Table of Contents

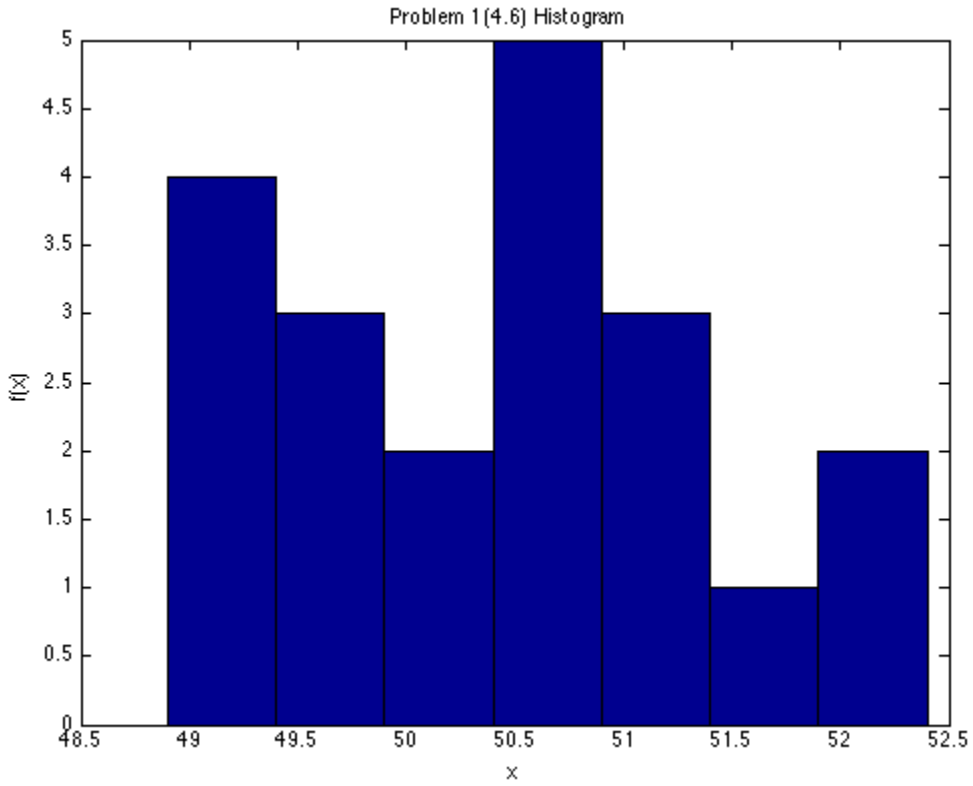
..... 1
Problem 1 (4.6) 1
Problem 2 (4.9) 2
Problem 4 (4.19) 4
Problem 5 (4.25) 5
Problem 6 (4.27) 6
Problem 7 (4.30) 8


```
% Deep Patel    Measurements    HW 2
```

Problem 1 (4.6)

```
clear all, close all, clc

f = [51.9,51.0,50.3,49.6,51.0,50.0,48.9,50.5,50.9,52.4,51.3,50.7,52.0,...
    49.4,49.7,50.5,50.7,49.4,49.9,49.2]
K = (1.87 * ((size(f,2)-1)^0.4)) + 1
x = [1 2 3 4 5 6 7 8]

figure;
hist(f, K); xlabel('x'); ylabel('f(x)');
title('Problem 1 (4.6)  Histogram');
```

```
f =

  Columns 1 through 7

   51.9000   51.0000   50.3000   49.6000   51.0000   50.0000   48.9000

  Columns 8 through 14

   50.5000   50.9000   52.4000   51.3000   50.7000   52.0000   49.4000

  Columns 15 through 20

   49.7000   50.5000   50.7000   49.4000   49.9000   49.2000


K =

    7.0722


x =

     1     2     3     4     5     6     7     8
```



