

Homework ch2

Question 1

```
%% Question 1
t = [3.4935;4.2853;5.1374;5.8181;6.8632;8.1841];
x = [6;10.1333;14.2667;18.4;22.5333;26.6667];

% organize G

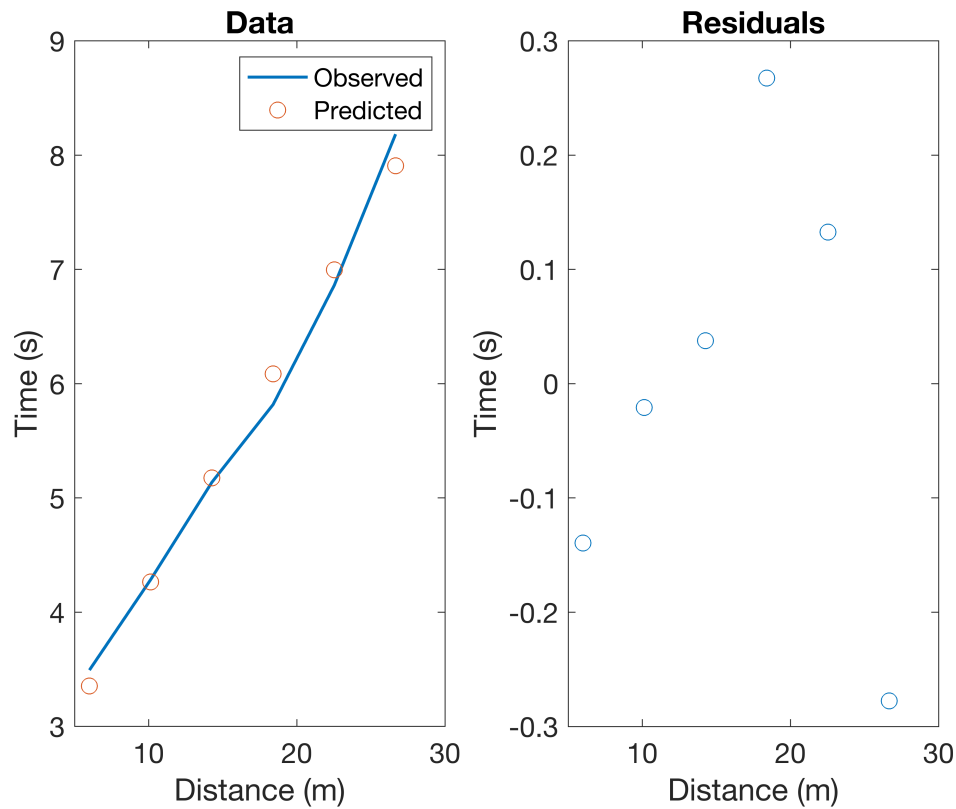
G = [ones(6,1),x];

% least square estimate s2

s2 = inv(G'*G)*G'*t;

t_pred = G*s2;
% plot the data and the fitted model, and the residuals.

figure(1)
subplot(1,2,1)
plot(x,t,'LineWidth',1.5)
hold on
plot(x,t_pred,'o','MarkerSize',8)
xlabel('Distance (m)')
legend('Observed','Predicted')
ylabel('Time (s)')
xlim([5,30])
set(gca,'fontsize',14)
title('Data')
subplot(1,2,2)
plot(x,t_pred-t,'o','MarkerSize',8)
xlabel('Distance (m)')
ylabel('Time (s)')
xlim([5,30])
set(gca,'fontsize',14)
title('Residuals')
```



