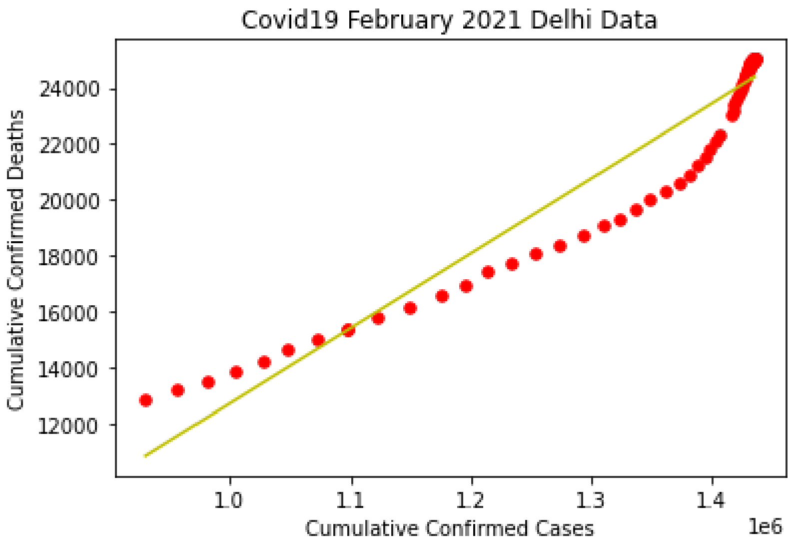
In [2]:

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

#Demonstrating Simple Linear Refression with 1 independent variable

df=pd.read_csv("data-Delhi.csv")

print(df)

X = np.array(df['Confirmed']).reshape(-1, 1)
y = np.array(df['Deaths']).reshape(-1, 1)

from sklearn.linear_model import LinearRegression
reg = LinearRegression().fit(X, y)
r2=reg.score(X, y)
coef=reg.coef_

intc=reg.intercept_

line=intc + coef*X

y_pred = reg.predict(y)

plt.scatter(X,y,color="r",marker="o",s=30)
plt.plot(X,line,color="y")
plt.xlabel('Cumulative Confirmed Cases')
plt.ylabel('Cumulative Confirmed Deaths')
plt.title('Covid19 February 2021 Delhi Data')
plt.show()

#To calculate standard error of regression slope
se = np.sqrt(1/(len(df)-2)*sum((y-y_pred)*(y-y_pred))/sum((X-np.mean(X))*(X-np.mean(X))))

print("Intercept value = ",intc)
print("Slope value = ",coef[0])
print("r2 value = ",r2)
print("Standard Error of regression slope = ",se)
```

```
    Unnamed: 0                 Time  State  Confirmed  Recovered  Deaths  \
0            0  2021-04-22 22:46:02  Delhi     930179     831928   12887   
1            1  2021-04-22 23:54:36  Delhi     956348     851537   13193   
2            2  2021-04-23 23:24:43  Delhi     980679     875109   13541   
3            3  2021-04-24 23:24:30  Delhi    1004782     897804   13898   
4            4  2021-04-25 22:29:17  Delhi    1027715     918875   14248   
..         ...                  ...    ...        ...        ...     ...   
85          85  2021-07-11 19:02:20  Delhi    1435083    1409325   25015   
86          86  2021-07-12 19:58:16  Delhi    1435128    1409417   25018   
87          87  2021-07-14 13:56:28  Delhi    1435204    1409501   25020   
88          88  2021-07-14 18:39:07  Delhi    1435281    1409572   25021   
89          89  2021-07-15 19:34:29  Delhi    1435353    1409660   25022   

    Active  New Cases  
0    85364        NaN  
1    91618    26169.0  
2    92029    24331.0  
3    93080    24103.0  
4    94592    22933.0  
..     ...        ...  
85     743       53.0  
86     693       45.0  
87     683       76.0  
88     688       77.0  
89     671       72.0  

