In [ ]:

```python
# =======================================================================
# This code is part of Assignment 3 of ML lab (Executive M-Tech -ML Ass
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#========================================================================
```

In [1]:

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder
from math import sqrt
```

In [2]:

```python
# Load the dataset from CSV
df = pd.read_csv('./insurance.csv')


# Remove the duplicate entries and Do the re-indexing of all the data
df.drop_duplicates(inplace=True)
df.reset_index(drop=True, inplace=True)

df.head(5)
```

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

In [3]:

```python
# Convert strings to digits we need to know the unique values
print("sex:     ", df['sex'].unique())
print("smoker: ", df['smoker'].unique())
print("region: ", df['region'].unique())

```

```
sex:     ['female' 'male']
smoker:  ['yes' 'no']
region:  ['southwest' 'southeast' 'northwest' 'northeast']
```

In [4]:

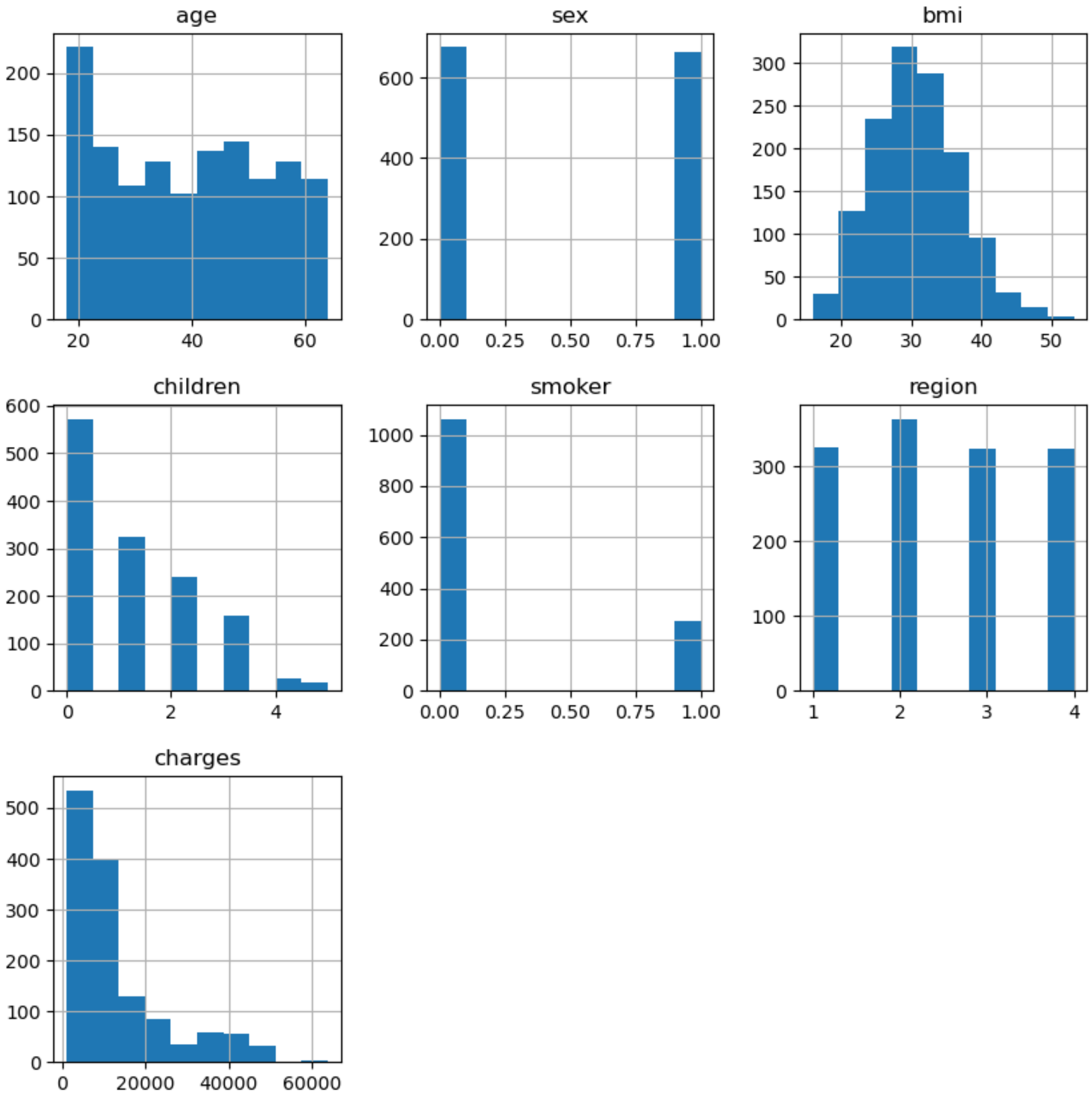
```
#update the strings with digit values
df['sex'] = df['sex'].apply({'male':0, 'female':1}.get)
df['smoker'] = df['smoker'].apply({'yes':1, 'no':0}.get)
df['region'] = df['region'].apply({'southwest':1, 'southeast':2, 'north

