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```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% ENGR 132
% Program Description
% This program aims to test an amidoxime-based fabric for uranium
% adsorption by submerging several samples of fiber in to tanks filled
% with uranimum spiked solutions. We are going to model a regression
% line with the given data.
%
% Assigment Information
%   Assignment:   PS 05, Problem 1
%   Author:    Tomoki Koike koike@purdue.edu
%   Team ID:   002-08
%   Paired Partner:  Yi Zhou, zhou823@purdue.edu
%   Contributor:  none
%   Our contributor(s) helped us:
%     [ ] understand the assignment expectations without
%         telling us how they will approach it.
%     [ ] understand different ways to think about a solution
%         without helping us plan our solution.
%     [ ] think through the meaning of a specific error or
%         bug present in our code without looking at our code.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

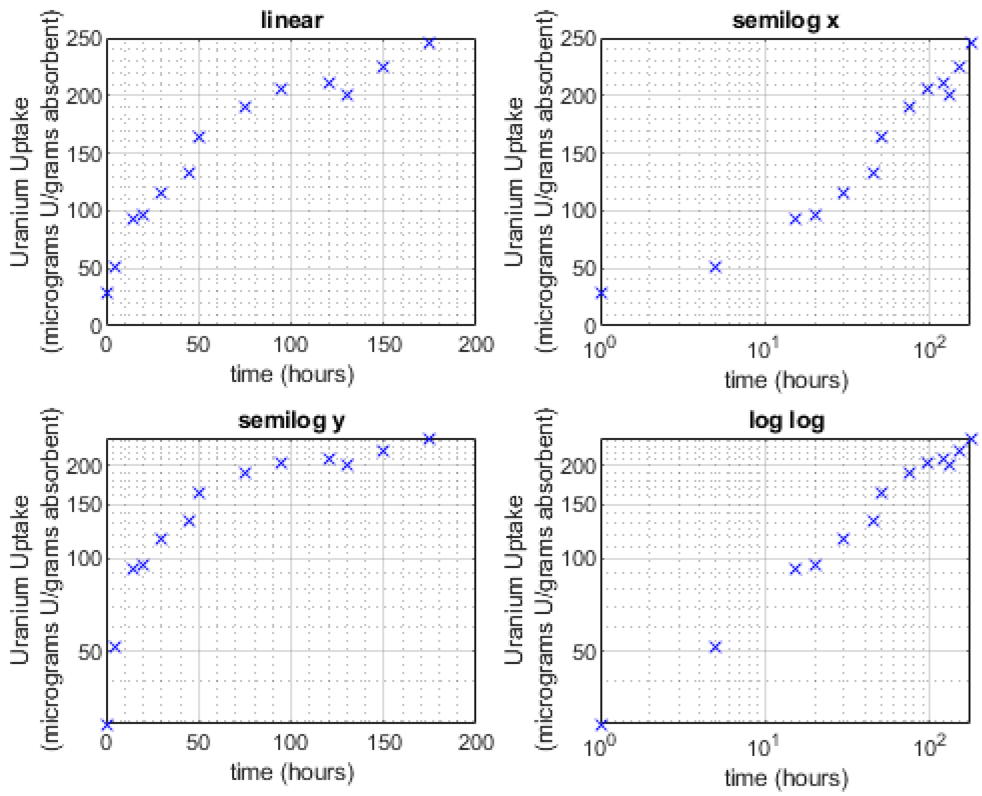
INITIALIZATION

```
% loading data
```

```
uraniumData = csvread("Data_uranium_adsorption.csv", 1,0);

% setting the columns varaiables
time = uraniumData(:,1);     % the time column of the data set
uranTake = uraniumData(:,2); % the uranium uptake of the data set
```

SUBPLOT FIGURE

```
% plotting the 2*2 plot of linear, semilogx, semilogy, and loglog
% for given data
figure
subplot(2,2,1)
plot(time, uranTake,"xb");
xlabel("time (hours)");
ylabel({'Uranium Uptake'; '(micrograms U/grams absorbent)'});
title("linear");
set(gca,'fontsize',8);
grid on
grid minor

subplot(2,2,2)
semilogx(time, uranTake,"xb");
xlabel("time (hours)");
ylabel({'Uranium Uptake'; '(micrograms U/grams absorbent)'});
title("semilog x");
set(gca,'fontsize',8);
grid on
grid minor

subplot(2,2,3)
semilogy(time, uranTake,"xb");
xlabel("time (hours)");
ylabel({'Uranium Uptake'; '(micrograms U/grams absorbent)'});
title("semilog y");
set(gca,'fontsize',8);
grid on
grid minor


subplot(2,2,4)
loglog(time, uranTake,"xb");
xlabel("time (hours)");
ylabel({'Uranium Uptake'; '(micrograms U/grams absorbent)'});
title("log log");
set(gca,'fontsize',8);
grid on
grid minor
```

