

ENED 1090: Engineering Models I
Homework Assignment #4

Due: Week of October 7th at the beginning of your Recitation Section

Instructions:

1. Before you begin editing this document, you must save this document to your laptop or you will end up losing all of your work. If you opened this document directly from Blackboard, click on the Enable Editing button then choose File → Save As and save the document to your laptop. You should set up a folder on your laptop for ENED1090 where you keep all of your homework assignments and lab reports.
2. **Show your work!**
3. It is fine to work with other students, but what you turn in must be your own work - not something copied from someone else.

Problem 1: The table below shows the velocity of an object in increments of 0.5 seconds.

t (seconds)	velocity (cm/s)
0	9
0.5	9.25
1.0	10
1.5	11.25

- (a) Using the data provided, estimate the velocity of the object at 0.825 seconds using *nearest point interpolation*.
 - a. 9.5 cm/s
- (b) Using the data provided estimate the velocity of the object at 0.825 seconds using *linear interpolation*. Do this part by hand (don't use *interp1*) and show your calculations.
 - a. 2 Points : (0.5, 9.25) and (1, 10)
 - b. Slope: $(10-9.25)/(1-0.5) = 1.5$
 - c. Equation of Line : Velocity - 10 = $1.5*(t-1)$
 - d. Velocity (Estimated) : $10+1.5*(0.825-1) = 9.8125$
- (c) Suppose we wish to *insert 3* new data points (evenly spaced in time, t) between each adjacent set of points in the table. What would the new increment for t be?
 - a. $N.I. = OldIncrement / (3+1) = 0.5/4 = 0.125$
- (d) Calculate the *three* new data points between t = 0.5 and t = 1.0 in the table below using *linear interpolation*. OK to use *interp1* for this. Show your calculations or MATLAB command to get these three points.

t	velocity (cm/s)
0.5	9.25
0.625	9.4375
0.75	9.6250
0.875	9.8125
1.0	10

Problem 2: The graph on the following page shows the position of an object in increments of 0.5 seconds.

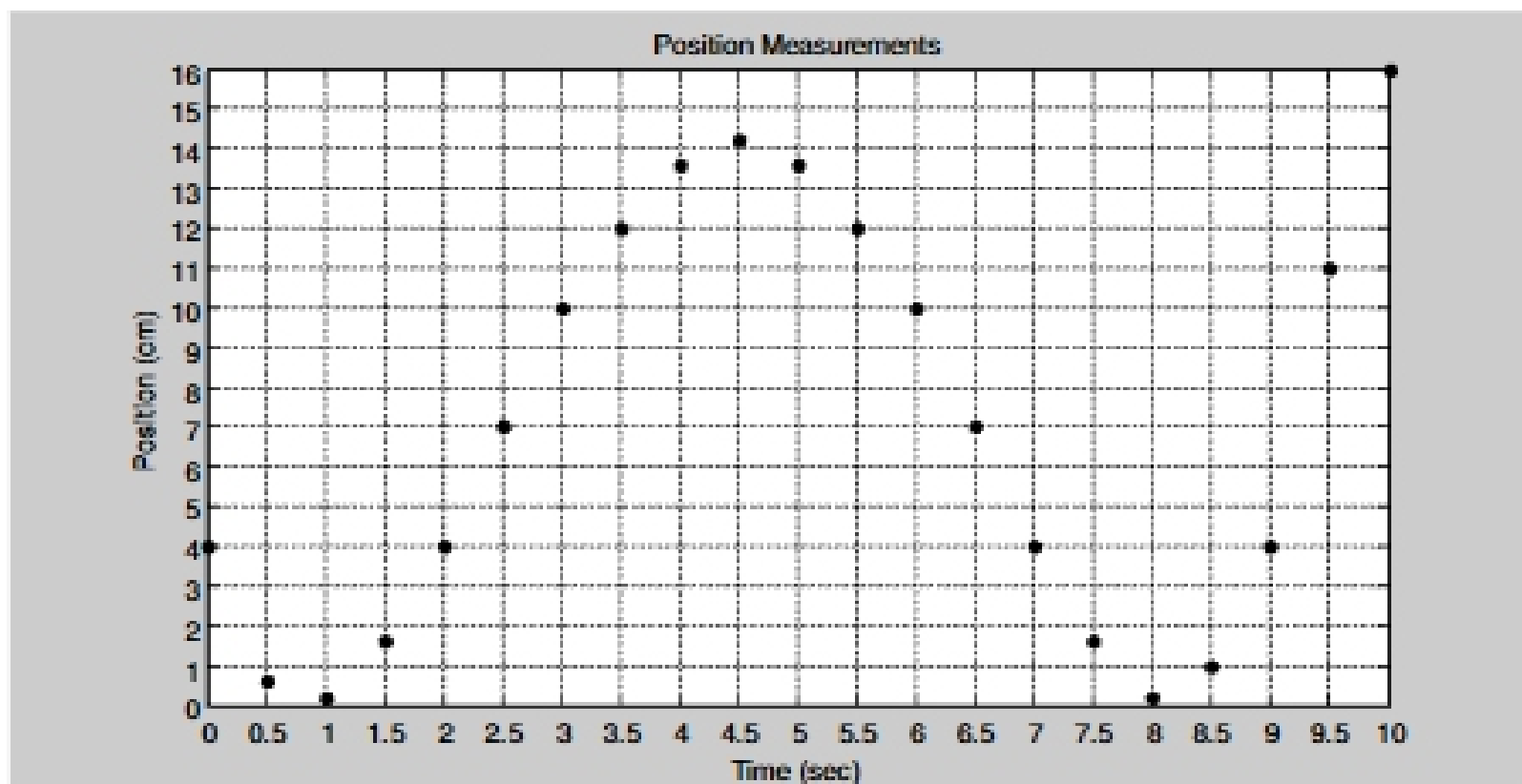
- (a) Using *linear interpolation*, estimate the position of the object at 6.85 seconds. Do this by hand (no *interp1*) and show your calculations.
- Two Points : (6.5,7) and (7,4)
 - Slope : $(4-7)/(7-6.5) = -6$
 - Equation of Line : Position - 7 = -6*(t - 6.5)
 - Position (Estimated) : $7 - 6 * (6.85-6.5) = 4.9$ cm
- (b) Now use *interp1* and linear interpolation to estimate the position of the object at 6.6, 6.7, 6.8, and 6.9 seconds.