Question 2

```
%% Question 2
```

```
sigma = 0.1;
% define weight matrix
W = 1/sigma * eye(6,6);
Gw = W*G;
dw = W*t;

s2w = inv(Gw'*Gw)*Gw'*dw;

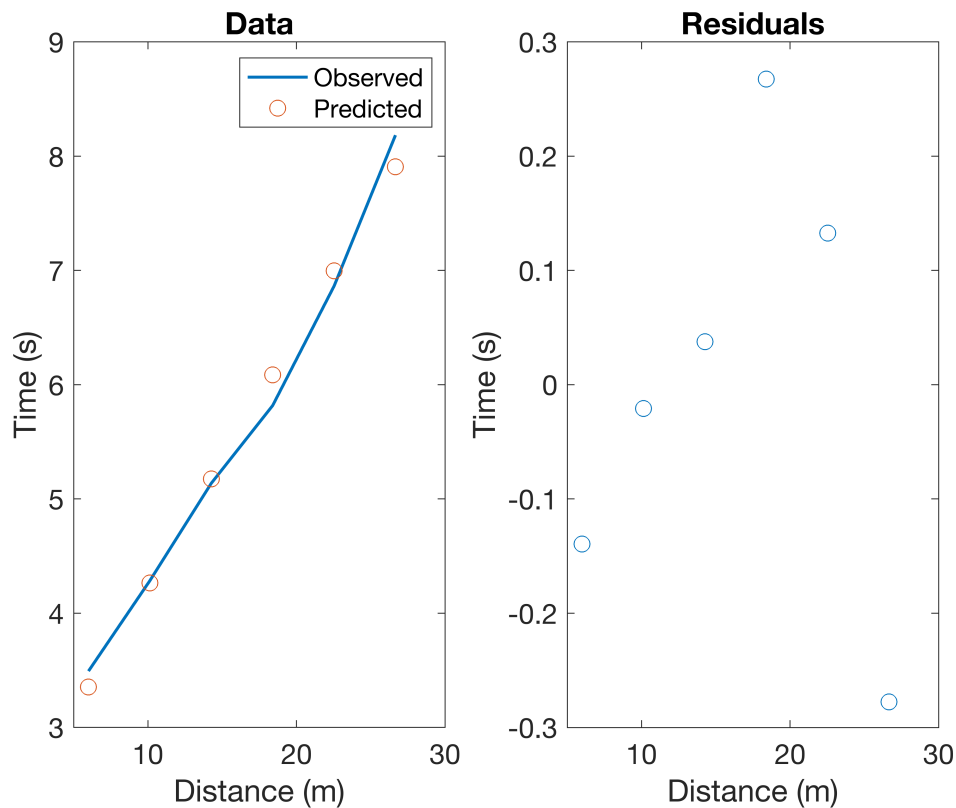
t_pred = G*s2w;
% plot the data and the fitted model, and the residuals.
```

```
figure(2)
subplot(1,2,1)
plot(x,t,'LineWidth',1.5)
hold on
plot(x,t_pred,'o','MarkerSize',8)
xlabel('Distance (m)')
legend('Observed','Predicted')
ylabel('Time (s)')
xlim([5,30])
set(gca,'fontsize',14)
title('Data')
subplot(1,2,2)
plot(x,t_pred-t,'o','MarkerSize',8)
```

```

xlabel('Distance (m)')
ylabel('Time (s)')
xlim([5,30])
set(gca,'fontsize',14)
title('Residuals')

```



In this problem, the estimation from least square and weight least square is the same and so do the graphs of travel times and residuals.

Question 3

```
%% Question 3
```

```

% chi2 for question 1
chi2 = (G*s2 - t)'*(G*s2 - t)./sigma^2

```

```
chi2 = 18.7502
```

```

% chi2 for question 2
chi2w = (W*(G*s2w - t))'*(W*(G*s2w - t))

```

```
chi2w = 18.7502
```

For both cases, the χ^2 is 18.7502, which is far away from the 4, the degrees of freedom. Therefore, the null hypothesis is likely to be rejected.

Question 4

```
%% Question 4 Evaluate the p-value for this model.
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```
p = 1-chi2cdf(chi2,4)
```

```
p = 8.7992e-04
```

```
pw = 1-chi2cdf(chi2w,4)
```

```
pw = 8.7992e-04
```

The p value for both cases is very small which proves that null hypothesis is rejected.