_dataset['charges'])
plt.title('Charges Distribution')
plt.show()
```

```
<ipython-input-24-a2fe9b394a51>: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(insurance_dataset['charges'])
```



Data Pre-Processing

Encoding the categorical features

```
# encoding sex column
insurance_dataset.replace({'sex':{'male':0,'female':1}}, inplace=True)

3 # encoding 'smoker' column
insurance_dataset.replace({'smoker':{'yes':0,'no':1}}, inplace=True)

# encoding 'region' column
insurance_dataset.replace({'region':{'southeast':0,'southwest':1,'northeast':2,'northwest':3}}, inplace=True)
```

Splitting the Features and Target

```
X = insurance_dataset.drop(columns='charges', axis=1)
Y = insurance_dataset['charges']
```

```
print(X)
```

```
      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 x 6 columns]
```

```
print(Y)
```

```
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
```

Splitting the data into Training data & Testing Data

```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=2)
print(X.shape, X_train.shape, X_test.shape)
```

```
(1338, 6) (1070, 6) (268, 6)
```

Model Training

Linear Regression

```
# loading the Linear Regression model
regressor = LinearRegression()
regressor.fit(X_train, Y_train)
```

```
▾ LinearRegression
LinearRegression()
```

Model Evaluation

```
# prediction on training data
training_data_prediction =regressor.predict(X_train)
# R squared value
r2_train = metrics.r2_score(Y_train, training_data_prediction)
print('R squared vale : ', r2_train)
# prediction on test data
test_data_prediction =regressor.predict(X_test)
print("*************************")
# R squared value
r2_test = metrics.r2_score(Y_test, test_data_prediction)
print('R squared vale : ', r2_test)
```

```
R squared vale :  0.751505643411174
*************************
R squared vale :  0.7447273869684076
```

Building a Predictive System

```
input_data = (31,1,25.74,0,1,0)

# changing input_data to a numpy array
input_data_as_numpy_array = np.asarray(input_data)

# reshape the array
input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

prediction = regressor.predict(input_data_reshaped)
print(prediction)

print('The insurance cost is USD ', prediction[0])
```

```
[3760.0805765]
The insurance cost is USD  3760.080576496057
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:439: UserWarning: X does not have valid feature names, but LinearRegression
  warnings.warn(
```

✓ 0s completed at 3:16 PM