df.head(5)
```

Out[4]:

	age	sex	bmi	children	smoker	region	charges
0	19	1	27.900	0	1	1	16884.92400
1	18	0	33.770	1	0	2	1725.55230
2	28	0	33.000	3	0	2	4449.46200
3	33	0	22.705	0	0	3	21984.47061
4	32	0	28.880	0	0	3	3866.85520

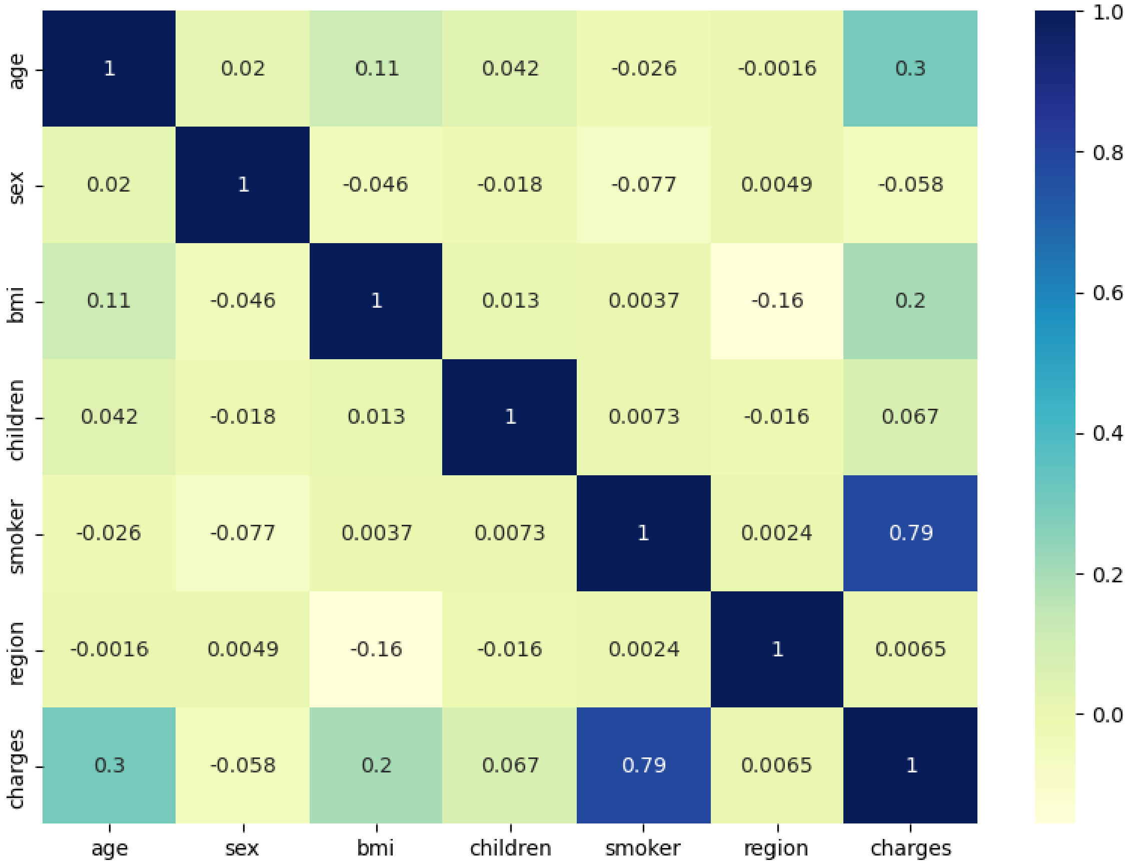
In [5]:

