ME 1020 Engineering Programming with MATLAB

Problem 6.9:

9. The following data give the drying time T of a certain paint as a function of the amount of a certain additive A.

a. Find the first-, second-, third-, and fourth-degree polynomials that fit the data, and plot each polynomial with the data. Determine the quality of the curve fit for each by computing J, S, and r^2.

b. Use the polynomial giving the best fit to estimate the amount of additive that minimizes the drying time.

A (oz)	0	1	2	3	4	5	6	7	8	9
T (min)	130	115	110	90	89	89	95	100	110	125

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% Problem 6.9
clear
clc
disp('Problem 6.9: Scott Thomas')

format shortEng

A = 0:1:9;
Aplot = 0:0.0001:9;
T = [130 115 110 90 89 89 95 100 110 125];

for k = 1:4
    coeff = polyfit(A,T,k);
    J(k) = sum((polyval(coeff,A) - T).^2);
end
J;
mu = mean(T);
for k=1:4
    S(k) = sum((T - mu).^2);
    r2(k) = 1 - J(k)/S(k);
end
S ;
r2;

p1 = polyfit(A,T,1);
Tfit1 = p1(1)*Aplot + p1(2);

p2 = polyfit(A,T,2);
Tfit2 = p2(1)*Aplot.^2 + p2(2)*Aplot + p2(3);

p3 = polyfit(A,T,3);
Tfit3 = p3(1)*Aplot.^3 + p3(2)*Aplot.^2 + p3(3)*Aplot + p3(4);

p4 = polyfit(A,T,4);
Tfit4 = p4(1)*Aplot.^4 + p4(2)*Aplot.^3 + p4(3)*Aplot.^2 + p4(4)*Aplot + p4(5);

Tmin = min(Tfit4)

p = [p4(1) p4(2) p4(3) p4(4) (p4(5) - Tmin)];
Amin=roots(p)

%plot(A,T, 'o', Aplot, Tfit1), xlabel('Amount of Additive A (oz)'),
%ylabel('Drying Time T (min)'),
%title('Problem 6.9: Scott Thomas')
%text(0.25, 128, 'T = -0.6967*A + 108.4364')
%text(0.25, 125, 'J = 1996.0, S =  2036.1, r^2 = 0.019682')

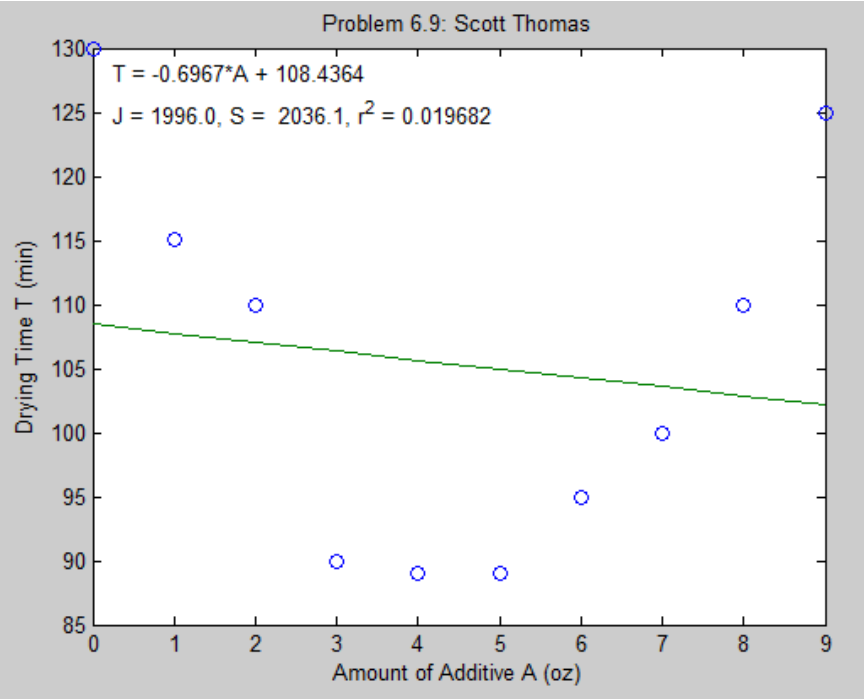
%plot(A,T, 'o', Aplot, Tfit2), xlabel('Amount of Additive A (oz)'),
%ylabel('Drying Time T (min)'),
%title('Problem 6.9: Scott Thomas')
%text(0.25, 133, 'T = 1.9053*A^2 - 17.8447*A + 131.3')
%text(0.25, 130, 'J = 79.2894, S =  2036.1, r^2 = 0.961058')