Problem 2 (4.9)

```
clear all, close all, clc

f1 = [51.9, 51.0, 50.3, 49.6, 51.0, 50.0, 48.9, 50.5, 50.9, 52.4, 51.3,...
    50.7, 52.0, 49.4, 49.7, 50.5, 50.7, 49.4, 49.9, 49.2];
f2 = [51.9, 48.7, 51.1, 51.7, 49.9, 48.8, 52.5, 51.7, 51.3, 52.6, 49.4,...
    50.3, 50.3, 50.2, 50.9, 52.1, 49.3, 50.7, 50.5, 49.7];
f3 = [51.1, 50.1, 51.4, 50.5, 49.7, 51.6, 51.0, 49.5, 52.4, 49.5, 51.6,...
    49.4, 50.8, 50.8, 50.2, 50.1, 52.3, 48.9, 50.4, 51.5];

% Sample Size (same for all)
N = size(f1,2)

% Sample Mean Values
xm1 = sum(f1)/N
xm2 = sum(f2)/N
xm3 = sum(f3)/N

s1 = 0;
s2 = 0;
s3 = 0;
for i = 1:N
    s1 = s1 + ((f1(i) - xm1)^2);
```

```
    s2 = s2 + ((f2(i) - xm2)^2);
    s3 = s3 + ((f3(i) - xm3)^2);
end

% Standard Deviations
s1 = (s1/(N-1))^(1/2)
s2 = (s2/(N-1))^(1/2)
s3 = (s3/(N-1))^(1/2)

% Degrees of Freedom for all
v = N-1

% Standard Deviation of the means
sm1 = s1/(N^(1/2))
sm2 = s2/(N^(1/2))
sm2 = s3/(N^(1/2))
```

```
N =

    20


xm1 =

   50.4650


xm2 =

   50.6800


xm3 =

   50.6400


s1 =

    0.9719


s2 =

    1.1768


s3 =

    0.9816


v =
```

```
    19
```

```
sm1 =

    0.2173
```

```
sm2 =

    0.2631
```

```
sm2 =

    0.2195
```

Problem 4 (4.19)

```
clear all, close all, clc

x = [204.5, 231.1, 157.5, 190.5, 261.6, 127.0, 216.6, 172.7, 243.8, 291.0]
N = 10
xm = sum(x)/N       % Mean
s = 0;
for i = 1:N
    s = s + ((x(i)-xm)^2);
end
s = s/(N-1)         % Variance
sd = s^(1/2)        % Standard Deviation
z = (203-xm)/sd     % z variable
p = 1 - normcdf(z)  % Probability of >203 micrometers
```

```
x =

  Columns 1 through 7

  204.5000  231.1000  157.5000  190.5000  261.6000  127.0000  216.6000

  Columns 8 through 10

  172.7000  243.8000  291.0000
```

```
N =

    10
```

```
xm =
```

```
   209.6300

s =

   2.4778e+03

sd =

   49.7778

z =

   -0.1332

p =

    0.5530
```

Problem 5 (4.25)

```
clear all, close all, clc

N1 = 16;
N2 = 21;
N3 = 9;
x1 = 32;
x2 = 30;
x3 = 34;
s1 = 3;
s2 = 2;
s3 = 6;

% Pooled mean value:
xm = (N1*x1 + N2*x2 + N3*x3) / (N1 + N2 + N3)

v1 = N1-1;
v2 = N2-1;
v3 = N3-1;

% Pooled sample standard deviation
sp = ((v1*s1*s1 + v2*s2*s2 + v3*s3*s3) / (v1 + v2 + v3))^(.5)

% Pooled sample standard deviation of the means
spm = sp / ((N1+N2+N3)^0.5)

%Degrees of freedom
dof = v1+v2+v3
```

```
tvPs = 2.021*spm

% Range in which the true mean should lie with 95% confidence
range = [xm-tvPs, xm+tvPs]
```

```
xm =

   31.4783


sp =

    3.4202


spm =

    0.5043


dof =

    43


tvPs =

    1.0191


range =

   30.4591   32.4974
```

Problem 6 (4.27)

```
clear all, close all, clc

% Using Chauvenet?s criterion b/c it is a small data set

x = [923 932 908 932 919 916 927 931 926 923];
N = 10;
xm = sum(x) / N
v = 0;
for i = 1:N
    v = v + (xm-x(i))^2;
end
v = v/(N-1)          % variance
sd = v^0.5           % standard deviation
sdm = sd / (N^0.5)   % standard deviation of the means
tvP = 3.169          % for P = 99%
```

```
tvPs = tvP*sdm
range = [xm - tvPs, xm + tvPs]

% 908 is an outlier because it is very far from the range of 99 prob

x = [923 932 932 919 916 927 931 926 923];
N = 9;

% True mean
txm = sum(x) / N
```

