中山大学软件学院 **2010** 级软件工程专业 (2011 学年秋季学期)

# 《SE-205 数值计算方法》期末试题 (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：_____

**（允许使用简单的计算器，严禁使用手机、电脑等智能设备）**

## 1. Fill in the blankets with proper answers (5 marks each, total 40 marks)

1) Suppose the approximate value $3.141601$ has 5 significant digits, then the relative error bound is about_____.

2) For the numerical integration formula $\int_a^b f(x)dx \approx \sum_{i=1}^{n} A_i f(x_i)$, if_____,

then we think it is not stable.

3) The error term of Lagrange polynomial approximation for the function **f** at the nodes

$$a \le x_0 < x_1 < \ldots < x_n \le b$$

is

_____.

4) The Chebyshev polynomial of degree 3 is

_____,

and it can be represented in trigonometric form as_____.

5) The recursive rule of Newton's methods for solving nonlinear equation f(x)=0 is_____, and its speed of convergence is_____for single root.

6) Let $X=(1,2,3)$ and $A=\begin{pmatrix} 2 & -2 \\ 0 & 3 \end{pmatrix}$, then $\|X\|_2 =$ _____, $\|A\|_\infty =$ _____.

7) Consider the Euler's methods for solving the initial value problem $y'=f(t,y)$ with

$y(t_0)=y_0$, the global discretization error is _____.

8) For the following linear system,

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

Seidel iteration formula in matrix form $X_{k+1}=BX_k+f$ is

_____

The iteration will_____(converge or not converge), because _____ .

**2. （12 marks）Consider the quadrature rule**

$$\int_0^h f(x)dx \approx \frac{h}{2}\left[f(0)+f(h)\right]+\lambda h^2\left[f'(0)-f'(h)\right],$$

**where $\lambda$ is some unknown parameter. Find the value of $\lambda$ so that the quadrature rule has as high degree of precision as possible.**

**3. （13 marks）Given 4 end points （1,0），（2,1），（3,0）and（5,0），find the three moment equation（三弯矩方程）for the cubic spline S(x) that satisfies the third, i.e. the periodic boundary condition.**

**4. （10 marks）Given the function constrain table**

| x | −1 | 1 | 3 | 4 |
|---|---|---|---|---|
| f(x) | −4 | −2 | −8 | 1 |

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

5. **Given the $3\times3$ matrix**

$$A=\begin{bmatrix}0 & -3 & -1\\ 1 & 2 & 1\\ 2 & 1 & 1\end{bmatrix}$$

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

**2、（5 marks）Using the factorization to solve the linear system.**

$$\begin{cases}-3x_2-x_3=3\\ x_1+2x_2+x_3=1\\ 2x_1+x_2+x_3=5\end{cases}$$

**6. （10 marks）Given the differential equation,**

$$\begin{cases}\dfrac{dy}{dt}=f(t)\\ y(a)=0\end{cases}$$

**and the step size is chosen to be $h=\dfrac{b-a}{n}$,where n is some positive number.**

**1、 Find the Euler recursive rule for numerically solving the equation;**

**2、 Find out the approximate solution at $t=b$.**