Exercise

Let $f(x) = \sin(e^x)$ on $-1 \leq x \leq 3$. Define a vector of 4,000 points in the interval that you will use to measure error. For each $n = 20, 40, 80, 160, 320, 640$, let $S_n(x)$ be a cubic spline interpolant of data obtained by sampling f at n equally spaced points in the interval. Compute the errors $E_n = \max |S_n(x) - f(x)|$ (the max is taken over your 4,000 point vector). Using a least squares linear fit, hypothesize on the behavior of E_n as a function of n.

Challenge: Analyze infant blood pressure data

You will be given a link to a CSV (comma separated value) file with three columns. The first column is elapsed time in milliseconds. The third column is a blood pressure reading taken from an infant. We won't use the second column.

Get as far as you can on the following tasks. If you get through them all, pull out a cigar and put your feet up on the desk.

1. Import the data into MATLAB.
2. Make a plot of the blood pressure as a function of time, for about half a minute of real time.
3. Find all the local minima of the blood pressure function.
4. Add the minima points as dots in your graph from #2. Each interval between minima corresponds to one heartbeat.
5. Use cubic interpolation to resample the curve at 101 points in a heartbeat, and calculate the area under the curve using the trapezoid rule. (This quantity relates to the volume of blood pumped during the heartbeat.)
6. Repeat #5 for every heartbeat. Make a histogram of the values.

Some useful commands: diff, find, for, hist, importdata, interp1, plot, trapz, xlim