Lab 6

Cubic spline interpolation

1. Consider the function: $f(x) = sin(x)$ defined on $[0, 2\pi]$ and the nodes $0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi$.

   a) display the value of the function, the value of the cubic natural spline and the value of cubic clamped spline function at $x = \frac{\pi}{4}$.

   b) plot the graphs of the function, the cubic natural spline and the cubic clamped spline functions, in the same figure.

   (Use Matlab function *spline*).

2. There are given 5 arbitrary points, using Matlab function *ginput*. Plot the points and the graph of cubic natural spline function that passes through all the given points.

3. In the following table there are some data regarding a moving car.

Time (in s)	0	3	5	8	13
Distance (in $feet$)	0	225	383	623	993
Speed (in $feet/s$)	75	77	80	74	72

   Use a clamped cubic spline to predict the position of the car and its speed when the time is $t = 10s$.

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4. (*Facultative*) Consider the function: $f(x) = \cos(x)$, the nodes $x = 0 : \frac{\pi}{4} : 2\pi$ and the linear polynomial spline $p_i(x) = f(x_i) + \frac{f(x_{i+1}) - f(x_i)}{x_{i+1} - x_i}(x - x_i)$ on each interval $[x_i, x_{i+1}]$. Plot, in the same figure, the graph of the function and of the corresponding linear spline function.