McGill University Department of Electrical and Computer Engineering

ECSE 443 Introduction to Numerical Methods Winter 2019

Assignment #4 Posted: March 17, 15:00 DUE: March 24, 17:00

Solve all problems. Show all your work, include all source code. All programs should be well documented, and the methods used should be clearly described. Clearly indicate the final answer. Follow instructions in the question. The assignment must be written using a word processor such as Microsoft word. Hand written submissions will not be accepted. For software portions of the project the source code as well as the output of the code will be required as part of the submission. You must include all references and sources that you used. The TA's will be instructed to look for plagiarism or other forms of misconduct and if found, will report the potential misconduct**.**

Question 1) (12 Marks) Write a program/MATLAB, (not using built in integration functions), script to perform the integration $I = \int_0^{\pi} ln\big(5 - 4 \cdot cos(x)\big)dx$ with a relative error of 10^{-6}. Show the number of segments used as well as the computations used for relative error. Using:

a) Mid-point rule
b) Trapezoidal Rule
c) Simpson's Rule

Question 2) (12 Marks) Write a program/MATLAB script (not using build in integration functions) to perform the integration. $\int_2^3 \int_x^{2x^3} (x^2 + y)dydx$ using Show the number of segments used as well as the computations used for absolute error. Using:

a) Mid-point rule
b) Trapezoidal Rule
c) Simpson's Rule

Question 3) (8 Marks) Derive the following:

a) The fifth backward difference which has error of order "h" (first order accurate).
b) The forward difference representation for $\frac{df(x)}{dx}$ which has error of order h^3(third order accurate).

Question 4) (8 Marks) Given the following data:

X	0	1	2	3	4
F(x)	30	33	28	12	-22

Find $f'(0), f'(2), f'(4)\ and\ f''(0)$ with representations that are second order accurate (h^2) and write a program/MATLAB script to compute the values.