Table of Contents

Pre-Demo

```
clear;      %clears all variables in current workspace
close all;  %closes all figures
clc         %clears command window
```

File Input

```
type 'data.txt';         %displays file content
data = load('data.txt'); %alternative to read file
X = data(:, 1);          %stores x values into matrix
y = data(:, 2);          %stores y values into column vector
m = length(y);           %Required to compute data
```

```
6.1101,17.592
5.5277,9.1302
8.5186,13.662
7.0032,11.854
5.8598,6.8233
8.3829,11.886
7.4764,4.3483
8.5781,12
6.4862,6.5987
5.0546,3.8166
5.7107,3.2522
14.164,15.505
5.734,3.1551
8.4084,7.2258
5.6407,0.71618
5.3794,3.5129
6.3654,5.3048
5.1301,0.56077
6.4296,3.6518
7.0708,5.3893
6.1891,3.1386
20.27,21.767
```

```
5.4901,4.263
6.3261,5.1875
5.5649,3.0825
18.945,22.638
12.828,13.501
10.957,7.0467
13.176,14.692
22.203,24.147
5.2524,-1.22
6.5894,5.9966
9.2482,12.134
5.8918,1.8495
8.2111,6.5426
7.9334,4.5623
8.0959,4.1164
5.6063,3.3928
12.836,10.117
6.3534,5.4974
5.4069,0.55657
6.8825,3.9115
11.708,5.3854
5.7737,2.4406
7.8247,6.7318
7.0931,1.0463
5.0702,5.1337
5.8014,1.844
11.7,8.0043
5.5416,1.0179
7.5402,6.7504
5.3077,1.8396
7.4239,4.2885
7.6031,4.9981
6.3328,1.4233
6.3589,-1.4211
6.2742,2.4756
5.6397,4.6042
9.3102,3.9624
9.4536,5.4141
8.8254,5.1694
5.1793,-0.74279
21.279,17.929
14.908,12.054
18.959,17.054
7.2182,4.8852
8.2951,5.7442
10.236,7.7754
5.4994,1.0173
20.341,20.992
10.136,6.6799
7.3345,4.0259
6.0062,1.2784
7.2259,3.3411
5.0269,-2.6807
6.5479,0.29678
```

```
7.5386,3.8845
5.0365,5.7014
10.274,6.7526
5.1077,2.0576
5.7292,0.47953
5.1884,0.20421
6.3557,0.67861
9.7687,7.5435
6.5159,5.3436
8.5172,4.2415
9.1802,6.7981
6.002,0.92695
5.5204,0.152
5.0594,2.8214
5.7077,1.8451
7.6366,4.2959
5.8707,7.2029
5.3054,1.9869
8.2934,0.14454
13.394,9.0551
5.4369,0.61705
```

File Input (Exercise)

```
f = fopen('data.txt' ,'r'); %opens file for reading
M = fscanf(f, '%f');        %reads data and stores to M
fclose(f);                  %closes file
```