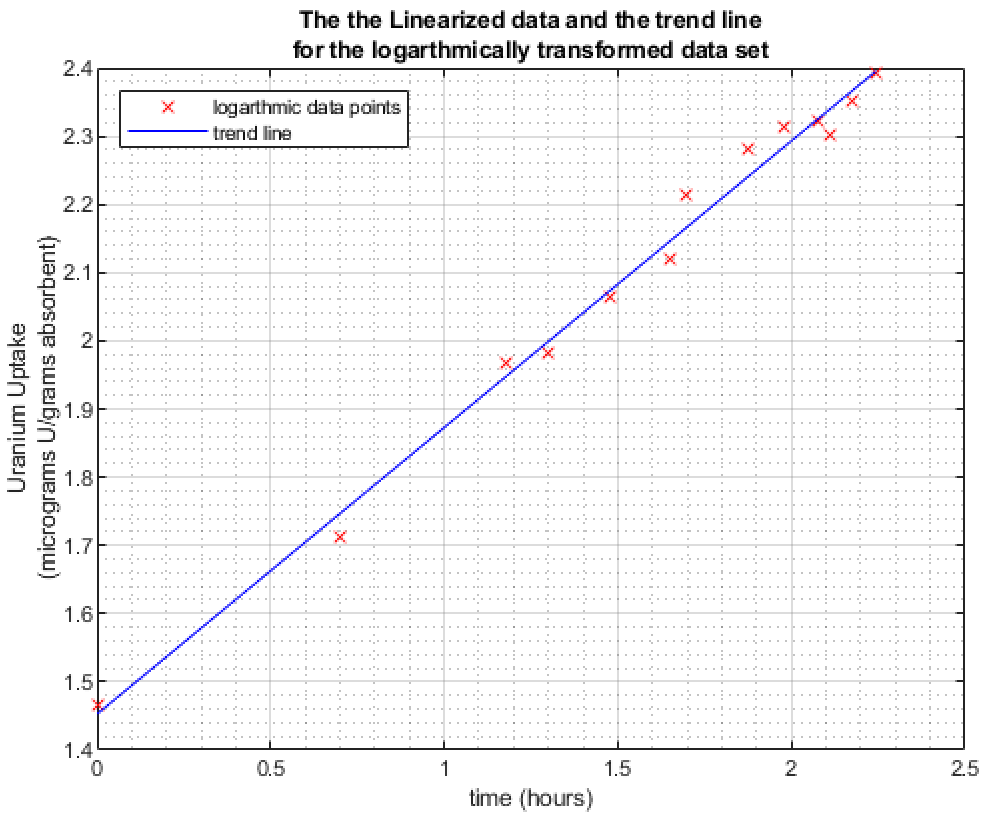


LINEARIZATION

```
logTime = log10(time);           % transforming the x values to log
logUranTake = log10(uranTake); % transforming the y values to log

% manipulating the linear regression
pfit = polyfit(logTime, logUranTake,1);   % slope and y-intercept
slope = pfit(1,1);                        % slope value
yInter = pfit(1,2);                       % y-intercept value
pval = polyval(pfit,logTime);             % the y-values corresponding
                                          % to the regression line

fprintf("The linear regression line for the data set is y = %.3fx +
 %.3f .",slope, yInter);
                % prining the linear model on the command window

% plotting the transformed data points with the predicted linear model
figure
plot(logTime,logUranTake, "xr",'DisplayName','logarthmic data points')
title({'The the Linearized data and the trend line' ;'for the
 logarithmically transformed data set'})
xlabel('time (hours)')
ylabel({'Uranium Uptake'; '(micrograms U/grams absorbent)'});
```

```
grid on
grid minor
set(gca,'FontSize',8)
hold on
plot(logTime,pval,"-b",'DisplayName','trend line')
hold off
legend('location','northwest')
```

The linear regression line for the data set is y = 0.420x + 1.453 .

