In [2]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

Reading the data through pandas

In [3]:
```
insurancedf=pd.read_csv('E:/Learning/Projects/Python_Projects/insurance.csv')
insurancedf
```

Out[3]:

	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
...	...	...	...	...	...	...	...
1333	50	male	30.970	3	no	northwest	10600.54830
1334	18	female	31.920	0	no	northeast	2205.98080
1335	18	female	36.850	0	no	southeast	1629.83350
1336	21	female	25.800	0	no	southwest	2007.94500
1337	61	female	29.070	0	yes	northwest	29141.36030

Data Exploratory Analysis

No.of Rows and Columns of the data

In [4]:
```
print('Numberof rows=',insurancedf.shape[0])
print('Numberof columns=',insurancedf.shape[1])
```

```
Numberof rows= 1338
Numberof columns= 7
```

Information about the data

In [5]:
```
insurancedf.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
```

Statistical Information about the data

In [6]:
```
insurancedf.describe()
```

Out[6]:

	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

Number of male and female customers

In [7]:
```
customer_no=insurancedf['sex'].value_counts().reset_index()
customer_no
```

Out[7]:

	sex	count
0	male	676
1	female	662

Created Age_Group Column and rearranged the columns

In [8]:
```
bins=[18,25,35,50,60,100]
labels=['18-25','25-35','35-50','50-60','60-100']
insurancedf['Age_Group']=pd.cut(insurancedf['age'],bins=bins,labels=labels, right=False)
Changed_Order=['age','Age_Group','sex','bmi','children','smoker','region','charges']
insurancedf[Changed_Order]
```

Out[8]:

	age	Age_Group	sex	bmi	children	smoker	region	charges
0	19	18-25	female	27.900	0	yes	southwest	16884.92400
1	18	18-25	male	33.770	1	no	southeast	1725.55230
2	28	25-35	male	33.000	3	no	southeast	4449.46200
3	33	25-35	male	22.705	0	no	northwest	21984.47061
4	32	25-35	male	28.880	0	no	northwest	3866.85520
...	...	...	...	...	...	...	...	...
1333	50	50-60	male	30.970	3	no	northwest	10600.54830
1334	18	18-25	female	31.920	0	no	northeast	2205.98080
1335	18	18-25	female	36.850	0	no	southeast	1629.83350
1336	21	18-25	female	25.800	0	no	southwest	2007.94500
1337	61	60-100	female	29.070	0	yes	northwest	29141.36030

1338 rows × 8 columns

Number of smokers and non_smokers

In [9]:
```
insurancedf['smoker'].value_counts().reset_index()
```

Out[9]:

	smoker	count
0	no	1064
1	yes	274

Number of smokers and non_smokers gender wise

In [10]:
```
gender_smoker=insurancedf.groupby(['smoker','sex'])['sex'].count()
gender_smoker
```

Out[10]:
```
smoker  sex
no      female    547
        male      517
yes     female    115
        male      159
Name: sex, dtype: int64
```

Number of smokers and non_smokers by gender and age_group

In [11]:
```
insurancedf.groupby(['smoker','Age_Group','sex'])['Age_Group'].count()
```

Out[11]:
```
smoker  Age_Group  sex
no      18-25      female    107
                   male      111
        25-35      female    111
                   male      104
        35-50      female    162
                   male      152
        50-60      female    122
                   male      108
        60-100     female     45
                   male       42
yes     18-25      female     27
                   male       33
        25-35      female     21
                   male       35
        35-50      female     39
                   male       51
        50-60      female     15
                   male       26
        60-100     female     13
                   male       14
Name: Age_Group, dtype: int64
```

Total insurance charged for smokers and non_smokers

In [12]:
```
insurancedf.groupby('smoker')['charges'].sum().reset_index()
```

Out[12]:

	smoker	charges
0	no	8.974061e+06
1	yes	8.781764e+06

Total insurance charged by gender_wise

In [13]:
```
insurancedf.groupby('sex')['charges'].sum().reset_index()
```

Out[13]:

	sex	charges
0	female	8.321061e+06
1	male	9.434764e+06

Total charges split by gender and smoker

In [14]:
```
insurancedf.groupby(['sex','smoker'])['charges'].sum().reset_index()
```

Out[14]:

	sex	smoker	charges
0	female	no	4.792977e+06
1	female	yes	3.528085e+06
2	male	no	4.181085e+06
3	male	yes	5.253679e+06

Total insurance charges according to age group

In [15]:
```
insurancedf.groupby('Age_Group')['charges'].sum().reset_index()
```

Out[15]:

	Age_Group	charges
0	18-25	2.505153e+06
1	25-35	2.805498e+06
2	35-50	5.552691e+06
3	50-60	4.470208e+06
4	60-100	2.422274e+06

