MIDDLE EAST TECHNICAL UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
ME 310 NUMERICAL METHODS
FALL 2014
PROGRAMMING PROJECT 4

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Due date : 01.01.2015
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The programming project will be submitted through METU-Class, as described in the "Programming Project Assignment Guidelines", which is posted on METU-Class.

Write a computer program to integrate any given function $f(x)$ from a to b using three point Gauss quadrature. Utilize the Gauss quadrature formula in a multiple segment approach. Divide the domain of integration $[a\ b]$ into n segments and apply the Gauss quadrature formula to each segment separately. Evaluate the integral with a pre-specified error tolerance starting from one segment and increasing the number of segments until desired accuracy is reached.

Your code should do the following:

- User defines the function $f(x)$, bounds of integration $[a, b]$, and error tolerance ε_s. Write your code as a function that can accept user defined variables and functions or main code that calls a function written as a separate file (a separate m file in MATLAB, a separate C/C++, Fortran, etc. file in other programing languages. Not applicable to MATHCAD).
- Also find the integral of the given function using built-in capabilities of the software/computer language you are using. Compare the results. (If you are using a programing language such as C/C++, Fortran, etc. compare the result of your code and the result of a built-in function in a software package only in your report)
- Present the results by displaying them on the screen. Give the number of segments at each step and approximate percent relative error for each integral calculated using those segments.

Present your results in a short report (a few pages of a word document only, saved as a pdf document) which should include the following:

- A basic introduction paragraph,
- Necessary hand calculations to write your code (type it in the word document)
- Formulations used in the calculations,
- Your numerical results,
- Discussion of the results and conclusion,
- Appendix section including your code.