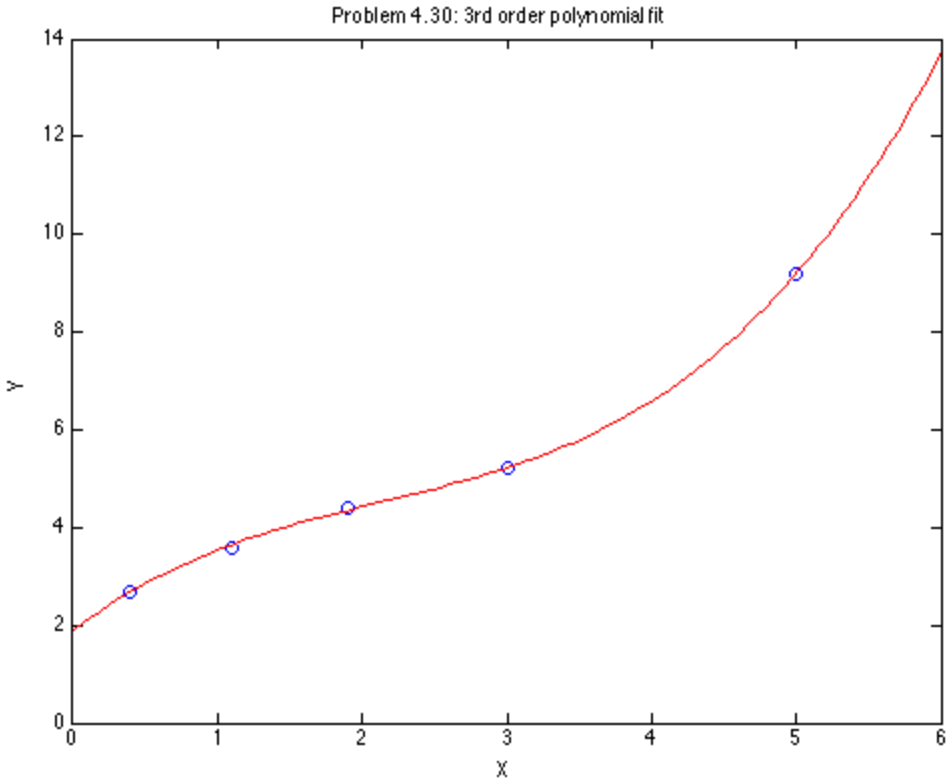
```
xm =

  923.7000


v =

   59.5667


sd =

    7.7179


sdm =

    2.4406


tvP =

    3.1690


tvPs =

    7.7344


range =

  915.9656  931.4344


txm =

  925.4444
```

Problem 7 (4.30)

```
clear all, close all, clc

N = 5;
X = [0.4 1.1 1.9 3.0 5.0]
Y = [2.7 3.6 4.4 5.2 9.2]

p = polyfit(X,Y,3)
x1 = linspace(0,6);
y1 = polyval(p,x1);
figure;
plot(X,Y,'bo')
hold on
plot(x1,y1,'r-')
hold off
xlabel('X'); ylabel('Y');
title('Problem 4.30: 3rd order polynomial fit');

K = [3*p(1), 2*p(2), p(3)]
Kx = [0 0 0 0 0];
yc = [0 0 0 0 0];
for i = 1:N
    Kx(i) = K(1)*X(i)^2 + K(2)*X(i) + K(3);
    yc(i) = p(1)*X(i)^3 + p(2)*X(i)^2 + p(3)*X(i) + p(4);
end
% Static Sensitivity
Kx
% Regression Model Y values
yc

sd = 0;
for i = 1:N
    sd = sd + (Y(i) - yc(i))^2;
end
sd = sd / (N-1);
% Standard Deviation
sd = sd^0.5

% Mean of x data
xm = sum(X) / N;
t = 2.77;

% Equation 4.39 interval
tvPs = t*sd/(N^0.5)
```

```
X =

    0.4000    1.1000    1.9000    3.0000    5.0000


Y =
```

```
    2.7000    3.6000    4.4000    5.2000    9.2000

p =

    0.1111   -0.7123    2.2463    1.8922

K =

    0.3332   -1.4247    2.2463

Kx =

    1.7297    1.0823    0.7422    0.9710    3.4527

yc =

    2.6838    3.6490    4.3503    5.2187    9.1982

sd =

    0.0370

tvPs =

    0.0458
```



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