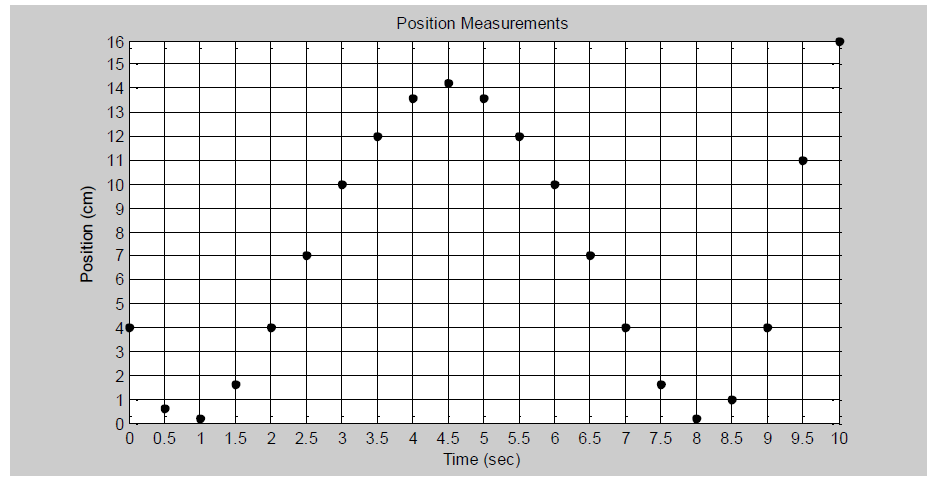
**ENED 1091 HW#3**

**Due Week of February 22nd**

**Problem 1:**  The graph below shows position measurements (in cm) collected every 0.5 seconds over a 10 second interval of time.



1. Using ***linear interpolation***, estimate the position of the object at 6.15 seconds. Do this by hand (no ***interp1***) and show your calculations.

**Calculation and Result (include units):**

1. Now use ***interp1*** and linear interpolation to estimate the position of the object at 6.1, 6.2, 6.3, and 6.4 seconds.

**MATLAB Command and Results (include units):**

**Problem 2:** For this problem, you need the data file, HW3P2.mat, posted on the Blackboard metasite with Homework #3. The file has a vector of times, t, which starts at 0 increments by 0.04 and ends at 0.8 seconds. It also has a vector of voltage measurements, V (volts), corresponding to the given times. Download the data file and save it in your current MATLAB folder. The command: load HW3P2 will load the two vectors into your workspace.

1. Plot the original data points (don’t connect the points with lines). Add title and axis labels (with units).

**Plot:**

1. Use ***interp1*** with a method of ***nearest*** to estimate the voltage every 0.005 seconds between 0 and 0.8 seconds. On a single plot, plot the original data points as red stars and the interpolated data points as black circles. Add title, axis labels (with units), and a legend.

**MATLAB Commands and Plot**

1. Repeat part (b) using ***linear*** interpolation.

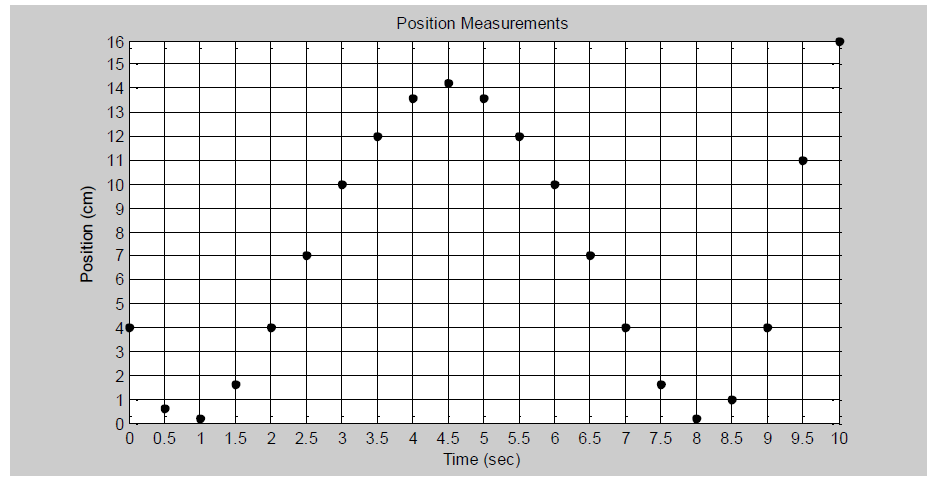
**MATLAB Commands and Plot**

1. Repeat part (b) using ***spline*** interpolation.

**MATLAB Commands and Plot**

1. What kind of waveform does your plot in part (d) look like? Could you possibly have picked this up from looking at the original data points?

**Problem 3:** The graph below shows position measurements (in cm) collected every 0.5 seconds over a 10 second interval of time.

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1. Using a Δt = 0.5 sec, estimate the velocity at t =  sec using the 2-point estimate and the 3-point estimate for the derivative. **Be sure to show your work and include units!**

2-point Estimate of Velocity at t = 6 sec: \_\_\_\_\_\_\_\_\_

3-point Estimate of Velocity at t = 6 sec: \_\_\_\_\_\_\_\_\_

1. Using the estimate for 2nd derivative and a Δt = 0.5 sec, estimate the acceleration at t = 6 sec. **Again, show work and include units!**

Estimate of Acceleration at t = 6 sec: \_\_\_\_\_\_

1. What could be changed to improve the accuracy of the derivative estimates?

**Problem 4:** For this problem, you need the data file, HW3P4.mat, posted on the Blackboard metasite with Homework #3. The MATLAB command: load HW3P4 will load the data into the MATLAB workspace. The data file has 4 vectors:

* t is a vector of times (seconds) starting at 0, incrementing by 0.1, and ending at 4
* pos is a vector of position measurements (mm) taken at the times specified in vector t
* t\_act is a vector of times (seconds) starting at 0, incrementing by 0.005, and ending at 4
* v\_act is a vector of velocity measurements (mm/s) corresponding to the times in t\_act

1. Plot the position measurements over time (don’t connect the individual data points with lines). Add a title and axis labels (with units) to the plot.

**Plot:**

1. Use the position measurements and the 2-pt reverse estimate for derivative to estimate the velocity at each time in vector t. Assume the initial velocity is 0.

**MATLAB Code for 2-PT Estimate of Velocity:**

1. On a single graph, plot the velocity estimates over time, t, as individual data points and the actual velocity (v\_act) over t\_act. Add a title, axis labels (with units), and a legend.

**Plot and MATLAB Code for Plotting:**

1. How could the accuracy of the velocity estimates be improved?