Encoding the object column data to find the correlation

In [16]:
```
from sklearn.preprocessing import LabelEncoder
```

In [17]:
```
encoder=LabelEncoder()
```

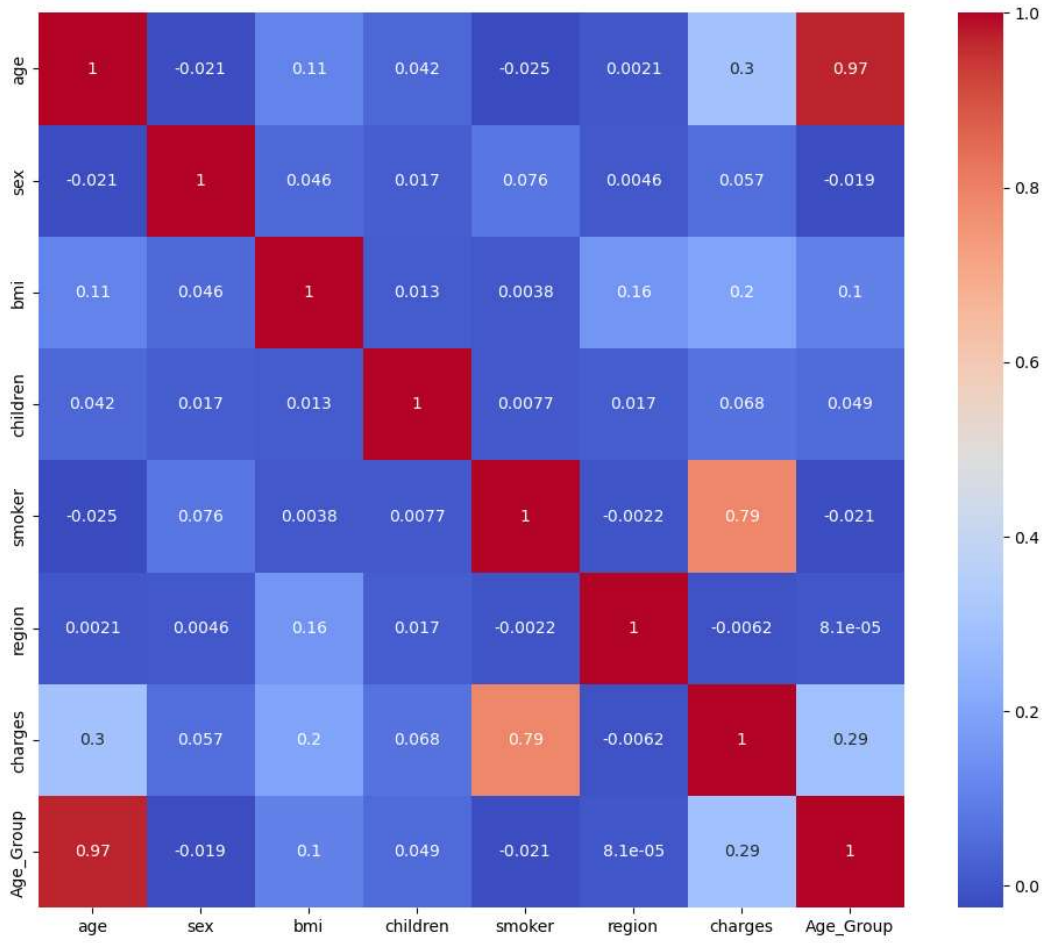
In [18]:
```
insurancedf['sex']=encoder.fit_transform(insurancedf['sex'])
insurancedf['smoker']=encoder.fit_transform(insurancedf['smoker'])
insurancedf['region']=encoder.fit_transform(insurancedf['region'])
insurancedf['Age_Group']=encoder.fit_transform(insurancedf['Age_Group'])
insurancedf
```

Out[18]:

	age	sex	bmi	children	smoker	region	charges	Age_Group
0	19	0	27.900	0	1	3	16884.92400	0
1	18	1	33.770	1	0	2	1725.55230	0
2	28	1	33.000	3	0	2	4449.46200	1
3	33	1	22.705	0	0	1	21984.47061	1
4	32	1	28.880	0	0	1	3866.85520	1
...	...	...	...	...	...	...	...	...
1333	50	1	30.970	3	0	1	10600.54830	3
1334	18	0	31.920	0	0	0	2205.98080	0
1335	18	0	36.850	0	0	2	1629.83350	0
1336	21	0	25.800	0	0	3	2007.94500	0
1337	61	0	29.070	0	1	1	29141.36030	4

1338 rows × 8 columns

In [20]:
```
corr=insurancedf.corr()
plt.figure(figsize=(12,10))
sns.heatmap(corr,annot=True, cmap='coolwarm')
plt.show()
```



