國立成功大學104學年度碩士班招生考試試題

系所組別：工程科學系乙組

考試科目：數值分析

考試日期：0212，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Explain what are round-off error and truncation error in numerical methods. (10%)

2. The function is given as $f(x)$, use Taylor series expansion to relate $f(x+\Delta x)$ and $f(x)$. (10%).

   Derive the relation: $\frac{df(x)}{dx}=\frac{1}{2\Delta x}[3f(x)-4f(x-\Delta x)+f(x-2\Delta x)]$ (10%)

3. Matrix A can be decomposed to be the product A=LU, where L is a lower triangular matrix and U is a upper triangular matrix, respectively. Given the matrix $A=\begin{pmatrix}2 & 4\\ 4 & 9\end{pmatrix}$, compute L=? and U=? (20%)

4. Use any curve fitting method to determine a polynomial p(x) of degree 2 such that p(-1) = 13, p(0) = 1, and p(1) = -1. (10%). Determine numerically the integral $\int_{-1}^{1}p(x)dx$=? and $\frac{d^2p(0)}{dx^2}$=? (10%).

5. Given a nonlinear equation $f(x)=0$, describe any method you know to find the roots of the equation. (10%),

6. The Gaussian quadrature gives the following formula

   $$\int_{-1}^{1}f(x)dx=C_0f(x_0)+C_1f(x_1)$$

   Describe how to determine the corresponding coefficients. (20%)