

Scientific Computing (COMP3407)

Programming Assignment 4

Start: May 1, 2019

Due: 22:00, May 20, 2019

1 Numerical Integration (40 marks)

Implement the midpoint rule and two-point Gaussian quadrature respectively. Then numerically compute each of the following integrals using these methods. Print the absolute difference between your results and the accurate values.

(a) $\int_0^1 \sqrt{x^3} dx.$

(b) $\int_{-1}^1 x \sin(1 - x^2) dx.$

(c) $\int_0^1 \frac{36}{(2x+1)^3} dx.$

(d) $\int_1^2 xe^{-x^2} dx.$

2 Convergence order (40 marks)

Use the composite trapezoid rule and the composite Simpson's rule to solve the following integration:

$$I(f) = \int_0^4 \sin(x) dx$$

for $n = 2^k$, $k = 1, \dots, 12$. Let A denote as the accurate value, I_k the numerical result you get from each method, and $e_k = |I_k - A|$ the absolute error. Compute the convergence order o_k of each algorithm as follows,

$$o_k = \frac{\ln(e_k/e_{k-1})}{\ln 2}, \quad k \geq 2$$

Them fill out the table below.

k	composite trapezoid		composite Simpson	
	e_k	o_k	e_k	o_k
1		---		---
2				
\vdots				
12				