Boğaziçi University
Department of Physics

Phys 496 Fall 2011

Problem Set 1

Due on October 19th, 2011

Problem 1

Simpson's rule is given by

$$\int_{x_1}^{x_3} = h\left[\frac{1}{3}f_1 + \frac{4}{3}f_2 + \frac{1}{3}f_3\right] + \mathcal{O}(h^5 f^{(4)})$$

Show that this formula yields exact result for a polynomial of degree-2.

Problem 2

Consider the following function

$$f(x) = x\,\sin(10\,x) + 2\,x^3\,\ln(x+4)\,.$$

Evaluate

$$\int_{-1}^{1} f(x)\,dx$$

a) Using generalized formula with $\mathcal{O}(\frac{1}{N^2})$,

b) Using extended formula with $\mathcal{O}(\frac{1}{N^3})$.

c) Find the errors for each formula and discuss the results for $N = 2^m$ where $m = 8, \cdots, 14$: Find out the ratio of the consecutive errors: $\epsilon_{m-1}/\epsilon_m$ for $9 \leq m \leq 14$, where ϵ_m is the error for the given $N = 2^m$ value.

Notes:

- Show your results in a table with N, I_1, ϵ_{I_1}, Ratio-1, I_2, ϵ_{I_2}, Ratio-2 columns.
- Error is defined as the difference between the evaluation and the actual value.
- Take the actual value to be 0.360000186767010.