Q3.1 Linear Least Square Fitting

Importing Libraries

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from prettytable import PrettyTable as ptbl
```

Importing Database

In [2]:

```
data = pd.read_csv('Salary_Data.csv')
```

In [3]:

```
data.describe()
```

Out[3]:

	YearsExperience	Salary
count	30.000000	30.000000
mean	5.313333	76003.000000
std	2.837888	27414.429785
min	1.100000	37731.000000
25%	3.200000	56720.750000
50%	4.700000	65237.000000
75%	7.700000	100544.750000
max	10.500000	122391.000000

Extracting Dependent and independent data from database int X and y variables

In [4]:

```
X = data.iloc[:,0].values
y = data.iloc[:,-1].values
```

Function for Linear Least Square Fitting

y = mx + b

In [5]:

```
def linearfitting(x,y):
    n = len(x)
    x_sq_sum = sum(x**2)
    x_sum = sum(x)
    yx_sum = sum(x*y)
    y_sum = sum(y)

    A = np.array([
        [x_sq_sum,x_sum],
        [x_sum,n]
        ])

    b = np.array([
        [yx_sum],
        [y_sum]
        ])

    invA = np.linalg.inv(A)
    M = np.matmul(invA,b)

    return M
```

Calling Linear Least Square fitting function on given database

In [6]:

```
M = linearfitting(X,y)
m = M[0][0]
b = M[1][0]
```

Visualizing Calculated Coefficient and constant

In [7]:

```
print("m = ",m,"\tb = ",b)
```

```
m =  9449.962321455096   b =  25792.200198668637
```

Calculating Approximate Values

In [8]:

```
y_pred = m*X + b
```

Table of actual values and predicted values

In [9]:

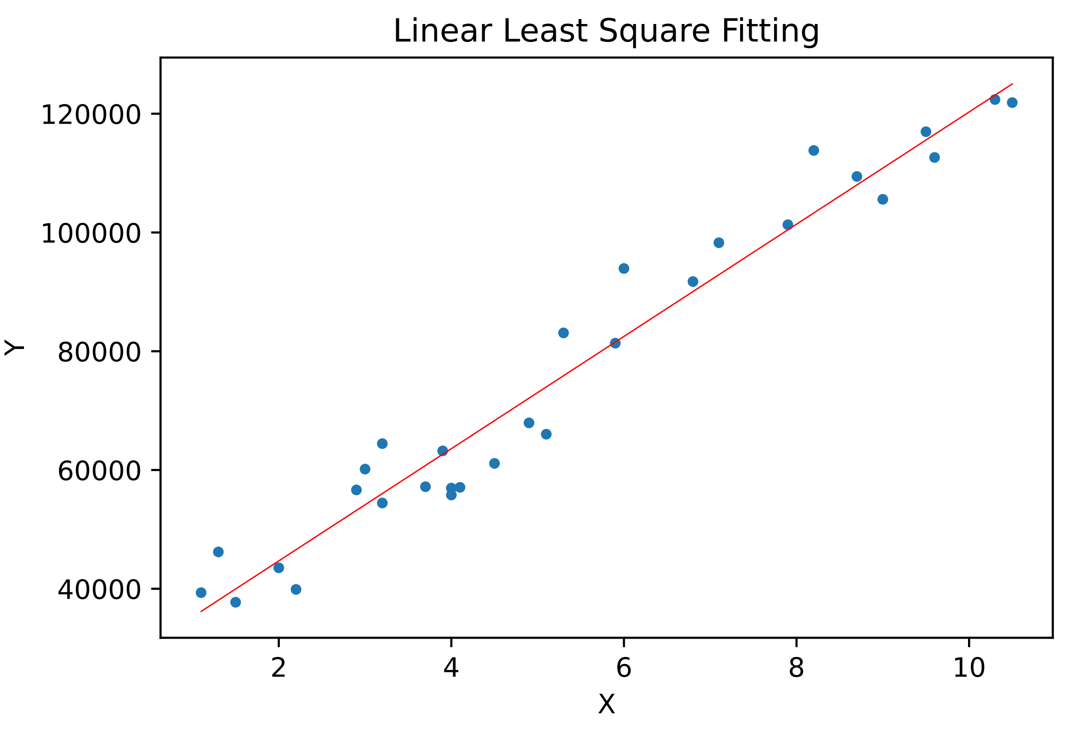
```
table = ptbl(['X','y','y-predicted'])
for i in range(len(X)):
    table.add_row([X[i],y[i],y_pred[i]])
print(table)
```

```
+------+----------+--------------------+
|  X   |    y     |    y-predicted     |
+------+----------+--------------------+
| 1.1  | 39343.0  | 36187.15875226924  |
| 1.3  | 46205.0  | 38077.15121656026  |
| 1.5  | 37731.0  | 39967.14368085128  |
| 2.0  | 43525.0  | 44692.12484157883  |
| 2.2  | 39891.0  | 46582.11730586985  |
| 2.9  | 56642.0  | 53197.090930888415 |
| 3.0  | 60150.0  | 54142.087163033924 |
| 3.2  | 54445.0  | 56032.07962732494  |
| 3.2  | 64445.0  | 56032.07962732494  |
| 3.7  | 57189.0  | 60757.06078805249  |
| 3.9  | 63218.0  | 62647.05325234351  |
| 4.0  | 55794.0  | 63592.04948448902  |
| 4.0  | 56957.0  | 63592.04948448902  |
| 4.1  | 57081.0  | 64537.04571663453  |
| 4.5  | 61111.0  | 68317.03064521657  |
| 4.9  | 67938.0  |  72097.0155737986  |
| 5.1  | 66029.0  | 73987.00803808963  |
| 5.3  | 83088.0  | 75877.00050238064  |
| 5.9  | 81363.0  |  81546.9778952537  |
| 6.0  | 93940.0  | 82491.97412739921  |
| 6.8  | 91738.0  | 90051.94398456329  |
| 7.1  | 98273.0  | 92886.93268099982  |
| 7.9  | 101302.0 | 100446.9025381639  |
| 8.2  | 113812.0 | 103281.89123460042 |
| 8.7  | 109431.0 | 108006.87239532797 |
| 9.0  | 105582.0 | 110841.8610917645  |
| 9.5  | 116969.0 | 115566.84225249205 |
| 9.6  | 112635.0 | 116511.83848463756 |
| 10.3 | 122391.0 | 123126.81210965612 |
| 10.5 | 121872.0 | 125016.80457394714 |
+------+----------+--------------------+
```

Visualizing Best Fit Line

In [10]:

```
plt.scatter(X,y, marker = '.')
plt.plot(X,y_pred,color = 'red',linewidth = 0.5)
plt.title('Linear Least Square Fitting')
plt.xlabel('X')
plt.ylabel('Y')
plt.show()
```



Evaluating Error in reconstruction

In [11]:

```
max_error = max(abs(y-y_pred)/y)
print(max_error)
```

```
0.17590842513666785
```