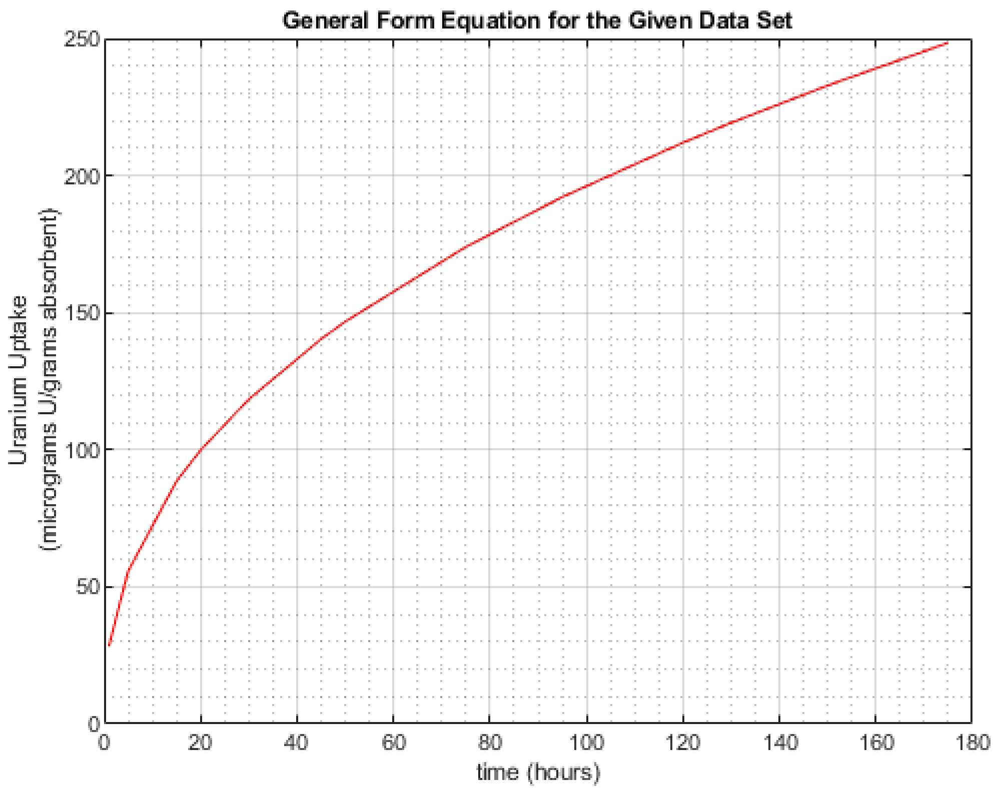


UPTAKE MODEL

```
% Because the linear regression model is
% log(y) = a*log(x) + b     //a and b are calculated by polyfit
% by manipulating this formula we can get
% y = 10^b*x^a

genFormX = time;
        % the x-values for the general form
genFormY = 10.^(yInter).*(genFormX).^(slope);
        % the y-values for the general form
fprintf("The general form of the best fit equation is y =
 10^(%.3f)*x^(%.3f) .",yInter, slope);
```

```
        % printing the equation on the command window

% plotting the general form of the equation for the data
figure
plot(genFormX,genFormY,"-r")
title('General Form Equation for the Given Data Set')
xlabel('time (hours)')
ylabel({'Uranium Uptake'; '(micrograms U/grams absorbent)'})
grid on
grid minor
set(gca,'FontSize',8)
```

The general form of the best fit equation is y =
*10^(1.453)*x^(0.420) .*



PREDICTIONS

```
% prediction for 10, 100, and 250 hours
predictionHr = [10 ; 100 ; 250];
predictionVal = 10.^(yInter).*(predictionHr).^(slope);
```

ANALYSIS

-- Q1

The type of function that best represents the data is the power function because the data points line up the most clearly as a linear function with having both x and y values in logarithmic scale.

-- Q2

The uranium uptake for 10, 100, and 250 hours is 74.6197, 196.3796, and 288.6208 respectively. From the prediction values and the visual figure of the general form of the equation provides the fact that the rate of increase is decreasing as the x-values increases. Due to this decrease in the tangent as time approaches infinity, the uranium uptake will be difficult to calculate with values that correspond to time that are very large values.

ACADEMIC INTEGRITY STATEMENT

We have not used source code obtained from any other unauthorized source, either modified or unmodified. Neither have we provided access to our code to another. The script we are submitting is our own original work.

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