In [1]:
```
import warnings                                       #Importing few important python li
warnings.filterwarnings('ignore')
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import copy
import math
%matplotlib inline
```

In [2]:
```
df = pd.read_csv('project_data.txt')                  #importing data_set
```

In [3]:
```
print(df.head())
print(df.shape)
m=df.shape[0]
```

```
   6.1101   17.592
0  5.5277   9.1302
1  8.5186  13.6620
2  7.0032  11.8540
3  5.8598   6.8233
4  8.3829  11.8860
(96, 2)
```

In [4]:
```
x = df.iloc[:,0]
y = df.iloc[:,1]
```

In [5]:
```
df.head()
```

Out[5]:

| | 6.1101 | 17.592 |
|---|---|---|
| **0** | 5.5277 | 9.1302 |
| **1** | 8.5186 | 13.6620 |
| **2** | 7.0032 | 11.8540 |
| **3** | 5.8598 | 6.8233 |
| **4** | 8.3829 | 11.8860 |

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

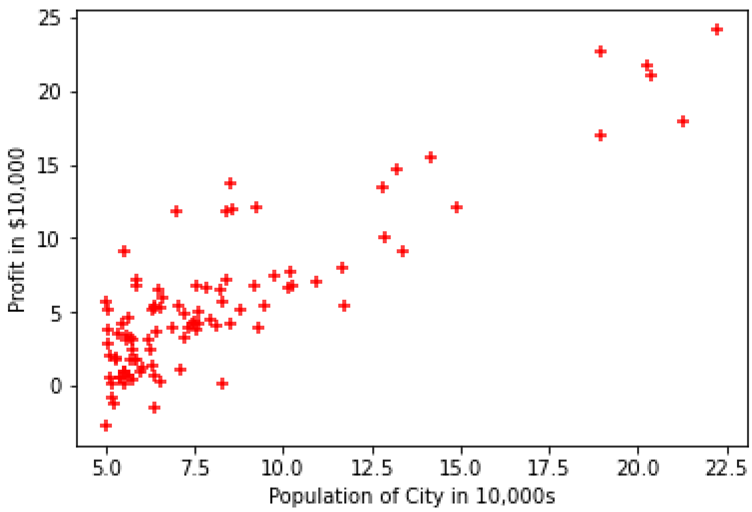
Out[6]:

| | 6.1101 | 17.592 |
|---|---|---|
| **count** | 96.000000 | 96.000000 |
| **mean** | 8.181151 | 5.716709 |
| **std** | 3.884451 | 5.404947 |
| **min** | 5.026900 | -2.680700 |
| **25%** | 5.690950 | 1.952550 |
| **50%** | 6.735950 | 4.455300 |
| **75%** | 8.639925 | 6.879150 |

| | 6.1101 | 17.592 |
|---|---|---|
| **max** | 22.203000 | 24.147000 |

In [7]:
```
plt.scatter(x,y,marker='+', c='r')
plt.xlabel('Population of City in 10,000s')
plt.ylabel('Profit in $10,000')
```

Out[7]:
```
Text(0, 0.5, 'Profit in $10,000')
```




In [8]:
```
def compute_cost(p, q, w, b):
    m = x.shape[0]
    total_cost = 0
    cost_sum=0
    for i in range(m):
        f_wb = w * x[i] + b
        cost = (f_wb - y[i]) ** 2
        cost_sum = cost_sum + cost
    total_cost = (1 / (2 * m)) * cost_sum
    return total_cost
```

In [9]:
```
initial_w = 2
initial_b = 1

cost = compute_cost(x, y, initial_w, initial_b)
print(type(cost))
print(f'Cost at initial w: {cost:.3f}')
```

```
<class 'numpy.float64'>
Cost at initial w: 75.887
```

In [10]:
```
def compute_gradient(p, q, w, b):                    #Using gradient descent to
    m = x.shape[0]
    dj_dw = 0
    dj_db = 0
    dj_dw = 0
    dj_db = 0
    for i in range(m):
        f_wb = w * x[i] + b
        dj_dw_i = (f_wb - y[i]) * x[i]
        dj_db_i = f_wb - y[i]
        dj_db += dj_db_i
        dj_dw += dj_dw_i
```

```
    dj_dw = dj_dw / m
    dj_db = dj_db / m
    return dj_dw, dj_db
```

In [11]:
```
initial_w = 0
initial_b = 0

tmp_dj_dw, tmp_dj_db = compute_gradient(x, y, initial_w, initial_b)
print('Gradient at initial w, b (zeros):', tmp_dj_dw, tmp_dj_db)
```

```
Gradient at initial w, b (zeros): -64.88968277207296 -5.716709374999997
```

In [12]:
```
test_w = 0.2
test_b = 0.2
tmp_dj_dw, tmp_dj_db = compute_gradient(x, y, test_w, test_b)

print('Gradient at test w, b:', tmp_dj_dw, tmp_dj_db)
```

```
Gradient at test w, b: -46.88085020596876 -3.880479166666666
```

