DEPARTMENT OF MATHEMATICS, IIT - GUWAHATI
Odd Semester of the Academic year 2015-2016
MA322 & MA 311M Assignment/Problem sheet 6
Instructor: Dr. J. C. Kalita
Due before midnight of 13 September 2015

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1. Compute π from an integral of the form $c\int_0^1 \frac{1}{1+x^2}dx$ by using Trapezoidal, Simpson's one-third and three-eighth rules. You must take the same number of intervals in all the three cases. Print the error in all the three cases. Now increase the number of intervals firstly 10 times and then 20 times and see the effect on the error.

2. Find the approximate values of the two integrals

$$4\int_0^1 \frac{1}{1+x^2}dx \quad \text{and} \quad \int_0^{\frac{1}{\sqrt{2}}}(\sqrt{1-x^2}-x)dx$$

by Simpson's one-third rule in such a way that the error ϵ is less than $\frac{1}{2}10^{-5}$. Your programme should be such that it starts with the smallest number of sub-intervals and then goes on increasing the number of sub-intervals till the desired accuracy is reached. Then provide a sub-intervals verses error plot.

3. (a) Write a procedure for evaluating $\int_a^b f(x)dx$ by subdividing the interval into n equal sub-intervals and then using the three-point Gaussian quadrature formula modified to apply it to the n different subintervals. The function f and n will be furnished to the procedure.

(b) Test the procedure written in 3 (a) on these examples:

$$\int_0^1 x^5dx \text{ using } n=1,2,10 \text{ and } \int_0^1 x^{-1}\sin x dx \text{ using } n=1,2,3,4.$$

HAPPY COMPUTING