中山大学软件学院 **2010** 级软件工程专业(2011学年秋季学期)

《数值分析》期中试题(A卷)

(考试形式：闭　卷　　考试时间：2小时)

警示

《中山大学授予学士学位工作细则》第六条

考试作弊不授予学士学位

方向：_____　　姓名：_____　　学号：_____

1. Fill in the blanket with proper answers (5 marks each, total 20 marks)

1) Suppose $\pi \approx 3.1415926$, then the approximate value 3.141601 has _____ significant digits.

2) The error term of Lagrange polynomial approximation for the function **f(x)** at the nodes $a \le x_0 < x_1 < ... < x_n \le b$ is

_____.

3) The recursive rule of Newton's methods for solving nonlinear equation f(x)=0 is:

_____,

and its speed of convergence is_____ near a multiple root.

4) The fast algorithm for evaluate the polynomial $y = \sum_{i=0}^{n} a_i x^i$ is called

_____, and the recursive rule is:

_____.

5) For the following nonlinear system, write out the Seidel iteration formula

$$\begin{cases} 3x + y - z = 3 \\ 2x - 5y - z = -4 \\ x + 3y - 6z = -2 \end{cases}$$

_____

2. (20 marks)Given the function constrain table

x	0	2	3	4
f(x)	5	5	23	69

first construct the divided difference table，and then find the Newton interpolation polynomial.

3. (20 marks) In order to solve the nonlinear equation $f(x)=e^{x}+10x-2=0$, we design the following fixed point iteration:

$$\begin{cases} x_0 = 0 \\ x_k = \dfrac{2-e^{x_{k-1}}}{10} \quad k>0 \end{cases}$$

1、 Show that the equation has unique root;

2、 Show that for any initial value in [-1,1], the fixed point iteration converges to the unique root.（Hint：Verify that on [-1,1]， $\varphi(x)$ is a contraction mapping）

4. (20 marks)Consider the nonlinear system

$$\begin{cases} 2x^2 - y^2 + 4x - 5 = 0 \\ x - 2y + 1 = 0 \end{cases}$$

1) Find analytically the zeros of the system;
2) Write out the Newton iteration for the system.

5. (20 marks)Given the 3×3 matrix

$$A=\begin{bmatrix} 0 & -4 & -2 \\ 1 & 1 & 1 \\ 2 & -2 & 1 \end{bmatrix}$$

1、Find out the PA=LU factorization for A. The factorization should be correspondent to Gauss elimination.（10 marks）

2、Using the factorization to solve the linear system.（10 marks）

$$\begin{cases} -4x_2 - 2x_3 = -16 \\ x_1 + x_2 + x_3 = 4 \\ 2x_1 - 2x_2 + x_3 = -6 \end{cases}$$