Indian Institute of Information Technology Vadodara

MA202: Numerical Techniques Lab
Semester: IV
Lab 9

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Section : **2A**

Course Instructor : **Dr Vivek Vyas**

Note: I have made PDF from next page using matlab only. They are in parts. I have merged them all.

Question-1

Table of Contents

Regression

```
x = [-3 -2 -1 0 1 2 3];
y = [0.2774 0.8958 1.5651 3.4565 3.0601 4.8568 3.8982];

% Degrees for polynomial regression
degree = [1 3 5 7];
l = length(degree);
```

Plottings

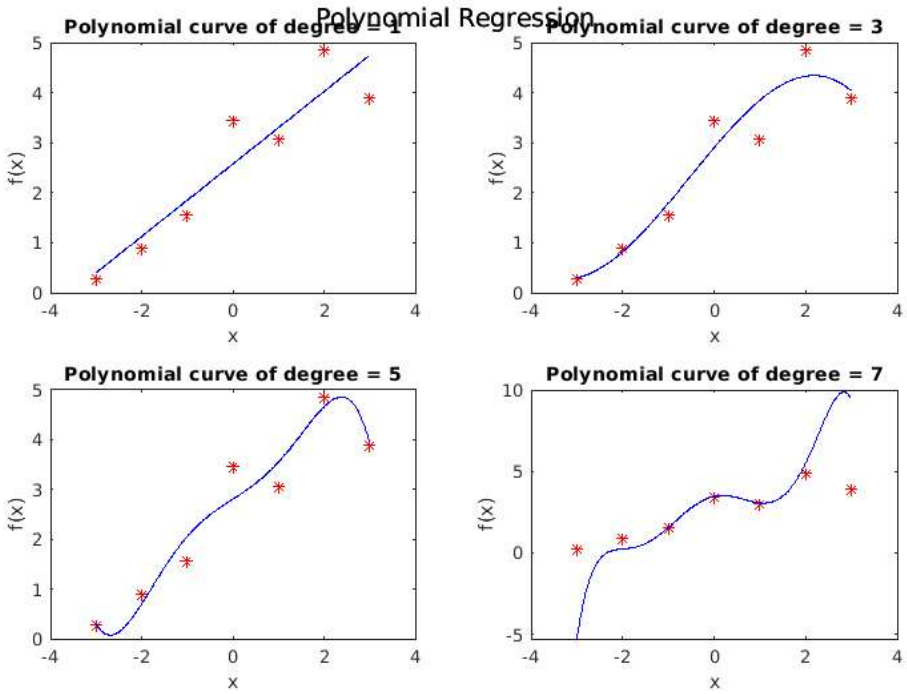
```
figure(1);
for i = 1:l
    t = polyregression(x, y, degree(i));
    xvalues = linspace(-3, 3, 500);
    yvalues = polyval(t, xvalues);
    subplot(2, 2, i)
    plot(x, y, 'r*', xvalues, yvalues, 'b-');
    title("Polynomial curve of degree = " + degree(i));
    xlabel('x');
    ylabel('f(x)');
end
sgtitle('Polynomial Regression');
snapnow;
figure(2);
[b, y] = linregression(x,y);
plot(x, y, 'r*', x, y, 'b-');
title("Linear Regression");
xlabel('x');
ylabel('f(x)');
snapnow;
disp ("Value of theta ");
disp(b);
figure(3);
[b, y] = linregressionpolyapp(x,y);
plot(x, y, 'r*', x, y, 'b-');
title("Linear Regression with poly. approx.");
```

```
xlabel('x');
ylabel('f(x)');
snapnow;
disp ("Value of theta");
disp(b);
```

Function for Polynomial Regression

```
function ypred = polyregression(x,y, limit)

    n = length(x);
    A = [x.' ones(n,1)];
    Y = y.';
    for i = 2:limit
        A = [A(:, 1).*(x.') A];
    end
    ypred = (inv((A.')*A)*(A.'))*Y;
end
```