MATLAB Command and Results:

```
EDU>> interp1([6.5 7],[7 4],6.6:0.1:6.9,'linear')
ans =
    6.4000    5.8000    5.2000    4.6000
```

Estimated

- E.P. at 6.6 seconds is 6.4 cm.
- E.P. at 6.7 seconds is 5.8 cm.
- E.P. at 6.8 seconds is 5.2 cm.
- E.P. at 6.9 seconds is 4.6 cm.

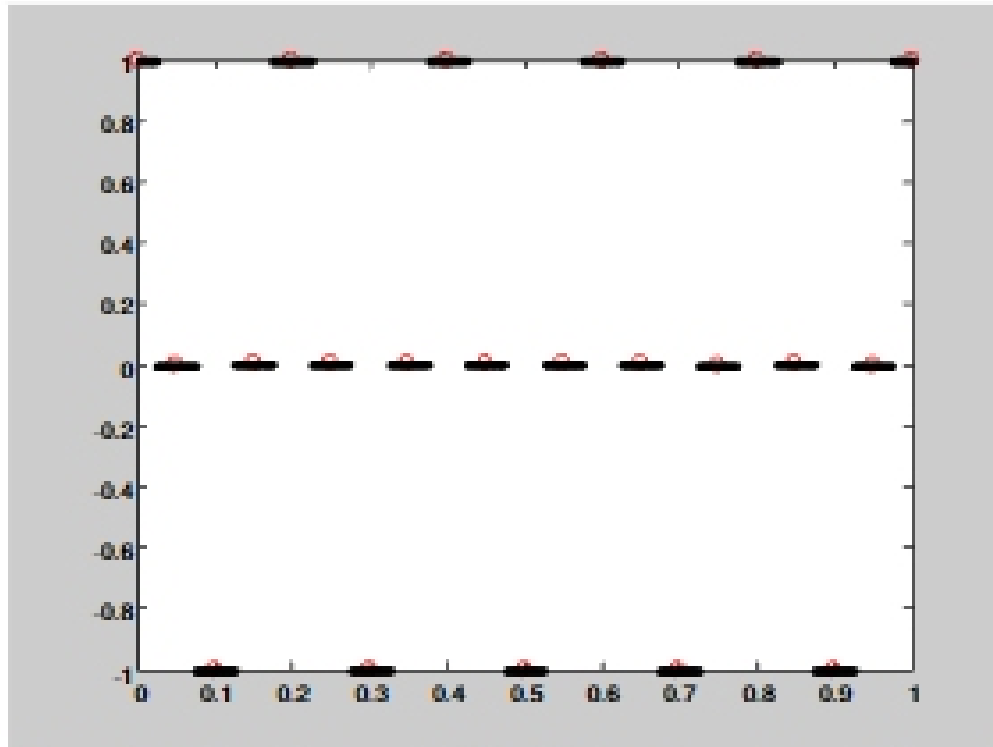


Problem 3: For this problem, you need the excel file, HW4_PB3.xlsx posted on the Blackboard metasite under Assignments, HW#4. The excel file has a vector of times, Time, which starts at 0 increments by 0.05 and ends at 1 second. It also has a vector of voltage measurements, Voltage, corresponding to the given times. Import both columns into MATLAB using the import tool or the xlsread command.

- (a) Use *interp1* with a method of *nearest* to estimate the voltage every 0.001 seconds between 0 and 1 second. On the same plot (not subplot), plot the original data points as red circles and the interpolated data points as black points.

MATLAB Commands and Plot

```
EDU>> tint = 0:0.001:1;  
EDU>> yint = interp1(Time, Voltage, tint, 'nearest');  
EDU>> plot(Time, Voltage, 'ro', tint, yint, 'k');
```



- (b) Use *interp1* with a method of *linear* to estimate the voltage every 0.001 seconds between 0 and 1 second. On the same plot (not subplot), plot the original data points as red circles and the interpolated data points as black points.

MATLAB Commands and Plot

```
EDU>> tint = 0:0.001:1;  
EDU>> yint = interp1(Time, Voltage, tint, 'linear');  
EDU>> plot(Time, Voltage, 'ro', tint, yint, 'k');
```

