**暨南大学本科实验报告专用纸**

课程名称 数值分析 成绩评定

实验项目名称 ComputingProblems 指导教师 LiangdaFang 实验项目编号 02 实验项目类型 验证 实验地点 N117

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实验时间 年 月 日 午～ 月 日 午 温度 ℃湿度

**Ⅰ、Problem**

Let f(x) = and the interval to be [-1, 1].

1. Write a program generating the Newton’s divided difference formula;

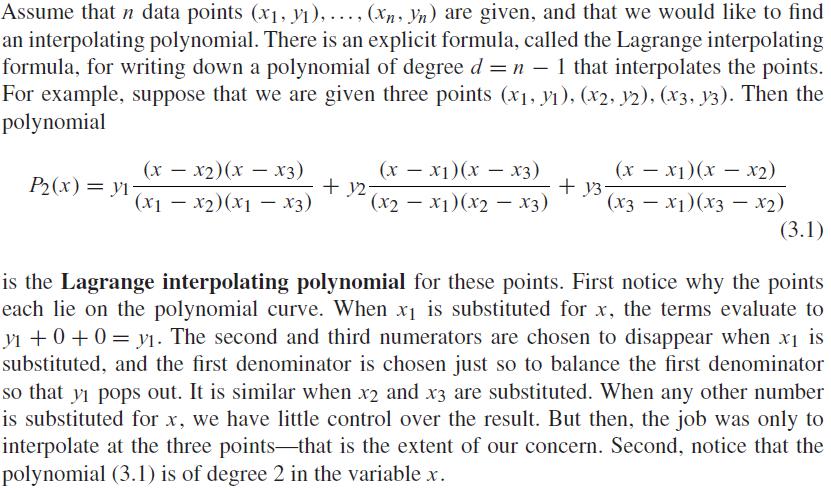
2. Use the program to generate a degree n polynomial with evenly spaced points and Chebyshev points for n = 10, 20 and 40;

3. Plot the polynomials for the above types (see Figure 3.8);

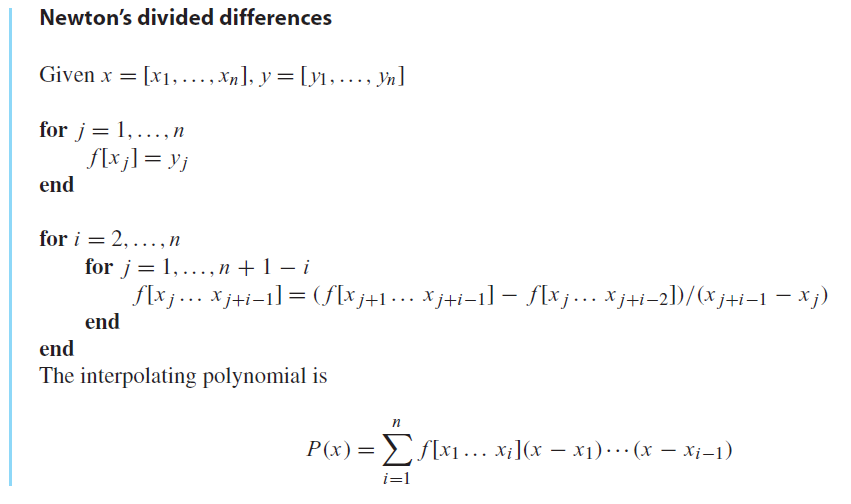
4. By sampling at a 0:05 step, create the empirical interpolation errors for each type, and plot a comparison (see Figure 3.11).

