## 北京科技大学 2020-2021 年 第 一 学期

Exam for Numerical Methods B (m210001) (计算方法 B), Time:2 Hours

Name: Student ID

## Part A: (50 points)

- 1. How many methods can be used to determine a root of f(x) = 0? to illustrate the ideas of each method and its advantages and disadvantages.
- 2. How many methods can be used to make the interpolation and polynomial approximation for a given data, to illustrate ideas of each method and the advantages and disadvantages of each methods.
- 3. How many methods can be used to solve the linear systems equations? to illustrate the ideas and its advantages and disadvantages.
- 4. How many methods can be used to solve initial-value problems of ordinary differential equations, to illustrate the ideas and its advantages and disadvantages.
- 5. To illustrate the ideas of Taylor polynomial approximation, interpolating polynomials approximation and the least squares approach.

## Part B: (10 points ) Fill blanks

1. (5 points ) Given 
$$A = \begin{bmatrix} 3 & 2 & 1 \\ -2 & 1 & 0 \\ 0 & 1 & -2 \end{bmatrix}$$
, then  $||A||_{\infty} =$ 

2. (5 points ) Given  $f(x) = 4x^3 + 3x^2 + 2x + 1$ , then f[0,1,2,3] =

## Part C: (40 points)

1. (10 points )Let  $f(x) = -x^3 - \cos x$  and  $p_0 = -1$ , Use the Newton's method to find approximate solution  $p_2$ . Could  $p_0 = 0$  be used?.



2. (10 points) Use the composite Trapzoidal rule with the indicated value of n to approximate the integration

$$\int_{-2}^{2} x^3 e^x \, \mathrm{d}x, \quad n = 4$$

3. (10 points ) Use the Gaussian Elimination Algorithm to solve the linear systems, if possible, and determine whether row interchange is necessary

$$\begin{cases} x_1 + 2x_2 + x_3 = 0 \\ 2x_1 + 2x_2 + 3x_3 = 3 \\ -x_1 - 3x_2 = 2 \end{cases}$$

4. (10 points ) The table 1 lists values of a function f(x) at various points, to find approximation value  $\sin 0.56789$  by using Lagrange interpolating polynomial of degree 1 and 2.

Table 1

x	0.4	0.5	0.6
sin x	0.38942	0.47943	0.56464