```
#Let us see the data and uniformity of the data
df.hist(bins=10, figsize=(10, 10))
plt.show()
```



In [6]:

```python
#Let us check correlation of the data
import seaborn as sns

plt.figure(figsize=(10,7))
sns.heatmap(df.corr(), annot = True, cmap="YlGnBu")
plt.show()
```



	age	sex	bmi	children	smoker	region	charges
age	1	0.02	0.11	0.042	-0.026	-0.0016	0.3
sex	0.02	1	-0.046	-0.018	-0.077	0.0049	-0.058
bmi	0.11	-0.046	1	0.013	0.0037	-0.16	0.2
children	0.042	-0.018	0.013	1	0.0073	-0.016	0.067
smoker	-0.026	-0.077	0.0037	0.0073	1	0.0024	0.79
region	-0.0016	0.0049	-0.16	-0.016	0.0024	1	0.0065
charges	0.3	-0.058	0.2	0.067	0.79	0.0065	1

```
#We can see that the "smoker" feature is the most affecting feature to the charges.
#Beside Smoker, BMI and age is also hold very good corr. in deciding the charges.
#Lets take only BMI feature and refine it further.
```

In [7]:

```python
print('bmi correlation : ', df['charges'].corr(df['bmi']))
print('smoker correlation : ', df['charges'].corr(df['smoker']))
print('age correlation : ', df['charges'].corr(df['age']))
```

```
bmi correlation :  0.1984008312262494
smoker correlation :  0.787234367280032
age correlation :  0.2983082125097864
```

Besed on these we can say that BMI is more accurate to move ahead so, we will take only BMI & charges

In [9]:

```
from sklearn.model_selection import train_test_split

x_data = df["bmi"].values
y_data = df["charges"].values

#Let us split the dataset to training and testing data
x_train, x_test, y_train, y_test = train_test_split(x_data, y_data, tes
```

In [10]:

```
#Let us see the number of rows in each i.e. training & test data
print("X_train shape: ", x_train.shape)
print("X_test shape: ", x_test.shape)
print("y_train shape: ", y_train.shape)
print("y_test shape: ", y_test.shape)
```

```
X_train shape:  (935,)
X_test shape:  (402,)
y_train shape:  (935,)
y_test shape:  (402,)
```

In [11]:

```python
class myLinearRegression() :

    def __init__( self ):
        self.b0 = 0
        self.b1 = 0
        self.predictions = list()

    def fit(self, x, y):
        x_mean = sum(x) / float(len(x))
        y_mean = sum(y) / float(len(y))
        n = len(x)
        numerator = 0
        denominator = 0

        for i in range(n):
            numerator += (x[i] - x_mean) * (y[i] - y_mean)
            denominator += (x[i] - x_mean) ** 2

        b1 = numerator / denominator
        b0 = y_mean - (b1 * x_mean)

        self.b0 = b0
        self.b1 = b1

    def predict(self, x_test):
        self.predictions.clear()
        for row in x_test:
            yhat = self.b0 + self.b1 * x_test
            self.predictions.append(yhat)
        return self.predictions

    def plot(self, X, Y):
        #plotting values
        x_max = np.max(X) + 5
        x_min = np.min(X) - 5

        #calculating line values of x and y
        x = np.linspace(x_min, x_max, 1000)
        y = self.b0 + self.b1 * x