**Ⅱ、Algorithm Summary**

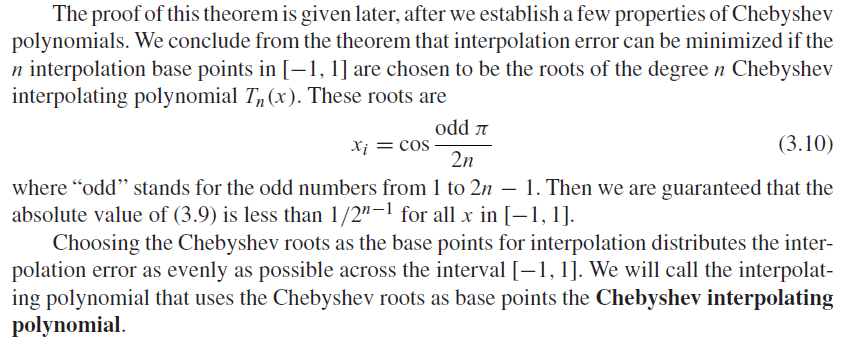
Lagrange interpolation



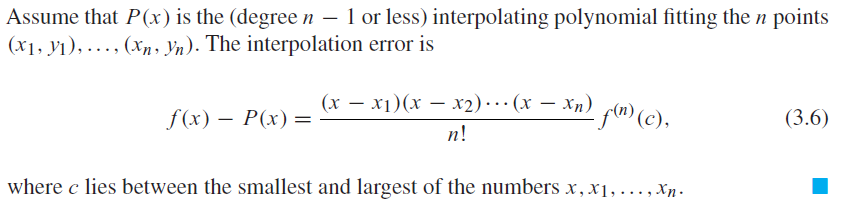
Newton’s divided differences



Chebyshev Interpolation



Interpolation error formula



**Ⅲ、Experimental procedures**

Step1. Write a function generating the Newton’s divided difference formula

Step2. Get the evenly spaced points X\_es and Chebyshev points X\_cbs

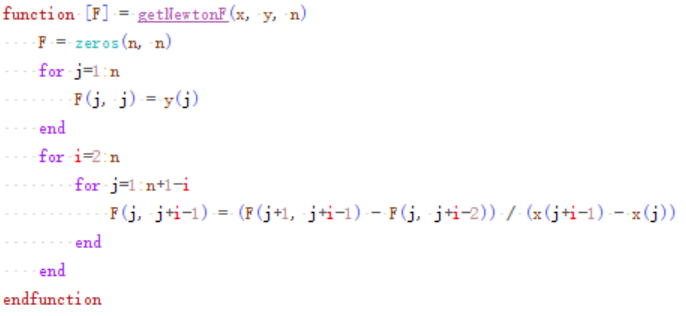
Step3. Generate the Y by X\_es and X\_cbs according to f(x) =

Step4. Use (X\_es, Y) and (X\_cbs, Y) to get a degree n polynomial

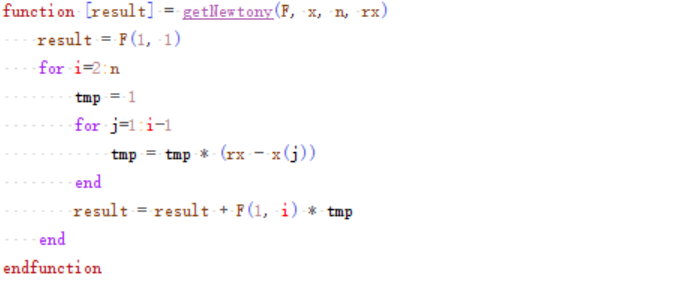
Step5. Plot them and get their errors

**Ⅳ、Result Analysis**

the function that calculating the matrix F of Newton’s divided difference formula



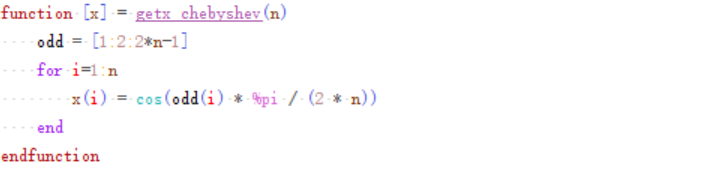
the function that calculating the result Y



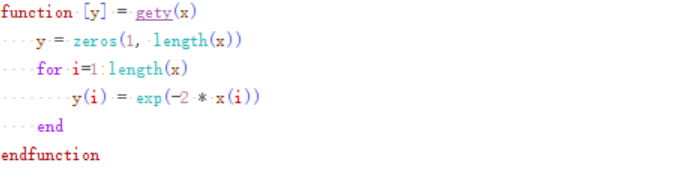
the function that get evenly spaced point



