In [1]:
```python
import pandas as pd
import numpy as np
```

In [114…
```python
db = pd.read_excel(
    'db_lec3.xls',
    sheet_name='db_lec3',
    header=0
)
db = pd.concat([pd.Series(1, index=df.index, name='00'), db], axis=1)
db.head()
```

Out[114…

	00	EXAM1	EXAM2	EXAM3	FINAL
0	1	73	80	75	152
1	1	93	88	93	185
2	1	89	91	90	180
3	1	96	98	100	196
4	1	73	66	70	142

In [115…
```python
X = db.drop(columns='FINAL')
y = db.iloc[:, 4]
```

In [116…
```python
for i in X.columns:
    X[i] = X[i]/np.max(X[i])
X.head()
```

Out[116…

	00	EXAM1	EXAM2	EXAM3
0	1.0	0.760417	0.816327	0.75
1	1.0	0.968750	0.897959	0.93
2	1.0	0.927083	0.928571	0.90
3	1.0	1.000000	1.000000	1.00
4	1.0	0.760417	0.673469	0.70

In [117…
```python
theta = np.array([0]*len(X.columns))
```

Out[117…
```
array([0, 0, 0, 0])
```

In [118…
```python
m = len(db)
```

Out[118…
```
25
```

In [119…
```python
def hypothesis(theta, X):
    return theta*X
```

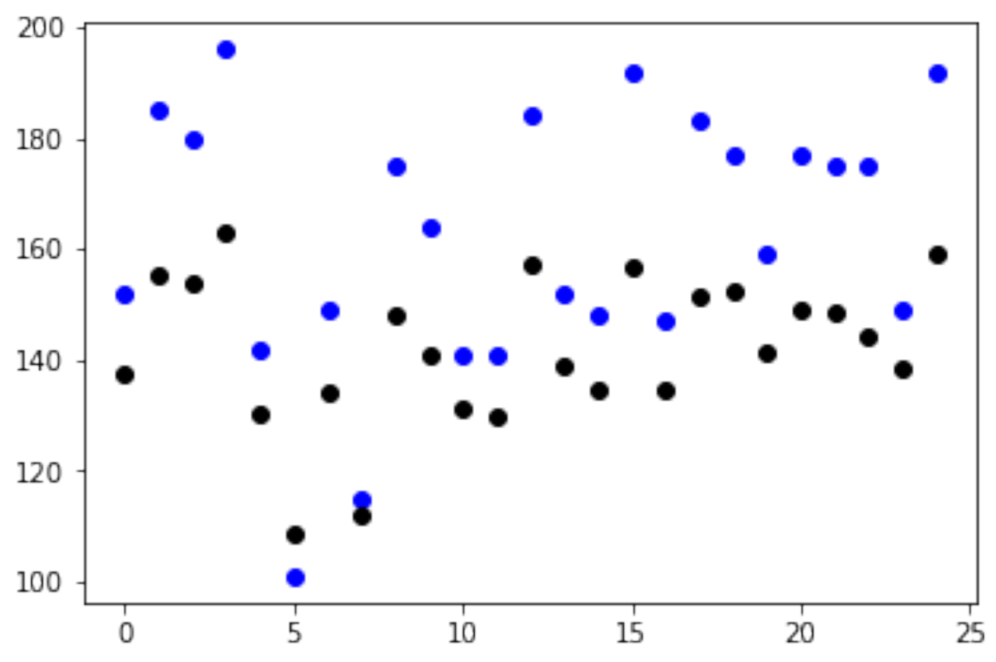
In [120…
```python
def computeCost(X, y, theta):
    y1 = hypothesis(theta, X)
    y1=np.sum(y1, axis=1)
    return sum(np.sqrt((y1-y)**2))/(2*m)
```

In [121…
```python
def gradientDescent(X, y, theta, alpha, i):
    J = []  #cost function in each iterations
    k = 0
    while k < i:
        y1 = hypothesis(theta, X)
        y1 = np.sum(y1, axis=1)
        for c in range(0, len(X.columns)):
            theta[c] = theta[c] - alpha*(sum((y1-y)*X.iloc[:,c])/len(X))
        j = computeCost(X, y, theta)
        J.append(j)
        k += 1
    return J, j, theta
```

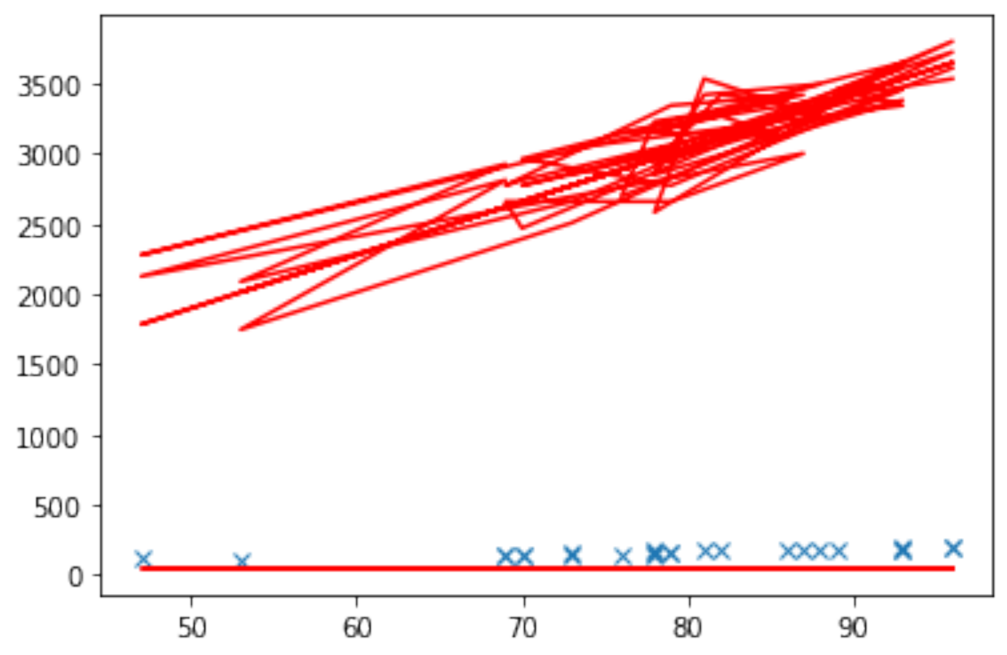
In [133…
```python
J, j, theta = gradientDescent(X, y, theta, 0.05, 100)
```

In [134…
```python
y_hat = hypothesis(theta, X)
y_hat = np.sum(y_hat, axis=1)
```

In [135…
```python
%matplotlib inline
import matplotlib.pyplot as plt
plt.figure()
plt.scatter(x=list(range(0, m)),y= y, color='blue')
plt.scatter(x=list(range(0, m)), y=y_hat, color='black')
plt.show()
```



In [136…
```python
x = db.values[:, 0:4]
plt.plot(x[:,1], y, "x")
plt.plot(x[:,1], x * theta, "r-")
plt.show()
```



In [137…
```python
print("The parameters a, b, c, c are ", theta)
```

```
The parameters a, b, c, c are  [49 38 38 38]
```

In [138…
```python
print("minimum MSE", j)
```

```
minimum MSE 10.294714965986394
```

In [139…
```python
print("MSE: ", J)
```

```
MSE:  [10.294714965986394, 10.294714965986394, 10.294714965986394, 10.294714965986394, 10.294714965986394, 10.294714965986394, 10.294714965986394, 10.2947
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94]
```