        #plotting line
        plt.plot(x, y, color='red', label='Linear Regression')

        #plot the data point
        plt.scatter(X, Y, color='blue', label='Data Point')

        plt.xlabel('BMI')
        plt.ylabel('Charges')

        plt.legend()
        plt.show()


    def r_square(self, x_test, y_test):
        y_mean = np.mean(y_test)

        sumofsquares = 0
        sumofresiduals = 0
        n = len(x_test)

        for i in range(n) :
            y_pred = self.b0 + self.b1 * x_test[i]
            sumofsquares += (y_test[i] - y_mean) ** 2
            sumofresiduals += (y_test[i] - y_pred) **2

        score  = 1 - (sumofresiduals/sumofsquares)

        return score
```

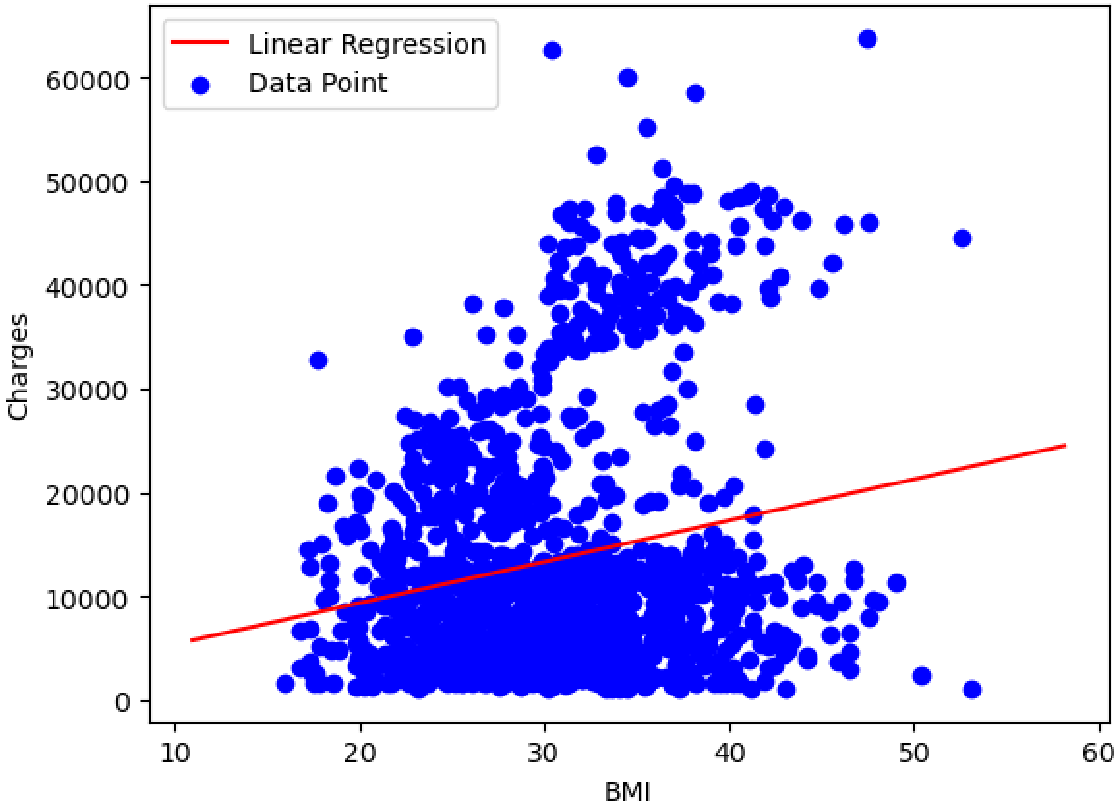
In [12]:

```
my_lr = myLinearRegression()

my_lr.fit(x_train, y_train)
test_prediction = my_lr.predict(x_test)

score = my_lr.r_square(x_test, y_test)
print(score)
```

```
0.7275704833996746
```

In [13]:

```
my_lr.plot(x_data, y_data)
```



In [ ]:

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