%plot(A,T, 'o', Aplot, Tfit3), xlabel('Amount of Additive A (oz)'),
%ylabel('Drying Time T (min)'),
%title('Problem 6.9: Scott Thomas')
%text(0.25, 133, 'T = 0.0106838*A^3 + 1.7611*A^2 - 17.3522*A + 131.0308')
%text(0.25, 130, 'J = 78.9368, S =  2036.1, r^2 =  0.9612314')

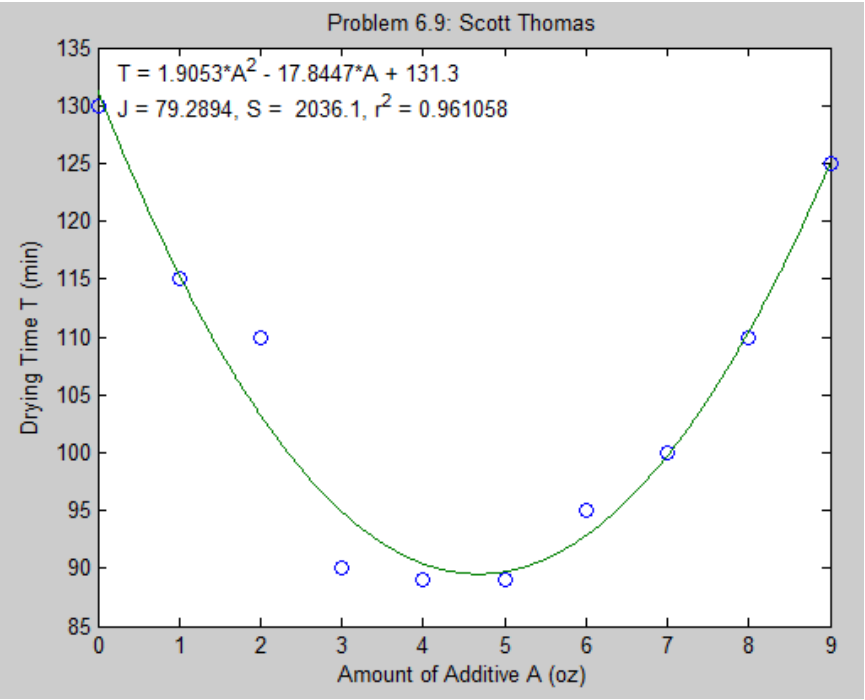
plot(A,T, 'o', Aplot, Tfit4), xlabel('Amount of Additive A (oz)'),
ylabel('Drying Time T (min)'),
title('Problem 6.9: Scott Thomas')
text(1, 128, 'T =  -0.02491*A^4 + 0.4591*A^3 - 0.7551*A^2 - 12.87*A + 129.9')
