Assignment 6-7

1. Compute 'π' from an integral of the form $\int_0^1 \frac{dx}{1+x^2}$, 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 twice and then four times and see the effect on the error. Prepare it in tabular form.

2. Find the approximate values of the integrals

$$\int_0^1 \frac{dx}{1+x^2}$$

by Simpson's one-third rule in such a way that the error is less than $\frac{1}{2} \times 10^{-5}$. 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. Prepare it in tabular form.

3. Repeat the Question 2 for the integral

$$\int_0^{\frac{1}{\sqrt{2}}} \left(\sqrt{1-x^2} - x\right) dx$$

4. Solve Q3 and Q5 with Gauss– Legendre two-point and three-point formula.

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5. Use the Jacobi method to solve the linear systems with TOL $= 10^{-3}$,

$$\begin{aligned} x_1 + 4x_2 - x_3 - x_4 &= -1 \\ 4x_1 + x_2 - x_3 + x_4 &= -2 \\ x_1 - x_2 + x_3 + 3x_4 &= 1 \\ -x_1 - x_2 + 5x_3 + x_4 &= 0. \end{aligned}$$

Now, take the number of iterations initially as 10. Then double it. Observe the effect on error and print it in shape of a table.

6. Repeat the exercise 1 using Gauss-Seidel method. Also, calculate the number of iterations in both the methods. Compare the speed of both methods.

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