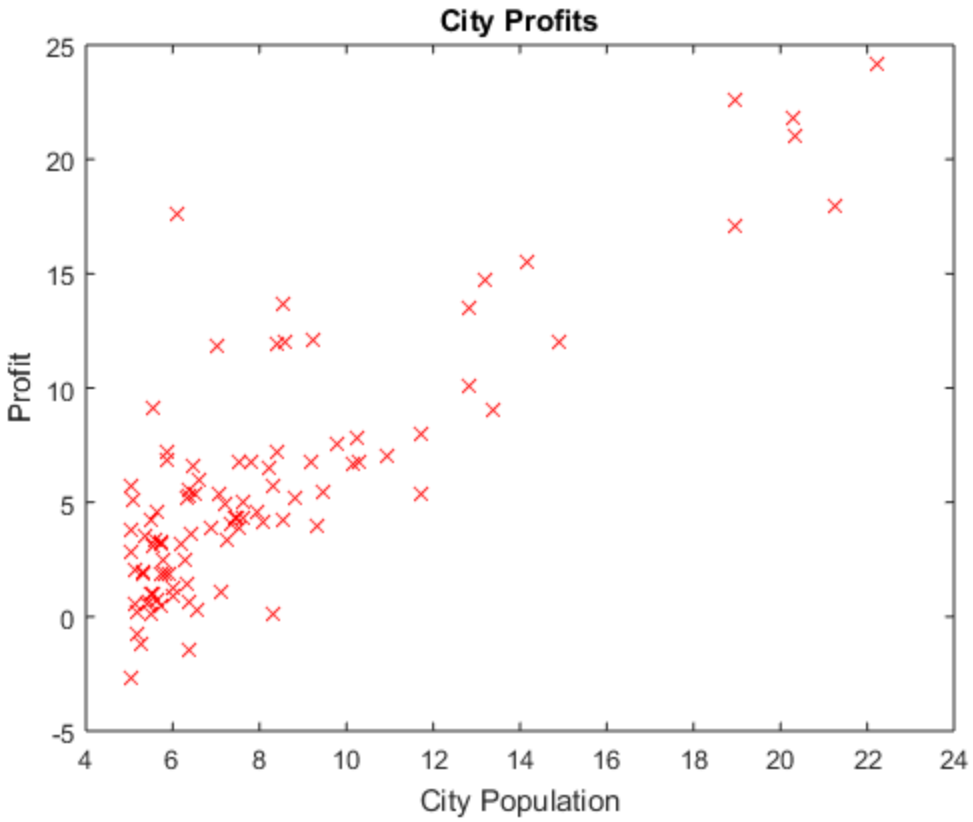
File Output (Exercise)

```
f2 = fopen('output.txt', 'w');  %overwrites file content
s = sprintf('Day %d', 2);       %formats string with number 2
fprintf(f2, '%s', s);           %writes this string to the file
fclose(f);                      %closes file
type output.txt                 %displays file content
```

```
Day 2
```

2D Plotting

```
plot(X, y, 'rx');           %displays points as red markers
title('City Profits');      %places title
xlabel('City Population');  %labels x-axis
ylabel('Profit');           %labels y-axis
```

