

The Very Last Numerical Methods Programming Project
Due May 7, 2010

Write a program that executes the natural cubic spline algorithm. You may do this in Maple with the program NCUBSP34 in the mws-8 folder on the textbook CD. As in Project 2, you'll need to add a feature to the program so that before quitting, it should ask whether you want to evaluate the spline at a point. If you enter Y or y, the program should ask for a point. After giving the value of the spline at that point, the program should loop around and ask again whether you want to evaluate the spline at a point, continuing until you no longer enter Y or y. Use the program to find a free cubic spline that fits the data on p. 101 for the population of the United States. Compare the results for 1930, 1965, and 2000 with the results you got earlier in the semester using the Lagrange interpolating polynomial. Which results seem more reasonable? Note: For 1930, or any date prior to 1950, the program should use $S_0(x)$, the piece of the spline for [1940, 1950]. For 2010, or any date after 1980, the program should use $S_4(x)$, the piece of the spline used for [1980, 1990]. The program should neither use nor print $S_5(x)$, which is merely a mathematical convenience. As a hint, here's one line of my Maple code:

```
while XX>=X[K+1] and K<N-1 do
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Next, write a program which executes the clamped spline algorithm. You may use the program CCUBSP35, but as in the previous paragraph, you will need to modify the program to allow you to evaluate the spline at as many points as you like. Just copy your additions to the first program into the second program. Use this program to do Exercise 18 on p. 101. Ignore the speed of the car at 3, 5, and 8 seconds. Use the output from your program to compute by hand the velocity at 10 seconds.

Extra credit options:

- Print the polynomial out nicely, rather than just printing the coefficients.
- Plot the spline function.
- Make nice menus for a user-friendly program allowing the user to modify points or change back and forth from a natural spline to a clamped spline.
- Use your imagination. You may want to check with me before using it too much.