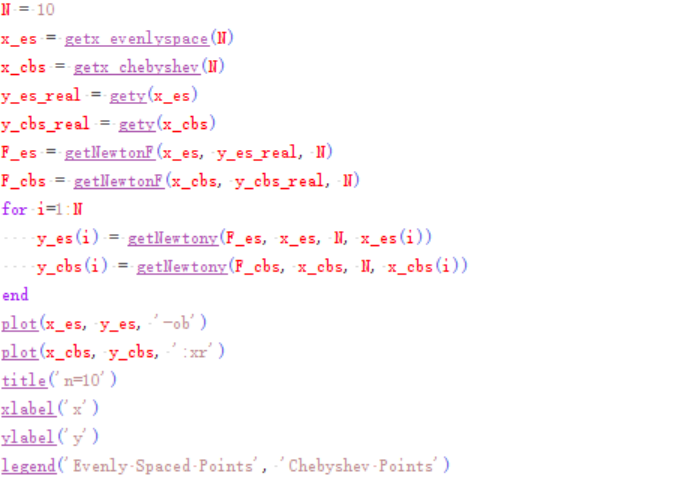
the function that get Chebyshev points



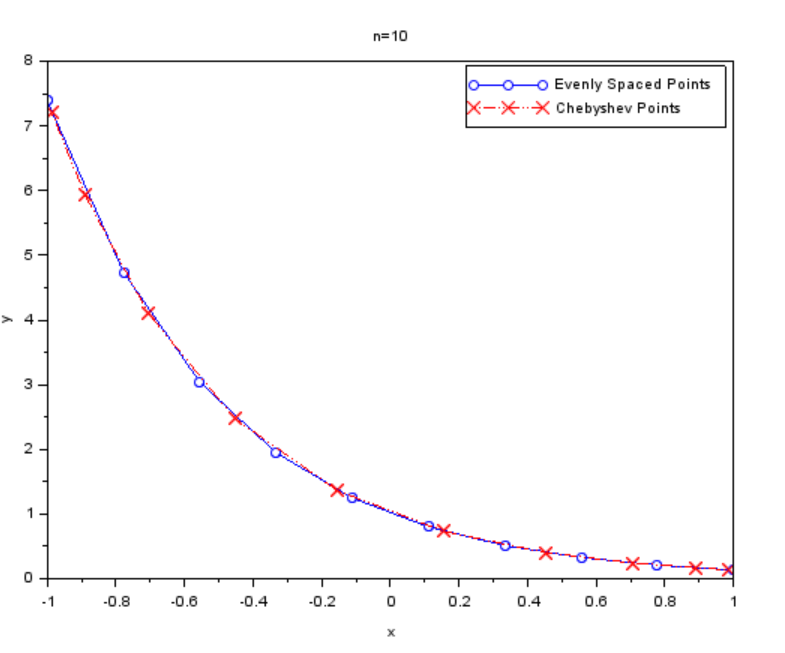
the function that get the Y of f(x) =



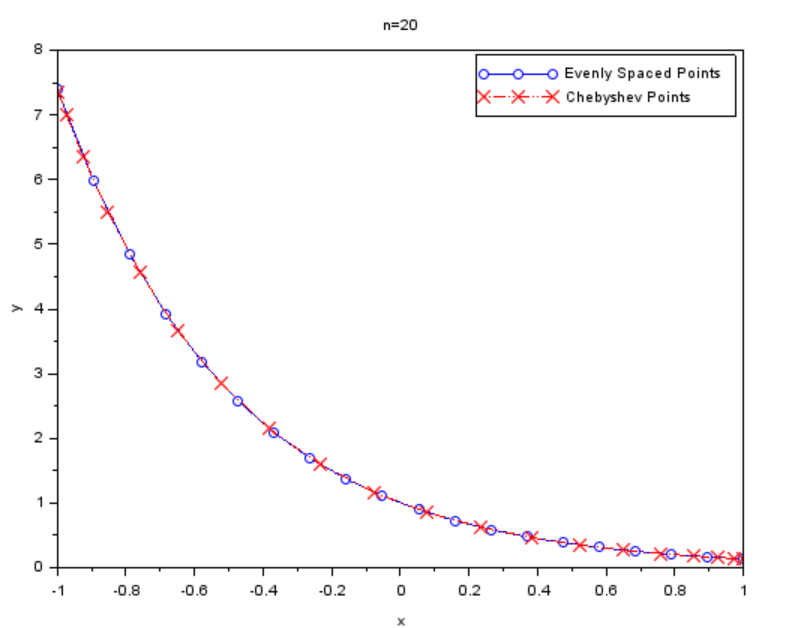
Plot the polynomials for the case n=10



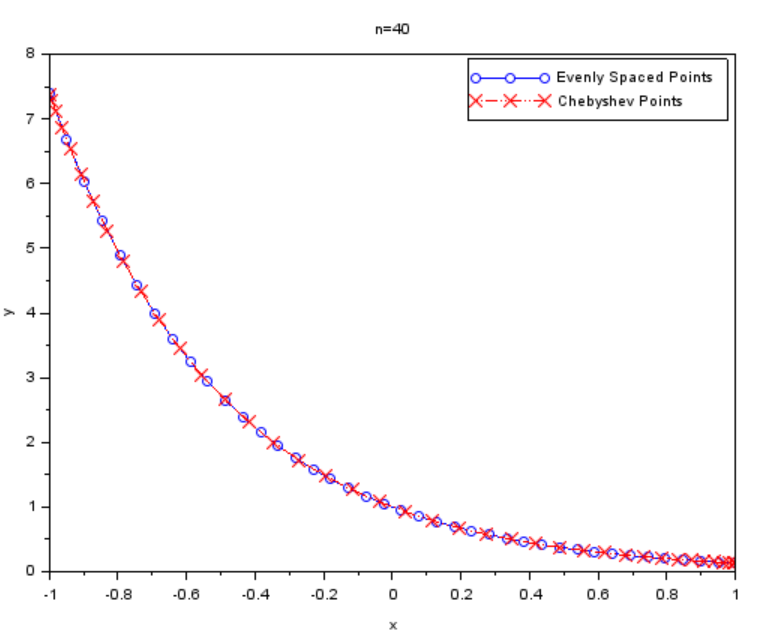