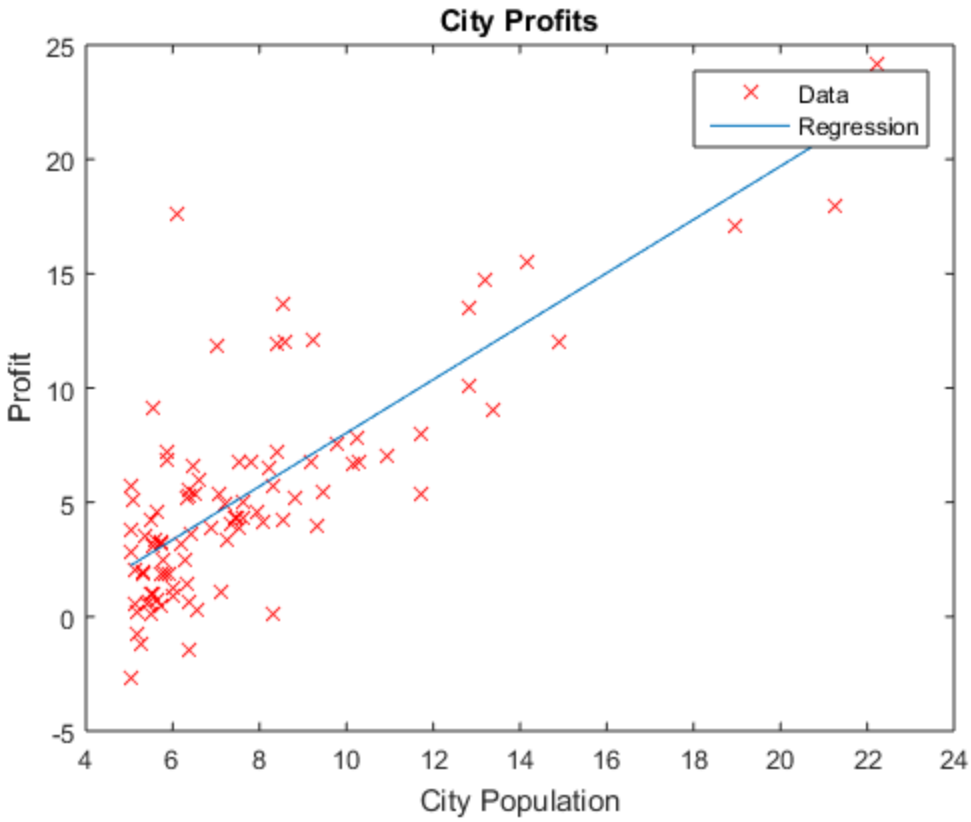


Regression (Source: https://www.coursera.org/learn/machine-learning)

```
X = [ones(m, 1), data(:,1)];    %Required to compute data
theta = gradientDescent(X, y, zeros(2, 1), 0.01, 1500); %alpha value
 of 0.01 with 1500 iterations
```

2D Plotting Cont.

```
hold on;                                %Instructs MATLAB to not
 overwrite plot
plot(X(:,2), X*theta, '-')              %Plots linear regression as a
 line
legend('Data', 'Regression')            %Key to show actual data and
 regression
hold off                                %Instructs MATLAB to proceed

theta0_vals = linspace(-10, 10, 100);   %range of x values
theta1_vals = linspace(-1, 4, 100);     %range of y values
```



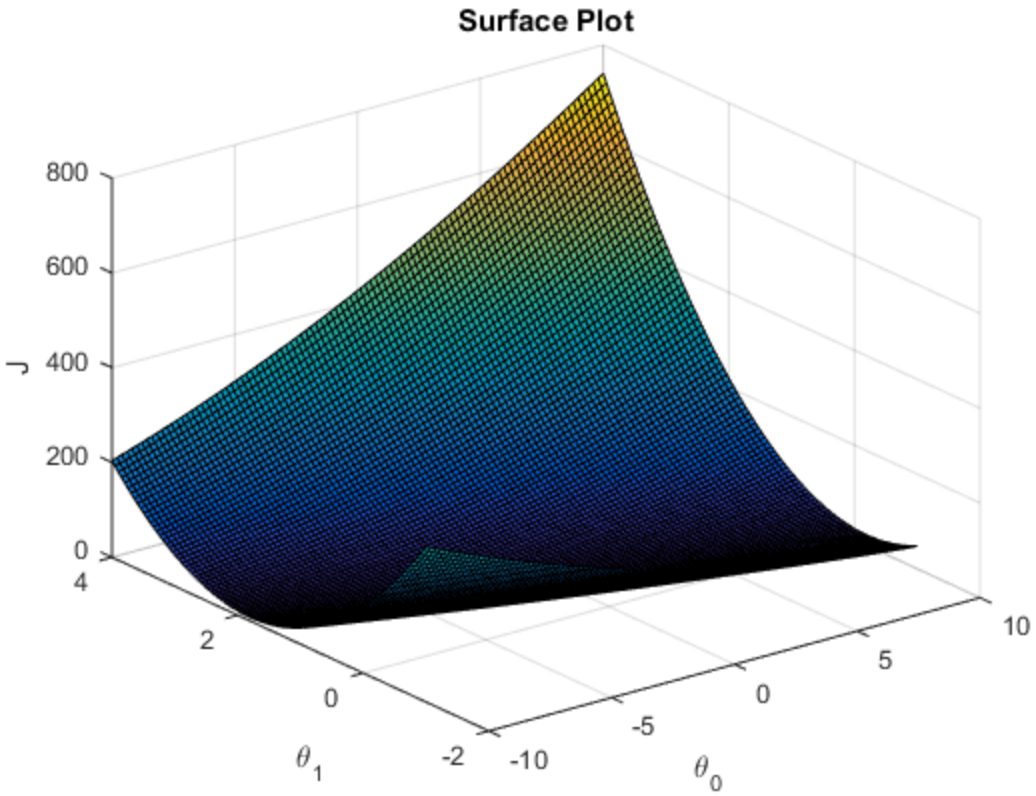
Regression Cont.