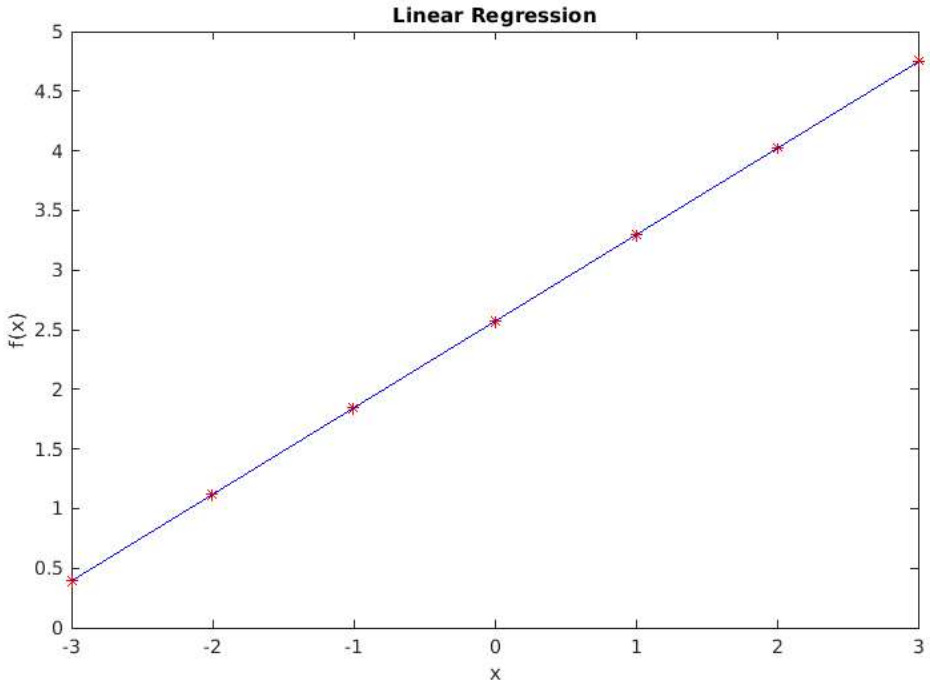
Warning: Matrix is close to singular or badly scaled. Results may be inaccurate. RCOND = 1.215045e-20.



Function for Linear Regression

```
function [b, ypred] = linregression(x,y)

    y = transpose(y);
```