[90 rows x 8 columns]
```



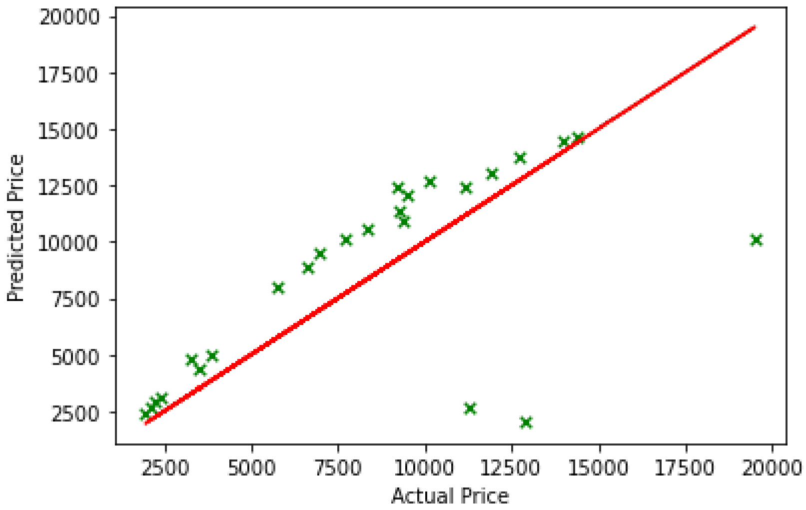

```
Intercept value =  [-14037.2764932]
Slope value =  [0.02677429]
r2 value =  0.9313659523193988
Standard Error of regression slope =  [0.02892491]
```

In [5]:
```
import pandas as pd
from sklearn.metrics import r2_score
import matplotlib.pyplot as plt

# set the max columns to none
pd.set_option('display.max_columns', None)

dp=pd.read_csv("insurance.csv")

df=dp
df.drop(df.index[(df['smoker']=='yes')],axis=0,inplace=True)
df.drop(df.index[(df['region']=='southeast')],axis=0,inplace=True)
df.drop(df.index[(df['region']=='southwest')],axis=0,inplace=True)
df.drop(df.index[(df['sex']=='female')],axis=0,inplace=True)
df.drop(df.index[(df['region']=='northwest')],axis=0,inplace=True)
df.drop('region',inplace=True ,axis=1)
df.drop('sex',inplace=True ,axis=1)
df.drop('smoker',inplace=True ,axis=1)
y=df['charges']
X=df.drop(['charges'],axis=1)
```

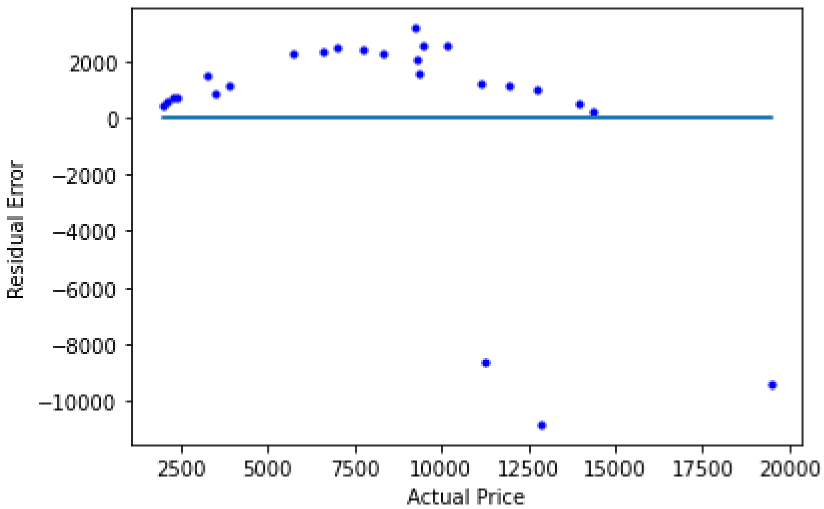
```
print("\n")
print(X)
print("\n")

# importing train_test_split from sklearn
from sklearn.model_selection import train_test_split
# splitting the data
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)

# importing module
from sklearn.linear_model import LinearRegression
# creating an object of LinearRegression class
LR = LinearRegression()
# fitting the training data
LR.fit(x_train,y_train)

y_prediction =  LR.predict(x_test)

print('Intercept = ')
print(LR.intercept_)

print('\nCoefficients = ')
print(LR.coef_)

print('\nr2 score for testing set = ', r2_score(y_test,y_prediction))

plt.scatter(y_test,y_prediction,color="g",marker="x",s=30)
plt.plot(y_test,y_test,color="r")
plt.xlabel('Actual Price')
plt.ylabel('Predicted Price')
plt.show()

plt.close()

plt.scatter(y_test,-y_test + LR.predict(x_test),color="blue",marker="o",s=10)
plt.plot(y_test,y_prediction-y_prediction,)
plt.xlabel('Actual Price')
plt.ylabel('Residual Error')
plt.show()

print('\n')
print(y_prediction)

age=input("\n\nEnter age: ")
```

```
bmi=input("Enter bmi: ")
chil=input("Enter children: ")
print("\nInsurance Price as per users input:")
print(LR.predict(pd.DataFrame({'age':[age],'bmi':[bmi],'children':[chil]})))
```

