In [1]:

```
import pandas as pd
import numpy as np
```

In [2]:

```
df = pd.read_csv('insurance.csv',index_col=None)
df
```

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
...	...	...	...	...	...	...	...
995	39	female	23.275	3	no	northeast	7986.47525
996	39	female	34.100	3	no	southwest	7418.52200
997	63	female	36.850	0	no	southeast	13887.96850
998	33	female	36.290	3	no	northeast	6551.75010
999	36	female	26.885	0	no	northwest	5267.81815

1000 rows × 7 columns

In [3]:

```
df.info
```

Out[3]:

```
<bound method DataFrame.info of      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
..   ...     ...     ...       ...    ...        ...          ...
995   39  female  23.275         3     no  northeast   7986.47525
996   39  female  34.100         3     no  southwest   7418.52200
997   63  female  36.850         0     no  southeast  13887.96850
998   33  female  36.290         3     no  northeast   6551.75010
999   36  female  26.885         0     no  northwest   5267.81815

[1000 rows x 7 columns]>
```

In [4]:

```
from sklearn.preprocessing import LabelEncoder

LE = LabelEncoder()
df['sex'] = LE.fit_transform(df['sex'])
df['smoker'] = LE.fit_transform(df['smoker'])
df['region'] = LE.fit_transform(df['region'])

df
```

Out[4]:

	age	sex	bmi	children	smoker	region	charges
0	19	0	27.900	0	1	3	16884.92400
1	18	1	33.770	1	0	2	1725.55230
2	28	1	33.000	3	0	2	4449.46200
3	33	1	22.705	0	0	1	21984.47061
4	32	1	28.880	0	0	1	3866.85520
...	...	...	...	...	...	...	...
995	39	0	23.275	3	0	0	7986.47525
996	39	0	34.100	3	0	3	7418.52200
997	63	0	36.850	0	0	2	13887.96850
998	33	0	36.290	3	0	0	6551.75010
999	36	0	26.885	0	0	1	5267.81815

1000 rows × 7 columns

Label Encoding Info:

sex: Male - 1, Female - 0
smoker: Yes - 1, No - 0
region: southwest - 3, southeast - 2, northwest - 1, northeast - 0

In [5]:

```
data = df.iloc[:,:6].values
data
```

Out[5]:

```
array([[19.   ,  0.   , 27.9  ,  0.   ,  1.   ,  3.   ],
       [18.   ,  1.   , 33.77 ,  1.   ,  0.   ,  2.   ],
       [28.   ,  1.   , 33.   ,  3.   ,  0.   ,  2.   ],
       ...,
       [63.   ,  0.   , 36.85 ,  0.   ,  0.   ,  2.   ],
       [33.   ,  0.   , 36.29 ,  3.   ,  0.   ,  0.   ],
       [36.   ,  0.   , 26.885,  0.   ,  0.   ,  1.   ]])
```

