Fall 2015 CIS 515

Fundamentals of Linear Algebra and Optimization
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Project 1

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Problem P1.
(1) Refer to the MATLAB program `Part1.m`.

(2) Except for the first and last control points, pairs of de Boor control points, b_0^{i+1} and b_3^i, have common equations in terms of d_{i+1}, and often d_i and/or d_{i+2}. By taking the coefficients of these terms and placing them in a matrix, A, the equation $Ad = x$ can then be written in a manner which satisfies all of the equations in terms of d. The first and last control points are placed in the x vector to satisfy the boundary conditions. In other words, since the first b_0 term does not have a matching b_3 term from a previous point, it cannot be written as a combination of d terms.

$$
\begin{aligned}
6b_0^2 &= \frac{3}{2}d_1 + \frac{7}{2}d_2 + (1)d_3 \\
6b_0^i &= (1)d_{i-1} + (4)d_i + (1)d_{i+1}; (3 \leq i < N-3) \\
6b_0^{N-2} &= (1)d_{N-3} + \frac{7}{2}d_{N-2} + \frac{3}{2}d_{N-1}
\end{aligned}
$$

Since the range of superscript values on the left side of the above equations is 2–$N-2$, and the subscripts of d have a range 1–$N-1$, a vector can be made for d which ranges 2–$N-2$ and the remaining values of d (since they each only occur in a single equation) can be included in the x vector.

Problem P2.
Refer to the MATLAB program `Part2_1.m` and `Part2_2.m`.