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

Task 1

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

```
      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]
```

```
df.info
```

```
<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]>
```

```
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
```

```
     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 x 7 columns]
```

Label Encoding Info:

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

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

```
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.   ]])
```

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

```
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 ,
```

```
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       5920.1041  , 17663.1442  , 16577.7795  ,  6799.458   ,
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       3947.4131  ,  1532.4697  ,  2755.02095 ,  6571.02435 ,
       4441.21315 ,  7935.29115 , 37165.1638  , 11033.6617  ,
      39836.519   , 21098.55405 , 43578.9394  , 11073.176   ,
       8026.6666  , 11082.5772  ,  2026.9741  , 10942.13205 ,
      30184.9367  ,  5729.0053  , 47291.055   ,  3766.8838  ,
      12105.32    , 10226.2842  , 22412.6485  , 15820.699   ,
       6186.127   ,  3645.0894  , 21344.8467  , 30942.1918  ,
       5003.853   , 17560.37975 ,  2331.519   ,  3877.30425 ,
       2867.1196  , 47055.5321  , 10825.2537  , 11881.358   ,
       4646.759   ,  2404.7338  , 11488.31695 , 30259.99556 ,
      11381.3254  , 19107.7796  ,  8601.3293  ,  6686.4313  ,
       7740.337   ,  1705.6245  ,  2257.47525 , 39556.4945  ,
      10115.00885 ,  3385.39915 , 17081.08    ,  9634.538   ,
      32734.1863  ,  6082.405   , 12815.44495 , 13616.3586  ,
      11163.568   ,  1632.56445 ,  2457.21115 ,  2155.6815  ,
       1261.442   ,  2045.68525 , 27322.73386 ,  2166.732   ,
      27375.90478 ,  3490.5491  , 18972.495   , 18157.876   ,
      20745.9891  ,  5138.2567  , 40720.55105 ,  9877.6077  ,
      10959.6947  ,  1842.519   ,  5125.2157  ,  7789.635   ,
       6334.34355 , 19964.7463  ,  7077.1894  ,  6948.7008  ,
      21223.6758  , 15518.18025 , 36950.2567  , 19749.38338 ,
      21348.706   , 36149.4835  , 10450.552   ,  5152.134   ,
       5028.1466  , 10407.08585 ,  4830.63    ,  6128.79745 ,
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       1694.7964  ,  5246.047   ,  2855.43755 , 48824.45    ,
       6455.86265 , 10436.096   ,  8823.279   ,  8538.28845 ,
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       7731.4271  , 43753.33705 ,  3981.9768  ,  5325.651   ,
       6775.961   ,  4922.9159  , 12557.6053  ,  4883.866   ,
       2137.6536  , 12044.342   ,  1137.4697  ,  1639.5631  ,
       5649.715   ,  8516.829   ,  9644.2525  , 14901.5167  ,
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       19798.05455 ,  2221.56445 ,  1634.5734  ,  2117.33885 ,
        8688.85885 , 48673.5588  ,  4661.28635 ,  8125.7845  ,
       12644.589   ,  4564.19145 ,  4846.92015 ,  7633.7206  ,
       15170.069   , 17496.306   ,  2639.0429  , 33732.6867  ,
       14382.70905 ,  7626.993   ,  5257.50795 ,  2473.3341  ,
       21774.32215 , 35069.37452 , 13041.921   ,  5245.2269  ,
       13451.122   , 13462.52    ,  5488.262   ,  4320.41085 ,
        6250.435   , 25333.33284 ,  2913.569   , 12032.326   ,
       13470.8044  ,  6289.7549  ,  2927.0647  ,  6238.298   ,
       10096.97    ,  7348.142   ,  4673.3922  , 12233.828   ,
       32108.66282 ,  8965.79575 ,  2304.0022  ,  9487.6442  ,
        1121.8739  ,  9549.5651  ,  2217.46915 ,  1628.4709  ,
       12982.8747  , 11674.13    ,  7160.094   , 39047.285   ,
        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 ])

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

regr = linear_model.LinearRegression()

regr.fit(data, charges)

y_pred = regr.predict(data)

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

```
y_pred))
print("Coefficient of determination: %.2f" % r2_score(charges,
y_pred))
```

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

Task 2

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

```
         step      type    amount     nameOrig  oldbalanceOrg
newbalanceOrig  \
0           1   PAYMENT   9839.64  C1231006815      170136.00
160296.36
1           1   PAYMENT   1864.28  C1666544295       21249.00
19384.72
2           1  TRANSFER    181.00  C1305486145         181.00
0.00
3           1  CASH_OUT    181.00   C840083671         181.00
0.00
4           1   PAYMENT  11668.14  C2048537720       41554.00
29885.86
...       ...       ...       ...          ...            ...
...
1047295    95   PAYMENT   9028.31   C351212668      105818.00
96789.69
1047296    95   PAYMENT   6290.51   C404585795       96789.69
90499.18
1047297    95   PAYMENT   2499.92  C2079661953       90499.18
87999.25
1047298    95   PAYMENT   4780.32  C2115046838         802.00
0.00
1047299    95   PAYMENT    789.77   C386614070       30791.00
30001.23

            nameDest  oldbalanceDest  newbalanceDest  isFraud
isFlaggedFraud
0        M1979787155             0.0             0.0        0
0
1        M2044282225             0.0             0.0        0
0
2         C553264065             0.0             0.0        1
0
3          C38997010         21182.0             0.0        1
0
```

```
4        M1230701703             0.0             0.0        0
0
...              ...             ...             ...      ...
...
1047295  M1938858197             0.0             0.0        0
0
1047296   M391493091             0.0             0.0        0
0
1047297   M227905058             0.0             0.0        0
0
1047298  M1154565434             0.0             0.0        0
0
1047299   M919485291             0.0             0.0        0
0

