Armstrong State University
Engineering Studies
MATLAB Marina – Interpolation Exercises

1. Briefly explain how interpolation can be used to estimate unknown values in a set of data. Briefly explain when the estimated values from interpolation are likely to be accurate.
2. Write a MATLAB program that will:
   - Evaluate the function $f(t) = 5te^{-0.5t}$ over the interval $t = 0$ to $t = 10$ seconds using a one second interval between values.
   - Use the MATLAB function `interp1` to estimate the value of $f(t)$ for $t = 5$ seconds, $t = 5.5$ seconds, and $t = 5.7$ seconds using linear interpolation.
   - Use the MATLAB function `interp1` to estimate the value of $f(t)$ for $t = 5$ seconds, $t = 5.5$ seconds, and $t = 5.7$ seconds using cubic spline interpolation.
   - Use the MATLAB function `interp1` to extrapolate the value of $f(t)$ for $t = 10.5$ seconds using linear interpolation.
3. Write a MATLAB program that will:
   - Evaluate the function $f(t) = 5te^{-0.5t}$ over the interval $t = 0$ to $t = 10$ seconds using a one second interval between values.
   - Use the MATLAB function `interp1` to estimate linearly interpolated points of $f(t)$ so that the interval between values is 0.25 seconds instead of the original one second (this will estimate three values between each of the original values and give four times as many points over the same range as the original interval).
   - Use the MATLAB function `interp1` to estimate cubic spline interpolated points of $f(t)$ so that the interval between values is 0.25 seconds instead of the original one second.
   - Plot the original $f(t)$ function along with plots of the linearly interpolated estimated function values and cubic spline interpolated estimated function values on the same plot in a figure window. Use circles for the points and no line for the original function points, use a dashed line for the line style of the plot of the linearly interpolated values, and use a solid line for the line style of the cubic spline interpolated values. Title and label the plot appropriately (a legend is a good idea here).
4. Write a MATLAB program that will:
   - Load the flow data from columns 1 and 2 of worksheet1 of the Excel file `flowdata.xlsx`.
   - Estimate the value of the flow for a height of 2.2 feet.
   - Extrapolate the value of the flow for a height of 6.0 feet.
   - (More challenging) Estimate one additional point between each pair of points and save the original plus interpolated data to columns 1 and 2 of worksheet2 of the same excel file. The data written to worksheet 2 should have the same headings as the original data in worksheet 1. The values for the height for the flow data are not equally spaced, so the midpoint of each pair of points will need to be computed based on the bracketing

heights for that pair of points. The original heights plus the midpoints can then be used to create a new array of heights to estimate the flow values for.

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