TFY4235/FYS8904
Problemset 6 Spring 2015

NTNU
Institutt for fysikk

Problem 1.
Evaluate the following integrals to at least 4 significant digits. It is suggested that you first use a Newton-Cotes method and/or a suitable Gauss quadrature routine of a given order that returns the weights and mesh points to calculate the integrals. Thereafter compare these results to what an adaptive canned integration routine gives. For comparison the exact results are also indicated.

$$I_1 = \int_0^1 \frac{\mathrm{d}x}{\sqrt{x^2+1}} = \ln\left(1+\sqrt{2}\right)$$

$$I_2 = \int_0^1 \mathrm{d}x\, \exp\left(-x^2\right) = \frac{\sqrt{\pi}}{2}\mathrm{erf}(1) \approx 0.746824132812427$$

$$I_3 = \int_0^\infty \mathrm{d}x\, \frac{x}{\exp(x)+1} = \frac{\pi^2}{12}$$

$$I_4 = \int_0^\infty \mathrm{d}x\; x^{-1/2}\exp(-x) = \Gamma(1/2) = \sqrt{\pi}$$

$$I_5 = P\int_0^\infty \frac{\mathrm{d}x}{x^2+x-2} = \frac{\ln(2)}{3}$$