[1047300 rows x 11 columns]
```

df.info

```
<bound method DataFrame.info of          step      type    amount
nameOrig  oldbalanceOrg  newbalanceOrig  \
0           1   PAYMENT   9839.64  C1231006815      170136.00
160296.36
1           1   PAYMENT   1864.28  C1666544295       21249.00
19384.72
2           1  TRANSFER    181.00  C1305486145         181.00
0.00
3           1  CASH_OUT    181.00   C840083671         181.00
0.00
4           1   PAYMENT  11668.14  C2048537720       41554.00
29885.86
...       ...       ...       ...          ...            ...
...
1047295    95   PAYMENT   9028.31   C351212668      105818.00
96789.69
1047296    95   PAYMENT   6290.51   C404585795       96789.69
90499.18
1047297    95   PAYMENT   2499.92  C2079661953       90499.18
87999.25
1047298    95   PAYMENT   4780.32  C2115046838         802.00
0.00
1047299    95   PAYMENT    789.77   C386614070       30791.00
30001.23

            nameDest  oldbalanceDest  newbalanceDest  isFraud
isFlaggedFraud
0        M1979787155             0.0             0.0        0
0
1        M2044282225             0.0             0.0        0
0
```

```
2          C553264065             0.0             0.0        1
0
3           C38997010         21182.0             0.0        1
0
4        M1230701703             0.0             0.0        0
0
...              ...             ...             ...      ...
...
1047295  M1938858197             0.0             0.0        0
0
1047296   M391493091             0.0             0.0        0
0
1047297   M227905058             0.0             0.0        0
0
1047298  M1154565434             0.0             0.0        0
0
1047299   M919485291             0.0             0.0        0
0

[1047300 rows x 11 columns]>
```

```
from sklearn.preprocessing import LabelEncoder

LE = LabelEncoder()
df['type'] = LE.fit_transform(df['type'])
df['nameOrig'] = LE.fit_transform(df['nameOrig'])
df['nameDest'] = LE.fit_transform(df['nameDest'])

df
```

```
         step  type    amount  nameOrig  oldbalanceOrg  newbalanceOrig
\
0           1     3   9839.64    125004      170136.00       160296.36

1           1     3   1864.28    360882       21249.00        19384.72

2           1     4    181.00    165023         181.00            0.00

3           1     1    181.00    960498         181.00            0.00

4           1     3  11668.14    567221       41554.00        29885.86

...       ...   ...       ...       ...            ...             ...

1047295    95     3   9028.31    694724      105818.00        96789.69

1047296    95     3   6290.51    723239       96789.69        90499.18

1047297    95     3   2499.92    583942       90499.18        87999.25

1047298    95     3   4780.32    603263         802.00            0.00
```

```
1047299    95     3    789.77    713704       30791.00        30001.23


         nameDest  oldbalanceDest  newbalanceDest  isFraud
isFlaggedFraud
0          274496             0.0             0.0        0
0
1          286268             0.0             0.0        0
0
2           73503             0.0             0.0        1
0
3           65423         21182.0             0.0        1
0
4          137860             0.0             0.0        0
0
...           ...             ...             ...      ...
...
1047295    266884             0.0             0.0        0
0
1047296    337296             0.0             0.0        0
0
1047297    307566             0.0             0.0        0
0
1047298    124109             0.0             0.0        0
0
1047299    433968             0.0             0.0        0
0

[1047300 rows x 11 columns]
```

```
data = df.iloc[:,:10].values
data
```

```
array([[1.00000e+00, 3.00000e+00, 9.83964e+03, ..., 0.00000e+00,
        0.00000e+00, 0.00000e+00],
       [1.00000e+00, 3.00000e+00, 1.86428e+03, ..., 0.00000e+00,
        0.00000e+00, 0.00000e+00],
       [1.00000e+00, 4.00000e+00, 1.81000e+02, ..., 0.00000e+00,
        0.00000e+00, 1.00000e+00],
       ...,
       [9.50000e+01, 3.00000e+00, 2.49992e+03, ..., 0.00000e+00,
        0.00000e+00, 0.00000e+00],
       [9.50000e+01, 3.00000e+00, 4.78032e+03, ..., 0.00000e+00,
        0.00000e+00, 0.00000e+00],
       [9.50000e+01, 3.00000e+00, 7.89770e+02, ..., 0.00000e+00,
        0.00000e+00, 0.00000e+00]])
```

```
label = df.iloc[:,-2].values
label
```

```
array([0, 0, 1, ..., 0, 0, 0])
```

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(data, label,
test_size=0.2, random_state=42)

from sklearn.linear_model import LogisticRegression

logreg = LogisticRegression(random_state=16)

logreg.fit(X_train, y_train)
```

```
LogisticRegression(random_state=16)
```

```
y_pred = logreg.predict(X_test)

from sklearn import metrics

cm = metrics.confusion_matrix(y_test, y_pred)
cm
```

```
array([[209217,     22],
       [   138,     83]])
```

```
from sklearn.metrics import classification_report
target_names = ['not spam', 'spam']
print(classification_report(y_test, y_pred,
target_names=target_names))
```

```
              precision    recall  f1-score   support

    not spam       1.00      1.00      1.00    209239
        spam       0.79      0.38      0.51       221

    accuracy                           1.00    209460
   macro avg       0.89      0.69      0.75    209460
weighted avg       1.00      1.00      1.00    209460
```

```
acc = metrics.accuracy_score(y_test, y_pred)
print("Accuracy: "+str(acc))
```

```
Accuracy: 0.9992361310035329
```