

**Universidad de Puerto Rico
Recinto Universitario de Mayagüez
Departamento de Física
Asignación 5**

Instrucciones: Para entregar en o antes del martes, 9 de marzo de 2021 a las 11:59 PM (20 puntos = 100%).

1.

Exercise 5.7: Consider the integral

$$I = \int_0^1 \sin^2 \sqrt{100x} \, dx$$

- a) Write a program that uses the adaptive trapezoidal rule method of Section 5.3 and Eq. (5.34) to calculate the value of this integral to an approximate accuracy of $\epsilon = 10^{-6}$ (i.e., correct to six digits after the decimal point). Start with one single integration slice and work up from there to two, four, eight, and so forth. Have your program print out the number of slices, its estimate of the integral, and its estimate of the error on the integral, for each value of the number of slices N , until the target accuracy is reached. (Hint: You should find the result is around $I = 0.45$.)
- b) Now modify your program to evaluate the same integral using the Romberg integration technique described in this section. Have your program print out a triangular table of values, as on page 161, of all the Romberg estimates of the integral. Calculate the error on your estimates using Eq. (5.49) and again continue the calculation until you reach an accuracy of $\epsilon = 10^{-6}$. You should find that the Romberg method reaches the required accuracy considerably faster than the trapezoidal rule alone.

2.

Exercise 5.8: Write a program that uses the adaptive Simpson's rule method of Section 5.3 and Eqs. (5.35) to (5.39) to calculate the same integral as in Exercise 5.7, again to an approximate accuracy of $\epsilon = 10^{-6}$. Starting this time with two integration slices, work up from there to four, eight, and so forth, printing out the results at each step until the required accuracy is reached. You should find you reach that accuracy for a significantly smaller number of slices than with the trapezoidal rule calculation in part (a) of Exercise 5.7, but a somewhat larger number than with the Romberg integration of part (b).

Instrucciones para Entregar sus Asignaciones

- 1) Prepare un archivo en pdf con la información que pide el ejercicio. Por ejemplo, si el ejercicio pide que escriba un programa, deberá mostrar su programa. Si el ejercicio pide output para un input dado, deberá mostrar el input y el output. Este archivo lo subirá a la plataforma Moodle del curso.
- 2) Suba también en archivos separados los programas usados para la hacer la asignación a la plataforma Moodle.