```
      age     bmi  children
8      37  29.830         2
10     25  26.220         0
17     23  23.845         0
44     38  37.050         1
60     43  27.360         3
...   ...     ...       ...
1294   58  25.175         0
1296   18  26.125         0
1315   18  28.310         1
1318   35  39.710         4
1325   61  33.535         0

[125 rows x 3 columns]


Intercept =
-3809.9095124767628

Coefficients =
[279.14545162  21.57634111 822.22492955]

r2 score for testing set =  0.3110662695971691
```



20000
17500
15000
12500
10000
7500
5000
2500
Predicted Price
2500
5000
7500
10000
12500
15000
17500
20000
Actual Price



2000
0
−2000
−4000
−6000
−8000
−10000
Residual Error
2500
5000
7500
10000
12500
15000
17500
20000
Actual Price

```
[13736.17127083  2375.62672732 10910.25008812  8913.99459572
 10122.33122643  2642.47366451 13034.39769918  2954.41515463
  2059.20660796 10572.46928622 12719.86673361 12381.81818526
  7997.10193108 11334.06480208  9475.03781125 14454.72198617
  4337.30417526 14625.23056028  2647.75976324  3124.92372874
  4770.72078037 10105.87751819 12385.70140246  4955.41702271
 12032.44142879]


Enter age: 45
Enter bmi: 22.85
Enter children: 2

Insurance Price as per users input:
[10889.10506415]
```

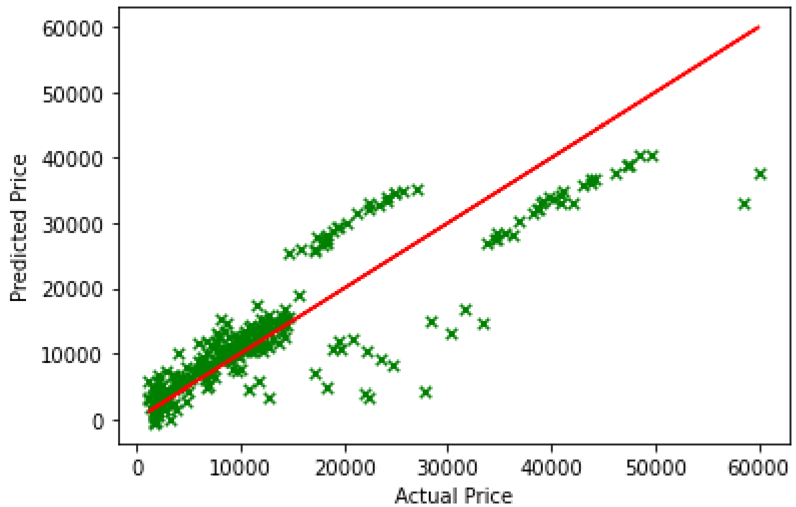
In [6]:

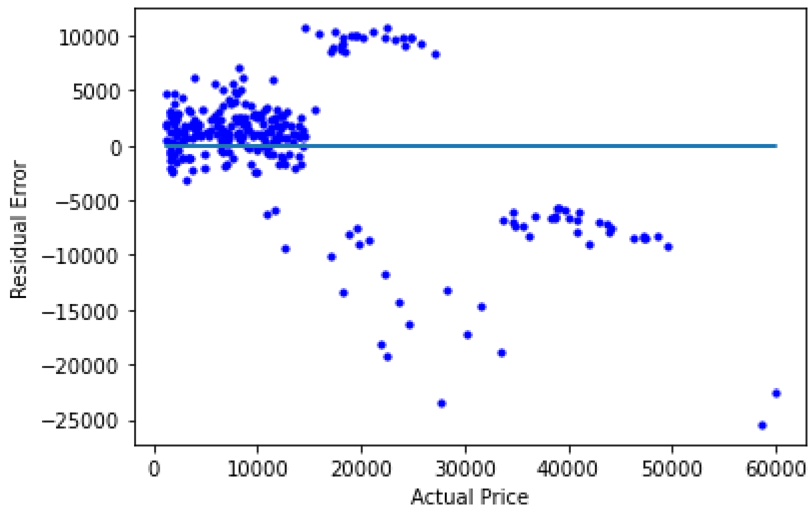
```
import pandas as pd
from sklearn.metrics import r2_score
import matplotlib.pyplot as plt