And its result is



Plot the polynomials for the case n=20

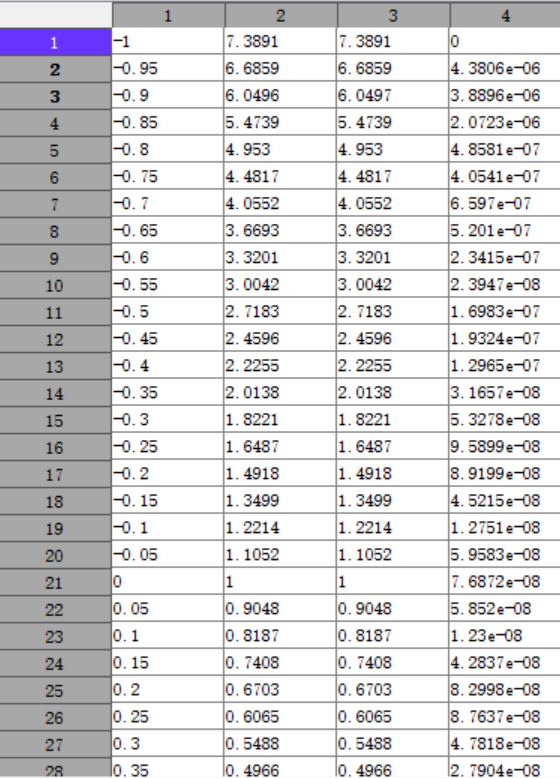


Plot the polynomials for the case n=20



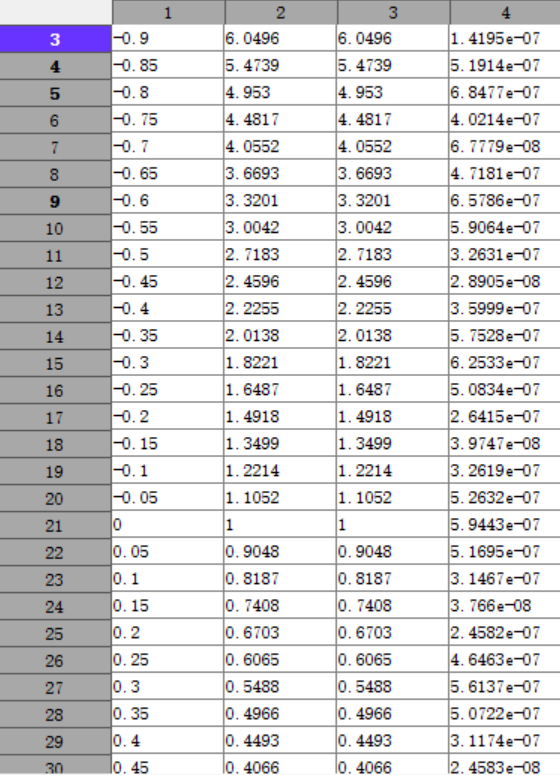
the empirical interpolation errors(n=10 | evenly spaced points)

(col1 = x, col2 = f(x), col3 = P(x), col4 = error)