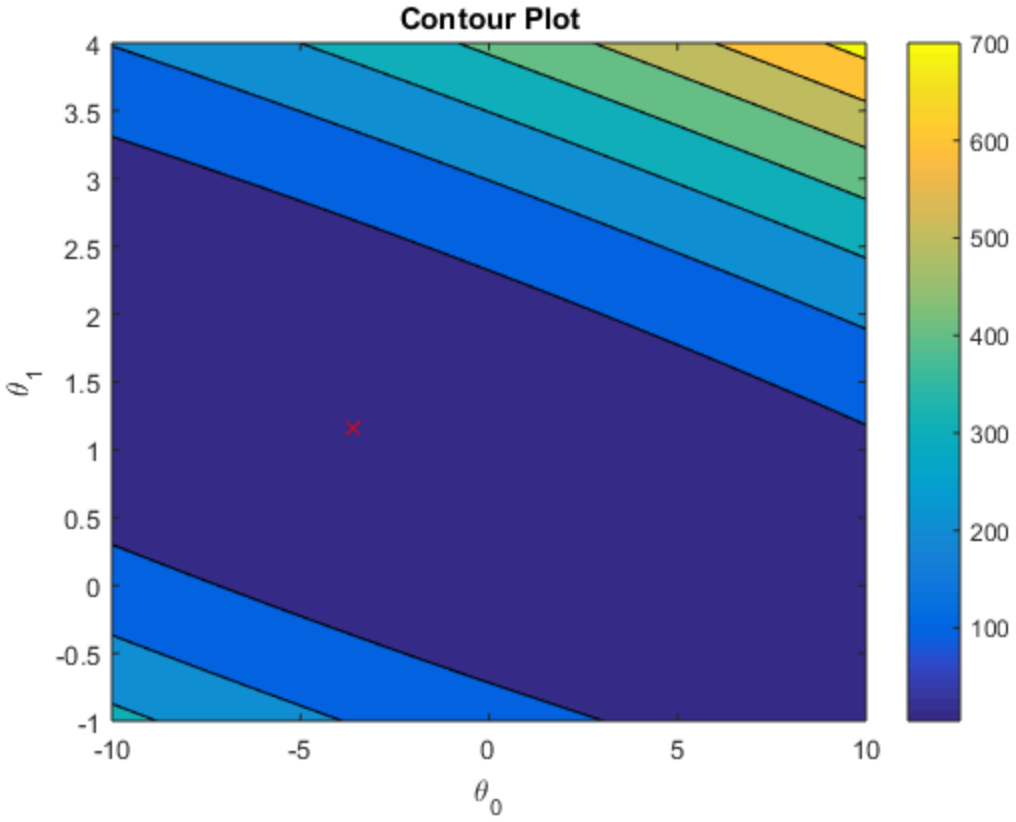
```
J_vals = zeros(length(theta0_vals), length(theta1_vals));   %makes
 matrix of 0's

for i = 1:length(theta0_vals)                               %stores
 cost of all points in matrix
    for j = 1:length(theta1_vals)
   t = [theta0_vals(i); theta1_vals(j)];
   J_vals(i,j) = computeCost(X, y, t);
    end
end
```