# set the max columns to none
pd.set_option('display.max_columns', None)

dp=pd.read_csv("insurance.csv")

dp=pd.concat([dp,pd.get_dummies(dp['sex'])],axis=1)
dp=pd.concat([dp,pd.get_dummies(dp['smoker'])],axis=1)
dp=pd.concat([dp,pd.get_dummies(dp['region'])],axis=1)

dp.drop('region',inplace=True ,axis=1)
dp.drop('sex',inplace=True ,axis=1)
dp.drop('smoker',inplace=True ,axis=1)
dp.drop('male',inplace=True ,axis=1)
dp.drop('yes',inplace=True ,axis=1)
dp.drop('southwest',inplace=True ,axis=1)

print(dp)

y=dp['charges']
X=dp.drop(['charges'],axis=1)

print("\n")
print(X)
```

```python
print("\n")

# importing train_test_split from sklearn
from sklearn.model_selection import train_test_split

x_train, x_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 1)

# importing module
from sklearn.linear_model import LinearRegression
# creating an object of LinearRegression class
LR = LinearRegression()
# fitting the training data
LR.fit(x_train,y_train)

print("\nIntercept = ")
print(LR.intercept_)

print("Coefficients = ")
print(LR.coef_)

y_prediction =  LR.predict(x_test)

print('\nr2 score for testing set = ', r2_score(y_test,y_prediction))

plt.scatter(y_test,y_prediction,color="g",marker="x",s=30)
plt.plot(y_test,y_test,color="r")
plt.xlabel('Actual Price')
plt.ylabel('Predicted Price')
plt.show()

plt.close()

plt.scatter(y_test,-y_test + LR.predict(x_test),color="blue",marker="o",s=10)
plt.plot(y_test,y_prediction-y_prediction,)
plt.xlabel('Actual Price')
plt.ylabel('Residual Error')
plt.show()

print('\n')
print('Predicted values for testing set(y_prediction)\n')
print(y_prediction)
```

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

      southeast
0             0
1             1
2             1
3             0
4             0
...         ...
1333          0
1334          0
1335          1
1336          0
1337          0

[1338 rows x 9 columns]


      age     bmi  children  female  no  northeast  northwest  southeast
0      19  27.900         0       1   0          0          0          0
1      18  33.770         1       0   1          0          0          1
2      28  33.000         3       0   1          0          0          1
3      33  22.705         0       0   1          0          1          0
4      32  28.880         0       0   1          0          1          0
...   ...     ...       ...     ...  ..        ...        ...        ...
1333   50  30.970         3       0   1          0          1          0
1334   18  31.920         0       1   1          1          0          0
1335   18  36.850         0       1   1          0          0          1
1336   21  25.800         0       1   1          0          0          0
1337   61  29.070         0       1   0          0          1          0

[1338 rows x 8 columns]
```

```
Intercept =
11343.689963450903
Coefficients =
[   257.49024669    321.62189278    408.06102001    242.15306559
 -23786.48604536    903.03300778    506.93644423   -135.34287187]

r2 score for testing set =  0.7623311844057112
```





