# 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

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

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 table1 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 |