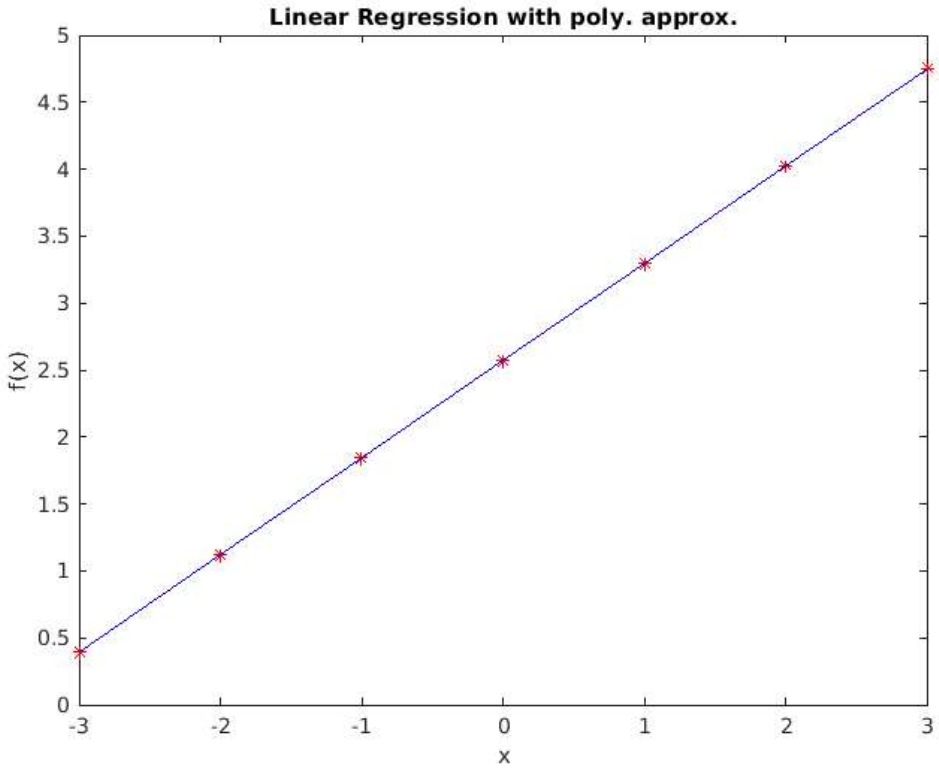
```
    sumX = 0;
    sumX2 = 0;
    sumY = 0;
    sumXY = 0;

    for i = 1:length(x)

        sumX = sumX + x(i);
        sumX2 = sumX2 + x(i)*x(i);
        sumY = sumY + y(i);
        sumXY = sumXY + x(i)*y(i);

    end

    b = (length(x)*sumXY - sumX*sumY)/(length(x)*sumX2 - sumX*sumX);
    a = (sumY - b*sumX)/length(x);

    ypred = a + b*x;
    b = [a; b];

end
```




```
Value of theta
    2.5728
    0.7243
```

Function for Linear Regression using Polynomical Approximation of first degree

```
function [b, ypred] = linregressionpolyapp(x,y)
    X = [ones(length(x),1) transpose(x)];
    y = transpose(y);
    b = X\y;
    ypred = (X*b).';
end
```




```
Value of theta
    2.5728
    0.7243
```

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Question-2

Table of Contents

Regression

```
x = [0.8 1.4 2.7 3.8 4.8 4.9];
y = [0.69 1.00 2.00 2.39 2.34 2.83];

% Degrees for polynomial regression
degree = [1 3 5 7];
l = length(degree);
```

Plotings

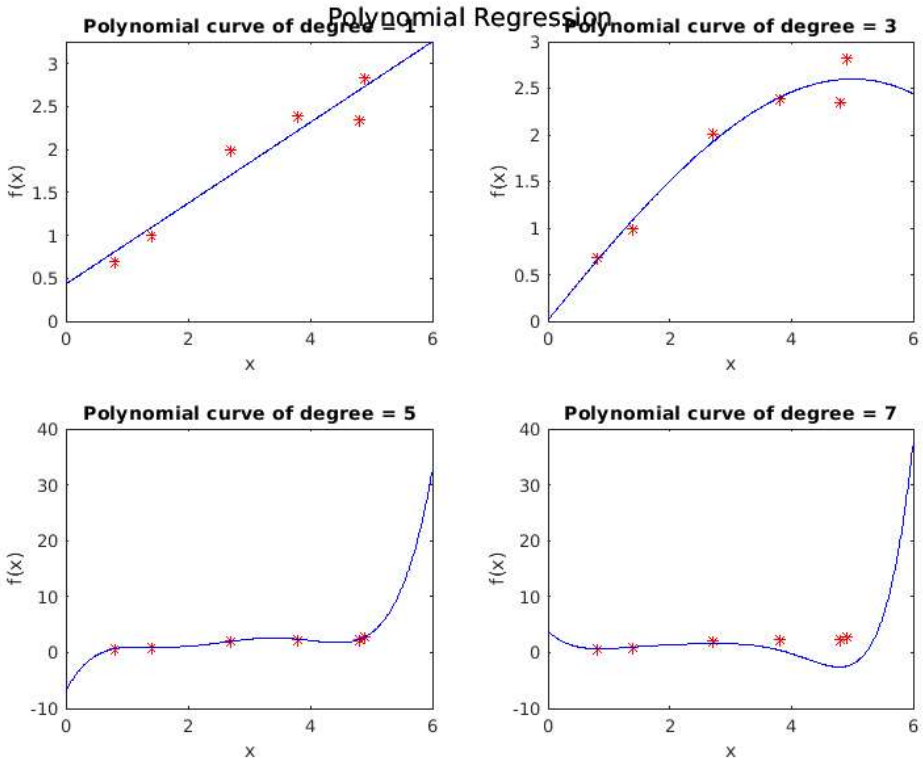
```
figure(1);

for i = 1:l

    t = polyregression(x, y, degree(i));
    xValues = linspace(0, 6, 500);
    yValues = polyval(t, xValues);
    subplot(2, 2, i)
    plot(x, y, 'r*', xValues, yValues, 'b-');
    title("Polynomial curve of degree = " + degree(i));
    xlabel('x');
    ylabel('f(x)');

end

sgtitle('Polynomial Regression');
snapnow;

figure(2);

[b, y] = linregression(x,y);
plot(x, y, 'r*', x, y, 'b-');
title("Linear Regression");
xlabel('x');
ylabel('f(x)');
snapnow;
disp ("Value of theta ");
disp(b);
```

```
figure(3);

[b, y] = linregressionpolyapp(x,y);
plot(x, y, 'r*', x, y, 'b-');
title("Linear Regression with poly. approx.");
xlabel('x');
ylabel('f(x)');
snapnow;
disp ("Value of theta");
disp(b);
```

