

臺灣大學數學系
100 學年度碩士班甄試試題

科目：數值分析(含程式設計) 2010.10.22

Problem 1. (25%)

- (a)(15%) Design a one dimensional root-finding algorithm for a smooth function $f(x)$.
(b)(10%) Explain how your algorithm may perform for finding the roots of the equation $f(x) = x \sin(\frac{10}{x}) = 0$ within the interval $[0.1, 1]$.

Problem 2. (25%)

- (a)(15%) Explain how the (i) Taylor series, (ii) Lagrange polynomial, and (iii) Hermite polynomial can be used to approximate a one dimensional smooth real function.
(b)(5%) Write a pseudo-code for one of the three method in (a).
(c)(5%) Give the complexity of the pseudo-codes in (b).

Problem 3. (25%)

- (a)(10%) Derive the Euler method for solving a initial value problem

$$y'(t) = f(t, y(t)), y(t_0) = y_0.$$

- (b)(5%) What is the local error of the Euler method?
(c)(5%) What is the global error of the Euler method?
(d)(5%) Suppose you apply the Euler method to $y'(t) = -10y(t)$. Do you think it is a good idea to choose the step-size $h = 0.3$?

Problem 4. (25%)

What is the most interesting scientific computation problem you have ever solved? Describe the problem, the difficulties/challenges, the algorithms/methods/ideas, the computer codes, and the results/findings.