Numerical Methods
Exercise Sheet 7

HS 16
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http://www.physik.uzh.ch/en/teaching/PHY233/HS2016.html

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Due: 09.11.2016 16:00

Exercise 1: Newton-Cotes formulas (100 Pts.)
a)Write a program to determine the integral $\int_0^5 \frac{7 \cdot dx}{x^2+1}$ numerically using Newton-Cotes quadrature:

- Trapezoidal rule; (10 points)
- Simpson's rule; (20 points)
- Simpson's 3/8th rule (20 points)

b) What steps are needed to approach the integral using a Gauss Quadrature? (10 points)

Which type(s) of Gauss quadrature can you use in principal?

c) Write a program to determine the integral $\int_0^5 \frac{7 \cdot dx}{x^2+1}$ numerically using

Gauss–Legendre quadrature. (20 points)

d) Compare the expected and obtained precisions of all the used methods. (20 points)

Exercise 2: Gauss-Laguerre Quadrature: optional (30 Pts.)

Implement Gauss-Laguerre Quadrature for the integral $\int_0^\infty e^{-x} \cdot sin(x) dx$.

Exercise 3: Optional (10 Pts.)

Proof that the consistency condition for the closed Newton-Cotes formulas, i.e.:

$$\sum_{k=0}^{K} \omega_k = 1$$

by analytically integrating the Newton-Cotes formulas for a given integrand. Note: A clever choice of the integrand can make your life very simple.

Maximum number of points for mandatory tasks on 09.11 : 100
Maximum possible number of points for tasks on 09.11 : 140