In [28]:
```
from sklearn.model_selection import train_test_split
```

In [29]:
```
insurancedf.columns
```

Out[29]:
```
Index(['age', 'sex', 'bmi', 'children', 'smoker', 'region', 'charges',
       'Age_Group'],
      dtype='object')
```

In [59]:
```
x=insurancedf[['age','sex', 'bmi', 'children','smoker']]
x
```

Out[59]:

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

1338 rows × 5 columns

In [60]:
```
y=insurancedf[['charges']]
y
```

Out[60]:

	charges
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

1338 rows × 1 columns

In [61]:
```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=43)
```

In [62]:
```
x_train
```

Out[62]:

	age	sex	bmi	children	smoker
1306	29	0	21.850	0	1
717	60	1	24.320	1	0
47	28	0	34.770	0	0
890	64	0	26.885	0	1
778	35	1	34.320	3	0
...	...	...	...	...	...
307	30	0	33.330	1	0
16	52	0	30.780	1	0
58	53	0	22.880	1	1
277	22	0	24.300	0	0
255	55	0	25.365	3	0

936 rows × 5 columns

In [63]:
```
x_test
```

Out[63]:

	age	sex	bmi	children	smoker
1162	30	1	38.830	1	0
1191	41	0	21.755	1	0
134	20	0	28.785	0	0
722	62	1	37.400	0	0
1250	24	1	29.830	0	1
...	...	...	...	...	...
796	30	1	44.220	2	0
0	19	0	27.900	0	1
111	55	0	29.700	2	0
18	56	1	40.300	0	0
42	41	1	21.780	1	0

402 rows × 5 columns

In [64]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
```

In [65]:
```
linear=LinearRegression()
```

In [66]:
```
linear.fit(x_train,y_train)
```

Out[66]:
```
LinearRegression
LinearRegression()
```

In [67]:
```
y_pred=linear.predict(x_test)
y_pred
```

Out[67]:
```
array([[ 8467.72852303],
       [ 5916.34859023],
       [ 2538.88021381],
       [15148.36519452],
       [27259.76335122],
       [ 9482.74249778],
       [10972.62721142],
       [ 7069.05066509],
       [ 9935.29783686],
       [ 1205.68450198],
       [27616.50622428],
       [24457.43453757],
       [10061.95900863],
       [ 8935.98211973],
       [ 2234.47068459],
       [ 5324.62122909],
       [ 3014.46782381],
       [26890.28805636],
       [ 7239.00140402],
```

In [68]:
```
mean_squared_error=mean_squared_error(y_test,y_pred)
print('mean_squared_error={}'.format(mean_squared_error))
```

```
mean_squared_error=41031399.106997944
```

In [69]:
```
mean_absolute_error=mean_absolute_error(y_test,y_pred)
print('mean_absolute_error={}'.format(mean_absolute_error))
```

```
mean_absolute_error=4421.929699239758
```

In [70]:
```
r2=r2_score(y_test,y_pred)
print('R_Square_value={}'.format(r2))
```

```
R_Square_value=0.7506749357266358
```

In [71]:
```
insurancedf.columns
```

Out[71]:
```
Index(['age', 'sex', 'bmi', 'children', 'smoker', 'region', 'charges',
       'Age_Group'],
      dtype='object')
```

So, 'age', 'sex', 'bmi', 'children', 'smoker' affects the charges but age, and smoker influenced the charges 72%

In [72]:
```
x1=insurancedf[['age','smoker']]
```

In [73]:
```
x_train,x_test,y_train,y_test=train_test_split(x1,y,test_size=0.3,random_state=43)
```

In [75]:
```
y_train
```

Out[75]:

	charges
1306	16115.30450
717	13112.60480
47	3556.92230
890	29330.98315
778	5934.37980
...	...
307	4151.02870
16	10797.33620
58	23244.79020
277	2150.46900
255	13047.33235

936 rows × 1 columns

In [77]:
```
y_test
```

Out[77]:

	charges
1162	18963.17192
1191	13725.47184
134	2457.21115
722	12979.35800
1250	18648.42170
...	...
796	4266.16580
0	16884.92400
111	11881.35800
18	10602.38500
42	6272.47720

402 rows × 1 columns

In [81]:
```
linear.fit(x_train,y_train)
```

Out[81]:
```
LinearRegression()
```

In [82]:
```
y1_pred=linear.predict(x_test)
```

In [83]:
```
r2=r2_score(y_test,y1_pred)
print('R_Square_value={}'.format(r2))
```

```
R_Square_value=0.7218789354407178
```

Independent variables age and smoker impacted the insurance charged 72%

In [ ]:
```

```