

Homework II

Deadline: 2019-4-10

Reminder. Homework must be done using MATLAB publish for coding problems and using MATLAB Publish/LATEX for calculation and analysis problems.

1. (10 pts) Let $\{\phi_j, j = 0, \dots\}$ be a system of orthogonal polynomials on $(0, 1)$ with respect to weight $w(x) = 1$. Show how to construct a system of orthogonal polynomials on (a, b) with $w(x) = 1$ from $\{\phi_j, j = 0, \dots\}$.
2. (10 pts) Is the Simpson's rule always more accurate than the Trapezium rule in numerical integration? If yes, give a proof; otherwise, give a counter example.
3. (15 pts) Reproduce the table in page "Richardson Extrapolation: Example" of "05integration.pdf".
4. (20 pts) Construct the Gauss quadrature rule over $[-1, 1]$ for $n = 1$ (i.e., you need to compute x_0, x_1 and w_0, w_1). Then use the rule to evaluate
 - $\int_{-1}^1 (x^3 + 3x^2 - 5)dx$,
 - $\int_{-1}^1 e^x dx$.
5. (10 pts) Reproduce the numerical results in page "Example" of "06differentiation.pdf".