Linnéuniversitetet
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Department of Mathematics
Assignment 3 - Numerical Integration
Numerical methods 1MA930 2024

Examiner: Andreas Petersson   2024-04-26

- The hand-in deadline is **23.59 on May 19**.

- You are allowed to work in groups of 1 to 4 people. Recommended group size is 2 to 3.

- Write a short but descriptive report on Tasks 2-7 below and hand in **as a single pdf-file**.

- Carefully explain your solution and any struggle you had. Include all relevant code and figures.

- **Do not plagiarize other groups or use large language models** - this is considered cheating and may be reported.

Task 1. (Preparatory, do not include in report) Read Section 5.4 followed by Reality Check 5 (page 278).

Task 2. Do Activity 1 in Reality Check 5. You are allowed (here and below) to either copy Program 5.2 from the book or use the MATLAB function `quad`. If you use `quad` you have to explain what method this function uses and cite your sources.

Task 3. Do Activity 2 in Reality Check 5. Here it is important that you think carefully what it is that you want to do before you start programming. In your report, remember to write out which function you are finding a root of. By "correct to three decimal places", we mean as usual that the error should be less than $0.5 \cdot 10^{-p}$. Note that the bisection method also gives a bound on the error.

Task 4. Do Activity 3 in Reality Check 5. Here you make use of your solution to Activity 2.

Task 5. Do Activity 4 in Reality Check 5. Remember to explain in detail how you found the derivative (by hand) that you use in the Newton–Raphson method. If you are doing things correctly, you need to differentiate an integral. Remember to compare with the solutions you got using the Bisection Method and ensure they are close. Note that the Newton–Raphson method does not

give a bound on the error, so you have to use the "method independent error estimate" of Lab 2.

Task 6. Do Activity 5 in Reality Check 5. The book's approach to animation is soon deprecated, so look up the MATLAB documentation for how to create animations nowadays instead. This page might be good: `https://se.mathworks.com/help/matlab/creating_plots/trace-marker-along-line.html`. Present your solution by including your full animation code and one example frame from it (as a figure) in the report.

Task 7. Do Activity 7 in Reality Check 5. Implement at least one of the (non-constant speed) examples of the function C mentioned in the book. Explain what changes you needed to make in your code to do this.

Task 8. (Concluding, do not include in report) What happens if you write `spy()` in MATLAB without giving a matrix as an argument?