In [25]:

```
charges = df.iloc[:,-1].values
charges
```

Out[25]:

```
array([16884.924   ,  1725.5523  ,  4449.462   , 21984.47061 ,
        3866.8552  ,  3756.6216  ,  8240.5896  ,  7281.5056  ,
        6406.4107  , 28923.13692 ,  2721.3208  , 27808.7251  ,
        1826.843   , 11090.7178  , 39611.7577  ,  1837.237   ,
       10797.3362  ,  2395.17155 , 10602.385   , 36837.467   ,
       13228.84695 ,  4149.736   ,  1137.011   , 37701.8768  ,
        6203.90175 , 14001.1338  , 14451.83515 , 12268.63225 ,
        2775.19215 , 38711.      , 35585.576   ,  2198.18985 ,
        4687.797   , 13770.0979  , 51194.55914 ,  1625.43375 ,
       15612.19335 ,  2302.3     , 39774.2763  , 48173.361   ,
        3046.062   ,  4949.7587  ,  6272.4772  ,  6313.759   ,
        6079.6715  , 20630.28351 ,  3393.35635 ,  3556.9223  ,
       12629.8967  , 38709.176   ,  2211.13075 ,  3579.8287  ,
       23568.272   , 37742.5757  ,  8059.6791  , 47496.49445 ,
       13607.36875 , 34303.1672  , 23244.7902  ,  5989.52365 ,
        8606.2174  ,  4504.6624  , 30166.61817 ,  4133.64165 ,
       14711.7438  ,  1743.214   , 14235.072   ,  6389.37785 ,
        5920.1041  , 17663.1442  , 16577.7795  ,  6799.458   ,
       11741.726   , 11946.6259  ,  7726.854   , 11356.6609  ,
        3947.4131  ,  1532.4697  ,  2755.02095 ,  6571.02435 ,
        4441.21315 ,  7935.29115 , 37165.1638  , 11033.6617  ,
```

```
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  2867.1196  , 47055.5321  , 10825.2537  , 11881.358   ,
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 6358.77645 , 19933.458   , 11534.87265 , 47462.894   ,
 4527.18295 , 38998.546   , 20009.63365 ,  3875.7341  ,
41999.52    , 12609.88702 , 41034.2214  , 28468.91901 ,
 2730.10785 ,  3353.284   , 14474.675   ,  9500.57305 ,
26467.09737 ,  4746.344   , 23967.38305 ,  7518.02535 ,
 3279.86855 ,  8596.8278  , 10702.6424  ,  4992.3764  ,
 2527.81865 ,  1759.338   ,  2322.6218  , 16138.76205 ,
 7804.1605  ,  2902.9065  ,  9704.66805 ,  4889.0368  ,
25517.11363 ,  4500.33925 , 19199.944   , 16796.41194 ,
 4915.05985 ,  7624.63    ,  8410.04685 , 28340.18885 ,
 4518.82625 , 14571.8908  ,  3378.91    ,  7144.86265 ,
10118.424   ,  5484.4673  , 16420.49455 ,  7986.47525 ,
 7418.522   , 13887.9685  ,  6551.7501  ,  5267.81815 ])
```

In [28]:

```
def NormalizeData(data):
    return (data - np.min(data)) / (np.max(data) - np.min(data))
```

In [29]:

```
charges = NormalizeData(charges)
```

In [20]:

```
from sklearn import linear_model
from sklearn.metrics import mean_squared_error, r2_score, mean_absolute_error
```

In [21]:

```
def huber_loss(y_true, y_pred, delta=1.0):
    residual = y_true - y_pred
    huber_loss = np.where(np.abs(residual) <= delta, 0.5 * residual ** 2, delta * (np.ab
s(residual) - 0.5 * delta))
    return np.mean(huber_loss)
```

In [30]:

```
regr = linear_model.LinearRegression()

regr.fit(data, charges)

y_pred = regr.predict(data)
```

Without Normalization

In [27]:

```
print("Coefficients: \n", regr.coef_)
print("Mean squared error: %.2f" % mean_squared_error(charges, y_pred))
print("Mean absolute error: %.2f" % mean_absolute_error(charges, y_pred))
print("Coefficient of determination: %.2f" % r2_score(charges, y_pred))
print("Huber Loss: %.2f" % huber_loss(charges, y_pred))
```

```
Coefficients:
 [  265.00281538  -276.07122609   332.34748636   415.6631237
 23799.08282857  -462.08574687]
Mean squared error: 34925480.46
Mean absolute error: 4039.36
Coefficient of determination: 0.76
Huber Loss: 4038.86
```

With Normalization

In [31]:

```
print("Coefficients: \n", regr.coef_)
print("Mean squared error: %.2f" % mean_squared_error(charges, y_pred))
```

```
print("Mean absolute error: %.2f" % mean_absolute_error(charges, y_pred))
print("Coefficient of determination: %.2f" % r2_score(charges, y_pred))
print("Huber Loss: %.2f" % huber_loss(charges, y_pred))
```

```
Coefficients:
 [ 0.00422999 -0.00440667  0.00530495  0.00663484  0.3798824  -0.00737584]
Mean squared error: 0.01
Mean absolute error: 0.06
Coefficient of determination: 0.76
Huber Loss: 0.00
```