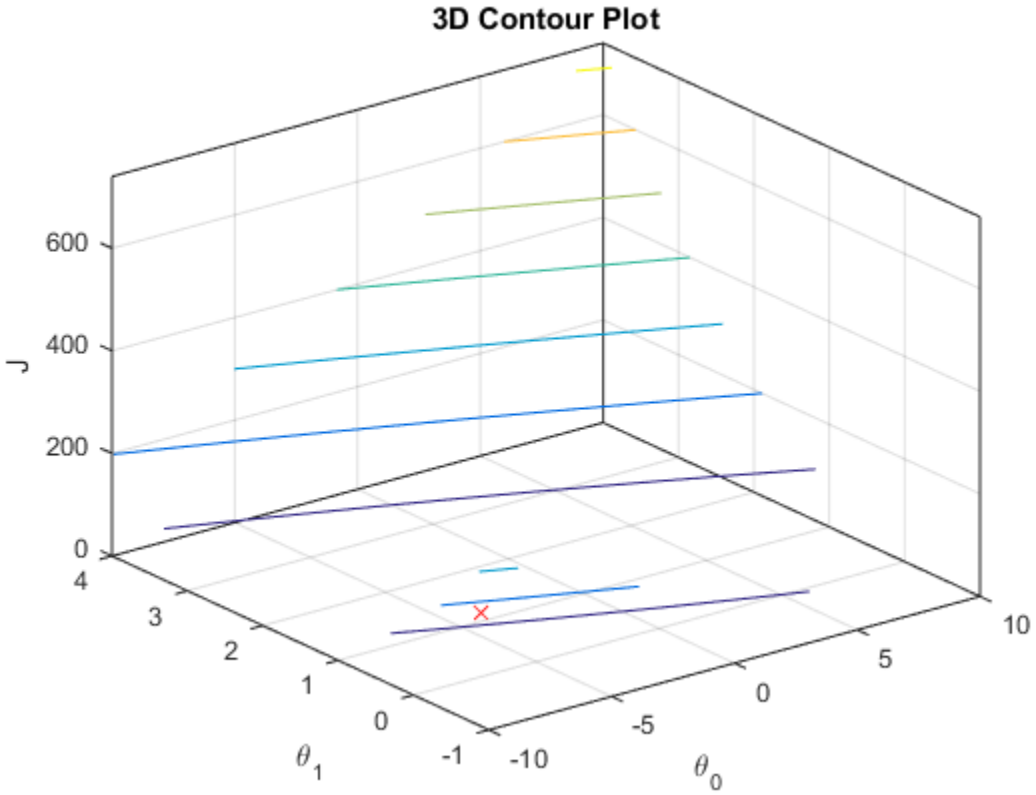
3D Plots (Exercise)

```
J_vals = J_vals';                          %transposes matrix in
 order to plot

figure;                                    %use Code++ Day 2
 Reference Sheet for assistance
surf(theta0_vals, theta1_vals, J_vals);
xlabel('\theta_0');
ylabel('\theta_1');
zlabel('J');
title('Surface Plot');
```

```
figure;
contourf(theta0_vals, theta1_vals, J_vals);
colorbar;
xlabel('\theta_0');
ylabel('\theta_1');
zlabel('J');
title('Contour Plot');
hold on;
plot(theta(1), theta(2), 'rx');

figure;
contour3(theta0_vals, theta1_vals, J_vals);
xlabel('\theta_0');
ylabel('\theta_1');
zlabel('J');
title('3D Contour Plot');
hold on;
plot(theta(1), theta(2), 'rx');
```




Contour Plot
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-10
-5
0
5
10
θ_1
θ_0
700
600
500
400
300
200
100


3D Contour Plot
J
600
400
200
0
4
3
2
1
0
-1
θ_1
-10
-5
0
5
10
θ_0

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Gradient Descent Function (Source: https://www.coursera.org/learn/machine-learning)

```
function [theta, J_history] = gradientDescent(X, y, theta, alpha,
 num_iters)

m = length(y);
J_history = zeros(num_iters, 1);

for iter = 1:num_iters %Performs Gradient Descent
    sum = 0;
    J = 0;

    for i = 1:m
        sum = sum + ((((theta(2,1)* X(i, 2)) + theta(1,1)) - y(i)) *
 X(i, 1));
    end
    J = sum/m;

    tempZero = theta(1,1) - (alpha * J);

    sum = 0;
    J = 0;

    for i = 1:m
        sum = sum + ((((theta(2,1)* X(i, 2)) + theta(1,1)) - y(i)) *
 X(i, 2));
    end
    J = sum/m;
    tempOne = theta(2,1) - (alpha * J);

    theta(1,1) = tempZero;  %Stores updated regression line parameters
    theta(2,1) = tempOne;

    J_history(iter) = computeCost(X, y, theta); %Saves cost every
 iteration

end %ends loop

end %ends function: theta has been updated with minimal cost
```

```
Not enough input arguments.

Error in gradientDescent (line 4)
m = length(y);
```

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Compute Cost Function (Source: https://www.coursera.org/learn/machine-learning)

```
function J = computeCost(X, y, theta)

m = length(y);

J = 0;  %Return value
sum = 0;

for i = 1:m %Uses Regression Cost Function (can also do this with
 element-wise operations)
    sum = sum + (((theta(2,1)* X(i, 2)) + theta(1,1)) - y(i))^2;
J = sum/(2*m);
end
```

```
Not enough input arguments.

Error in computeCost (line 4)
m = length(y);
```

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