Function for Polynomial Regression

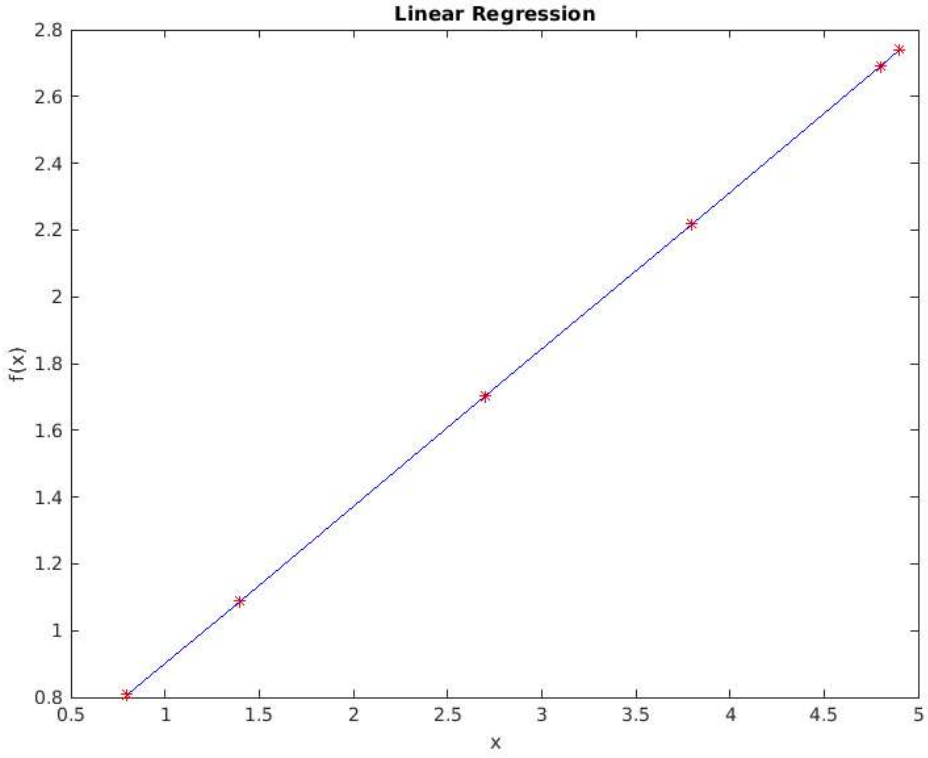
```
function ypred = polyregression(x,y, limit)

    n = length(x);
    A = [x.' ones(n,1)];
    Y = y.';
    for i = 2:limit
        A = [A(:, 1).*(x.') A];
    end
    ypred = (inv((A.')*A)*(A.'))*Y;
end
```

Warning: Matrix is close to singular or badly scaled. Results may be inaccurate. RCOND = 9.062839e-24.