text(1, 125, 'J = 68.71, S =  2036.1, r^2 =  0.9662')

```

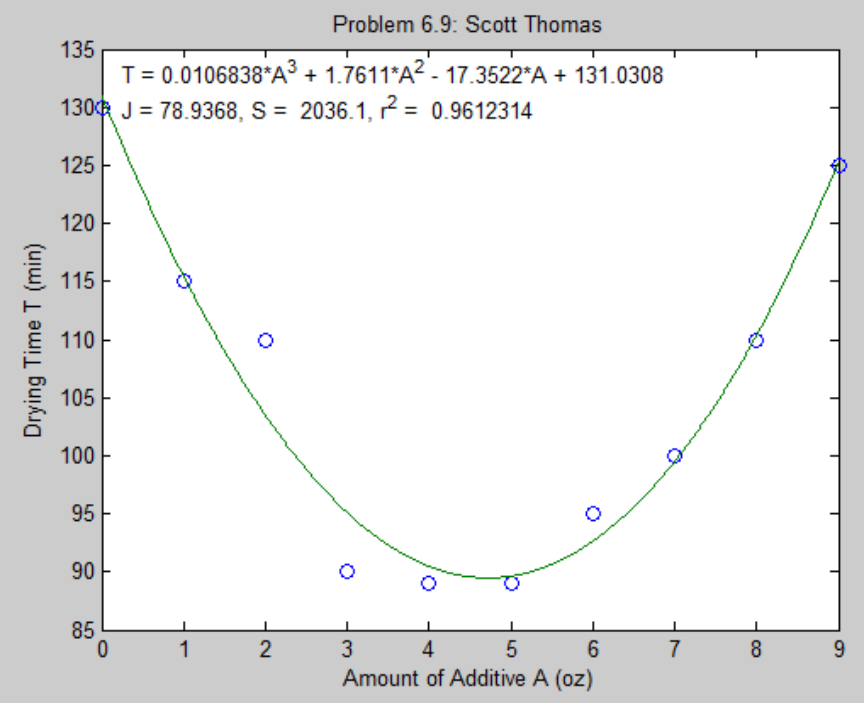
1st order equation:



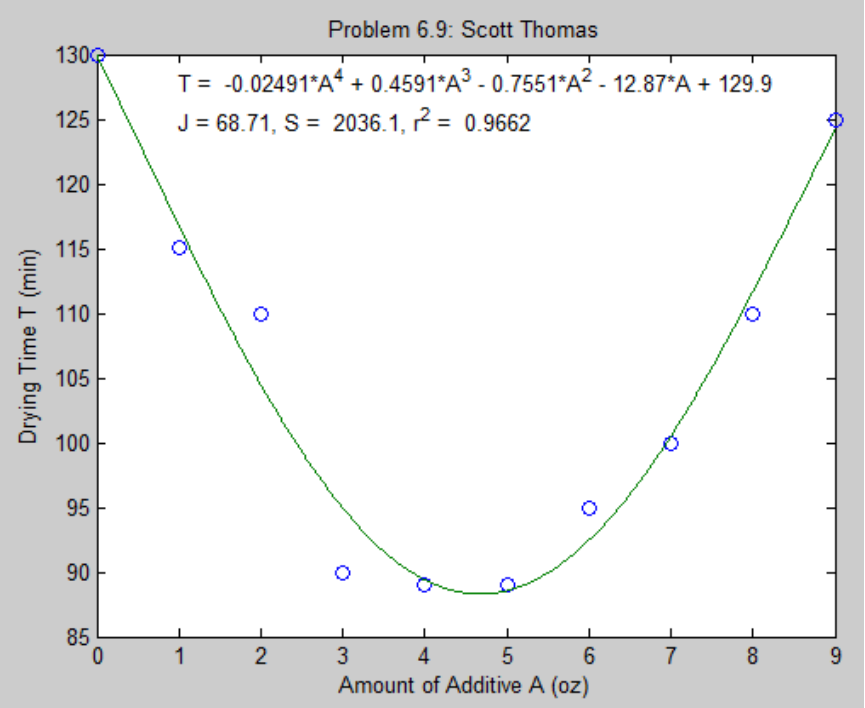
2nd order equation:



3rd order equation:



4th order equation:



Amount of Additive A to Minimize Drying Time: A = 4.6766 oz

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Problem 6.9: Scott Thomas

Tmin =

    88.3036e+000


Amin =

    14.3887e+000
    -5.3129e+000
     4.6766e+000
     4.6765e+000

fx >>
```