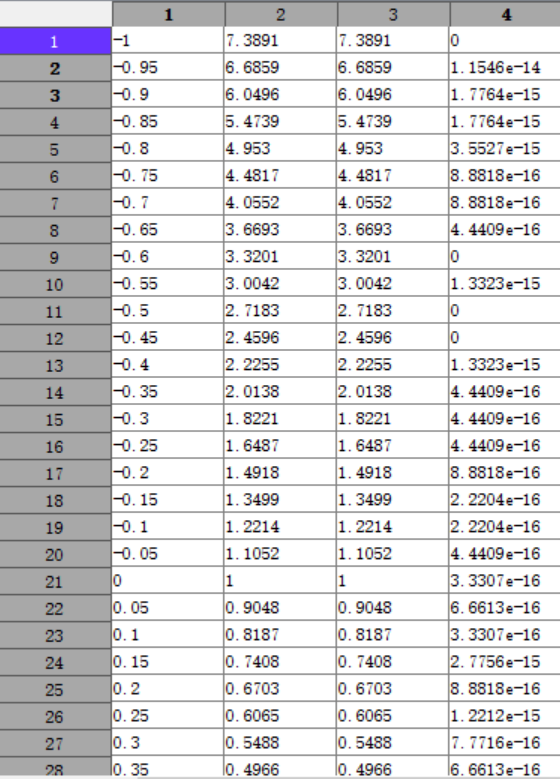
the empirical interpolation errors(n=10 | Chebyshev points)

(col1 = x, col2 = f(x), col3 = P(x), col4 = error)



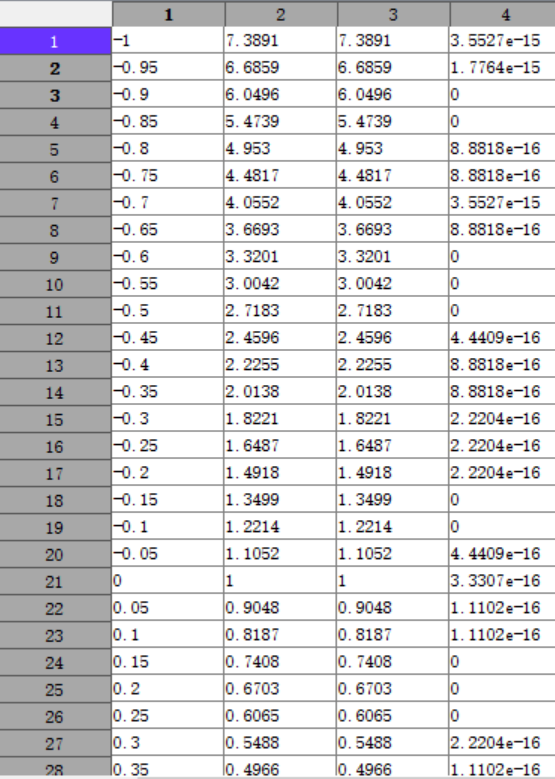
the empirical interpolation errors(n=20 | evenly spaced points)