Function for Linear Regression

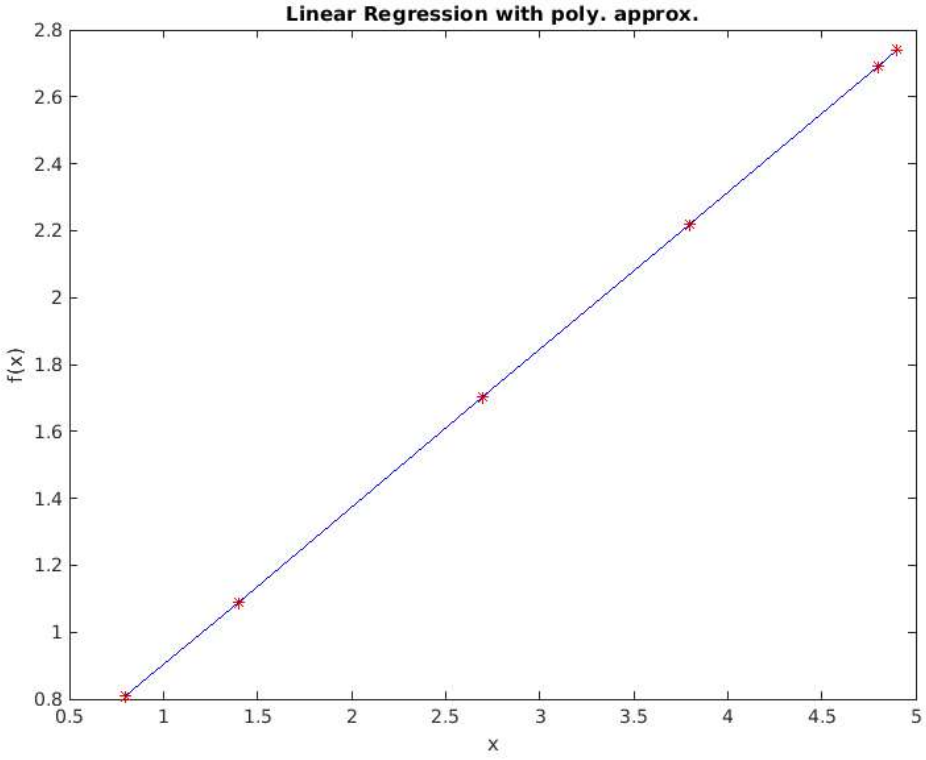
```
function [b, ypred] = linregression(x,y)

    y = transpose(y);

    sumX = 0;
    sumX2 = 0;
    sumY = 0;
    sumXY = 0;

    for i = 1:length(x)

        sumX = sumX + x(i);
        sumX2 = sumX2 + x(i)*x(i);
        sumY = sumY + y(i);
        sumXY = sumXY + x(i)*y(i);

    end

    b = (length(x)*sumXY - sumX*sumY)/(length(x)*sumX2 - sumX*sumX);
    a = (sumY - b*sumX)/length(x);

    ypred = a + b*x;
    b = [a; b];

end
```




```
Value of theta
    0.4327
    0.4703
```

Function for Linear Regression using Polynomical Approximation of first degree

```
function [b, ypred] = linregressionpolyapp(x,y)
    X = [ones(length(x),1) transpose(x)];
    y = transpose(y);
    b = X\y;
    ypred = (X*b).';
end
```




```
Value of theta
    0.4327
    0.4703
```

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