In [13]:
```
def gradient_descent(p, q, w_in, b_in, cost_function, gradient_function, alpha, num_
    m = len(p)

    # An array to store cost J and w's at each iteration — primarily for graphing la
    J_history = []
    w_history = []
    w = copy.deepcopy(w_in)  #avoid modifying global w within function
    b = b_in

    for i in range(num_iters):

        # Calculate the gradient and update the parameters
        dj_dw, dj_db = gradient_function(p, q, w, b )

        # Update Parameters using w, b, alpha and gradient
        w = w - alpha * dj_dw
        b = b - alpha * dj_db

        # Save cost J at each iteration
        if i<100000:      # prevent resource exhaustion
            cost =  cost_function(p, q, w, b)
            J_history.append(cost)

        # Print cost every at intervals 10 times or as many iterations if < 10
        if i% math.ceil(num_iters/10) == 0:
            w_history.append(w)
            print(f"Iteration {i:4}: Cost {float(J_history[-1]):8.2f}   ")

    return w, b, J_history, w_history #return w and J,w history for graphing
```

In [14]:
```
# initialize fitting parameters. Recall that the shape of w is (n,)
initial_w = 0.
initial_b = 0.

# some gradient descent settings
iterations = 1500
alpha = 0.01

w,b,_,_ = gradient_descent(x ,y, initial_w, initial_b,
```

```
                    compute_cost, compute_gradient, alpha, iterations)
print("w,b found by gradient descent:", w, b)
```

```
Iteration    0: Cost     5.90
Iteration  150: Cost     4.43
Iteration  300: Cost     4.02
Iteration  450: Cost     3.79
Iteration  600: Cost     3.65
Iteration  750: Cost     3.57
Iteration  900: Cost     3.52
Iteration 1050: Cost     3.50
Iteration 1200: Cost     3.48
Iteration 1350: Cost     3.47
w,b found by gradient descent: 1.1849957023502022 -3.926439005456633
```

In [15]:

```
m = x.shape[0]
predicted = np.zeros(m)

for i in range(m):
    predicted[i] = w * x[i] + b
```

In [16]:

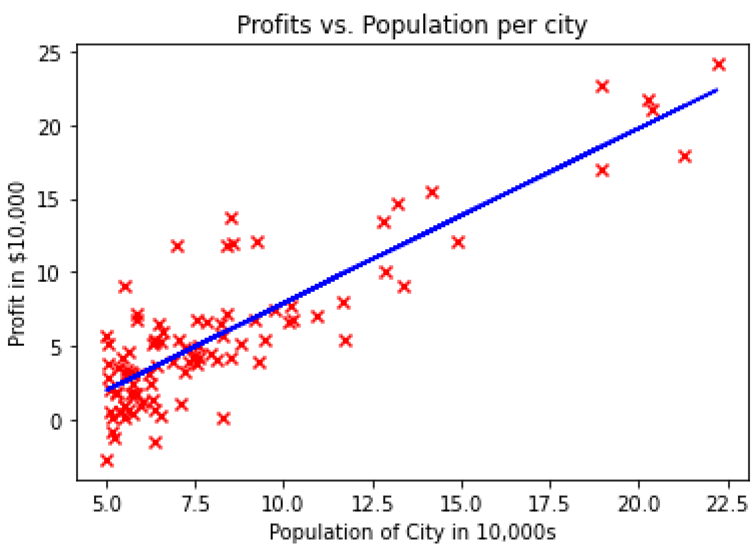
```
# Plot the linear fit
plt.plot(x, predicted, c = "b")

# Create a scatter plot of the data.
plt.scatter(x, y, marker='x', c='r')

# Set the title
plt.title("Profits vs. Population per city")
# Set the y-axis label
plt.ylabel('Profit in $10,000')
# Set the x-axis label
plt.xlabel('Population of City in 10,000s')
```

Out[16]:

```
Text(0.5, 0, 'Population of City in 10,000s')
```




In [17]:

```
predict1 = 5.5 * w + b
print('For population = 35,000, we predict a profit of $%.2f' % (predict1*10000))

predict2 = 9.0 * w + b
print('For population = 70,000, we predict a profit of $%.2f' % (predict2*10000))
```

```
For population = 35,000, we predict a profit of $25910.37
For population = 70,000, we predict a profit of $67385.22
```

In [18]:

```
def sigmoid(z):
    g = 1/(1+np.exp(-z))
    return g
```

In [19]:

```
def predict(X, w, b):
    m, n = X.shape
    p = np.zeros(m)
    for i in range(m):
        z_wb = np.dot(X[i],w)
        for j in range(n):
            z_wb += 0
        z_wb += b

        f_wb = sigmoid(z_wb)

        p[i] = 1 if f_wb>0.5 else 0

    return p
```

In [20]:

```
np.random.seed(1)
tmp_w = np.random.randn(2)
tmp_b = 0.3
tmp_X = np.random.randn(4, 2) - 0.5

tmp_p = predict(tmp_X, tmp_w, tmp_b)
print(f'Output of predict: shape {tmp_p.shape}, value {tmp_p}')
```

```
Output of predict: shape (4,), value [0. 1. 1. 1.]
```