(col1 = x, col2 = f(x), col3 = P(x), col4 = error)



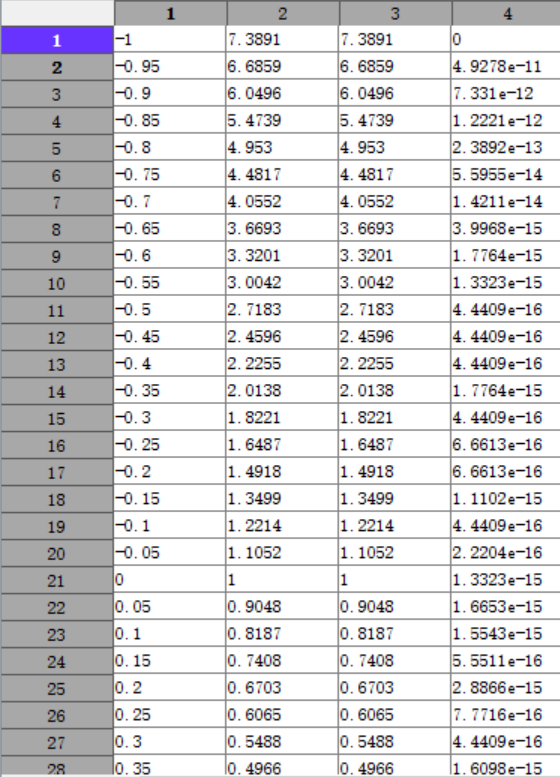
the empirical interpolation errors(n=20 | Chebyshev points)

(col1 = x, col2 = f(x), col3 = P(x), col4 = error)



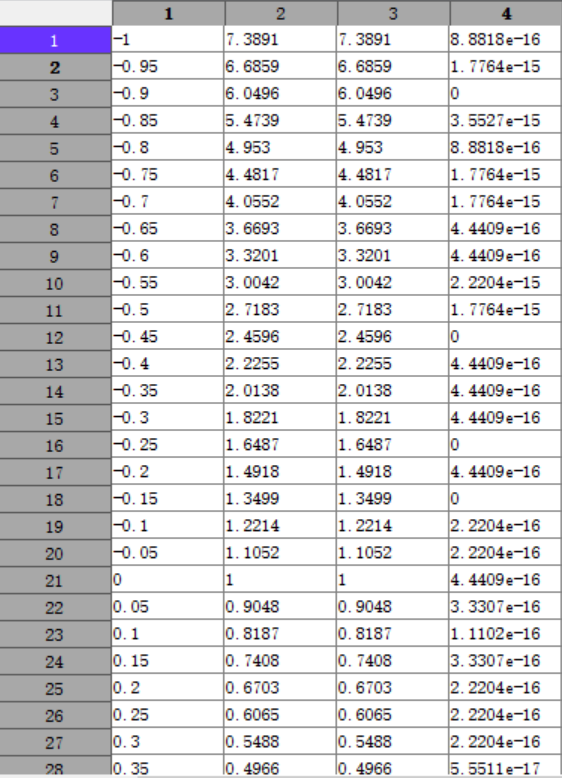
the empirical interpolation errors(n=40 | evenly spaced points)

(col1 = x, col2 = f(x), col3 = P(x), col4 = error)



the empirical interpolation errors(n=20 | Chebyshev points)

(col1 = x, col2 = f(x), col3 = P(x), col4 = error)



**Ⅴ、Experimental Summary**

In this experiment, we can get the fitting curve of the points given with good effect through Lagrange interpolating polynomial. As for choosing the base points x, we can use evenly spaced points or Chebyshev points. As we can see, two methods both get rather small error, but Chebyshev points get little error relatively.