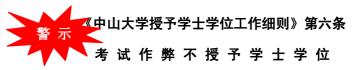
中山大学软件学院 2009 级软件工程专业(2010学年秋季学期)

## 《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)



方向:_		姓名:	学号:			
(允许使	用简单的计算器,	使用智能手机、电	脑等设备当作作弊处	<b></b> 上理)		
	l in the blanket varks)	with proper answ	vers (5 marks eac	h, total 40		
1)	,		e approximate value	3.141601		
2)		ımerical	integration	formula		
	$\int_{-1}^{1} f(x) dx \approx \frac{1}{3} \left[ f(x) dx \right]$	$\left(-\frac{1}{2}\right) + 4f(0) + f\left(\frac{1}{2}\right)$	$\left[\frac{1}{2}\right]$ has	_ degrees of		
	precision.					
3)	For the numerica	l integration formu	$\operatorname{ala} \int_{a}^{b} f(x) dx \approx \sum_{i=1}^{n} A_{i}$	$A_i f(x_i)$ , if		
		_, then we think it is	s <b>not</b> stable.			
4)	The error term of Lagrange polynomial approximation for the function at the nodes					
		$a \le x_0 < x_1 < \dots < x_n$	$< x_n \le b$			
	is					
5)	The Chebyshev no	lynomial of degree 4				
3,			, and it has	points of		
	alternation.					
6)	The recursive rule $f(x)=0$ is:	of Newton's metho	ds for solving nonlin	ear equation		
	and its speed of con	nvergence is	,			
7)	) The fast algorithm for evaluate the polynomial $y = \sum_{i=0}^{n} a_i x^n$ is					
	, and the recursive rule i					

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

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

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2. Write out the three-moment equation(三弯矩方程) of the cubic spline that pass through  $(-1,y_1)$ ,  $(0,y_2)$  and  $(1,y_3)$  with the clamped condition  $S'(x_0) = y_0'$  and  $S'(x_2) = y_2'$ . (11 marks)

3. 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. (12 marks)

4. Given the  $3 \times 3$  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. (5 marks)

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

5. Using the Romberg algorithm to find the numerical integration for  $\int_0^1 x^2 dx$ . It's only to calculate up to that [0,1] is divided into 4 subintervals. (12 marks)

6. Given the differential equation,

$$\begin{cases} \frac{dy}{dx} = 0.5y\\ y(0) = 2 \end{cases}$$

and the step size is chosen to be h = 0.2,

- 1. Write the Euler recursive formula. (6 marks)
- 2. Find out the approximate solution at x=1. (4 marks)

(EXTRA WORK) Given three points on the plane:  $(-1, y_1), (0, y_2), (1, y_3)$ , and three base functions

$$f_1(x) = 1$$
$$f_2(x) = x$$
$$f_3(x) = a + bx + x^2$$

where a and b are some fixed constants.

1. Derive the normal equation for the linear least square problem for the linear combination: (6 marks)

$$f(x) = c_1 f_1(x) + c_2 f_2(x) + c_3 f_3(x)$$

2. Do you think what are the best choice for a and b, so that the normal equation is easy to solve? (4 marks)