

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：數值分析【應數系碩士班乙組】

題號：424006

※本科目依簡章規定「不可以」使用計算機

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Please write down all the detail of your computation and answers.

1. (20%) Find (1) the Hermite polynomial, (2) natural (free) cubic spline that interpolates \sqrt{x} at $x_0 = 1$ and $x_1 = 4$.
2. (20%) (1) Write down the algorithm of Newton method to solve a root γ of the nonlinear equation $f(x) = 0$.
(2) If γ is a simple root of $f(x)$ and the initial value is sufficiently close to γ , show that this iteration converges to γ quadratically by the fixed point theorem.
(3) What happens if γ is a multiple root? Why?
3. (20%) Derive the composite trapezoidal rule for numerical integration with error formula.
4. (20%) (1) State the pivoting strategies of Gaussian elimination with maximal column pivoting (partial pivoting), scaled column pivoting (implicit scaling) and maximal pivoting (complete pivoting) for $n \times n$ matrix A .
(2) Which one has the highest accuracy to solve linear systems?
(3) Which one uses the least CPU time?
5. (20%) Let A be an $n \times n$ nonsingular matrix and B be an $n \times m$ matrix. State the fastest numerical method to compute (1) determinant of A , (2) $A^{-1}B$. How many arithmetic operations are needed in (1), and what is the minimal memory needed in (2)?

