MACM 316 - Computing Assignment 5

- Read the *Guidelines for Assignments* first.
- Submit a one-page PDF report to Crowdmark and upload your Matlab scripts (as m-files) to Canvas. *Do not use any other file formats*.
- Keep in mind that Canvas discussions are open forums.
- You must acknowledge any collaborations/assistance from colleagues, TAs, instructors etc.

Part A: (2 marks)

Construct a natural cubic spline to approximate $f(x) = e^{-x}$ by using the values given by $f(x)$ at $x = 0,0.25,0.5,0.75,1.0$. Use the derivatives of the spline to approximate $f'(0.5)$ and $f''(0.5)$. Compare the approximations to the actual values.

Part B (3 marks):

Repeat part A over the interval [0, 1] with equal node spacings

$$h = 2^{-m}, m = 3,4,5,6,7.$$

Tabulate or form a plot of the absolute error for $f'(0.5)$ and $f''(0.5)$ as a function of h. Using big-oh notation describe the error in your approximations to $f'(0.5)$ and $f''(0.5)$ as a function of h. Your answer here should be of the form $O(h^p)$: what is p?

Part C (4 marks):

Repeat parts A and B using clamped cubic splines.

Part D (1 mark):

What is better here, the natural or clamped cubic spline? Explain.

Continued on page 2

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- Refer to the Guidelines for Computing Assignments for general rules, requirements on written communication, information on the graphical presentation, and the grading scheme.
- Remember that you will be marked based on your report so make sure that it includes all of your results. We do not normally access your submitted Matlab scripts, but we may if we have academic integrity or other concerns.
- You may use spline functions that are built into Matlab if you wish.

Submit your 1 page report for this question to Crowdmark in .pdf format according the Assignment Guidelines described in the syllabus.

Submit your Matlab code to Canvas "Computing Assignment 5 - Matlab Code". Do not include identifying information on your report.

After marking, we will post a few exemplary reports as sample solutions. We appreciate your support on this. If you do not wish to have your report posted, please state so at the top of your report.

Continued on page 2