Predicted values for testing set(y_prediction)

```
[ 4383.68089988 12885.03892192 12589.21653212 13286.22919217
   544.72832757 32117.58400779 12919.04237221 12318.62183013
  3784.29145555 29468.45725408 11002.8139431  17539.69473777
  8681.35471964  8349.04325528  3130.12725504 10445.83896118
  3863.74357865  6944.62510786 15009.63121084 14441.59911874
 12543.65768867 32958.72553095  9072.63608136  8986.85860053
  3022.85773294  8164.97136102  9556.07558002 10743.20363927
  7694.01743692  4373.43771674 14140.93557984  5811.78545062
 34631.91316718 27009.11191231 33348.14098668  9532.96786929
 30421.65017927 26648.91186842 15157.78333287 33895.76121465
  6303.38552088 14059.15156303 10713.4467824  15089.36171493
  4187.95334069 13106.4297513   4336.19603407 28607.05556216
  7243.57117377 14269.4643165  13282.36924936 12329.61280721
  1851.87215658  8876.2837892  26089.18341811 10125.8221046
 34218.77265378 14537.70022165  3232.07805794  5889.64309508
  6558.45711628 14952.73214832 26943.84457634  3272.57672674
 15795.18877494 11220.12036023 11132.67761401 10461.51218201
  1520.17580687 25268.32319722 37555.4332681  33131.32070966
  1986.54437212 11348.45648105 13683.62487834 34970.76597049
  3194.05204265  3875.19388449 10355.84468565 10429.85383112
   -74.18168095 14069.96921025 10335.95235396  3160.49129709
 33495.55139469 33108.38629603  7159.042252   37712.17792565
 12860.01613403 10312.33535752 30118.39165257 33999.155218
 14744.35977759 10797.48057723   228.32604517 10550.25751993
  9637.2654186  14963.62716464 14973.49438453  6077.52837971
 13679.44499708 26048.6188477  28140.15460801 27428.44651929
 35323.96326034 27120.17093173   635.73242244  9265.30720109
  4700.17995399 12458.33462103  5334.04136712  4797.80959774
  1053.28620015 18801.23368294  3268.21781045  1680.06692797
 11731.45541277 12594.4560403  11876.24500234  3722.26917923
  8907.38977334 13909.79277731  7727.28039545  6573.92347482
 36668.28291771 12172.54974158 12246.4759298  29298.69540744
 36065.08836969 11635.06903459 28119.47917939  -420.5228157
  8255.48679122 31611.56891923  8278.51950655  -682.91733795
  1175.50251941  4610.52460783  7592.72365991 12602.74525758
 14871.84794414  8696.2661006  28916.17140639 15712.12938325
 14688.56307722 11117.34115616  1910.78149758 10065.51386262
  3785.83713249  6165.85822972 11400.42215978  5505.08475585
 14580.76982237 13691.35579602 12694.51188244  7023.42319484
 12388.68766385 10922.09183278 10269.55783904  4543.27270357
  5648.10144357 40390.9900769  13059.47316213  4308.66813543
```

```
  8433.53823713  4680.92297563 32207.14761827 11261.09752853
 10966.92628193  6893.83017801  6439.49932262  6698.81354717
 33082.53354683 34892.66990169  2163.75212652  7664.10129233
  5208.63123781 15537.4388228   1472.95942494 11431.38761905
 13442.52462926 11497.84155642 10547.85065715 13216.06609157
  2392.9275311  27535.86192673  2350.29363146 14750.02090702
  6294.4943912  10590.51504221 14975.55458721 38857.75707767
  2100.48817818  1489.62172706  5170.63120404  7556.77055613
  7905.80683902  4503.61764622 10680.78553577  8938.12057203
  9389.70713251 11104.75136012 10325.31689891  9247.40925093
  8075.54835929   895.79174623 10136.82246673  7306.72664577
  6626.07986045 11706.84936779  5409.99685749 32864.25315855
  7088.39118065  6309.6941707   7934.10447803 38948.10610123
 11941.19483711 28316.17975841  2882.4783976  33202.36401978
  3690.60862539 31577.22772525 13825.53657174  2716.91852953
  1908.80043495  1262.92212969  6109.40830379  4463.80387639
 25580.05728181 15737.66640221  5345.8549026  13030.85900261
 38954.05091304  4792.05740177 12711.42561622 11335.66208015
 27785.54316341  2794.86874955 13392.79241645  5727.91540048
 15215.43600554  5772.15783816 16929.82927411  3896.74375465
 12197.3470759  34682.24329155 10666.53272796 10601.36016707
  4875.20490336 16734.59399629 14399.64496923  5497.30018065
 11149.82336777 12497.70437379  4626.74808217  7169.33486073
 27667.13758601 32240.5545494   -474.41779055 40306.05467371
  9397.25562995  7750.27185181 10671.66257411 33555.1844395
 35949.5230514  36650.46723087  4961.92884343  6116.92057448]
```

In [ ]: