

homework2

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1 实验要求

使用 C/C++ 实现两种解线性方程组的算法：

1. 列主元 Gauss 消元法
2. Gauss-Seidel 迭代法

2 算法原理

2.1 待解线性方程组

考虑两点边值问题

$$\begin{cases} \varepsilon \frac{d^2 y}{dx^2} + \frac{dy}{dx} = a, & 0 < a < 1 \\ y(0) = 0, & y(1) = 1 \end{cases}$$

容易知道它们的精确解为

$$y = \frac{1-a}{1-e^{-\frac{1}{\varepsilon}}}(1-e^{-\frac{x}{\varepsilon}}) + ax$$

为了把微分方程离散，把 $[0, 1]$ 区间 n 等分，令 $h = \frac{1}{n}$,

$$x_i = ih, \quad i = 1, 2, \dots, n-1$$

得到差分方程

$$\varepsilon \frac{y_{i-1} - 2y_i + y_{i+1}}{h^2} + \frac{y_{i+1}}{h} = a$$

简化为

$$(\varepsilon + h)y_{i+1} - (2\varepsilon + h)y_i + \varepsilon y_{i-1} = ah^2$$

从而离散后得到的微分方程组的系数矩阵为

$$A = \begin{bmatrix} -(2\varepsilon + h) & \varepsilon + h & & & \\ \varepsilon & -(2\varepsilon + h) & \varepsilon + h & & \\ & \varepsilon & -(2\varepsilon + h) & \ddots & \\ & & \ddots & \ddots & \varepsilon + h \\ & & & \varepsilon & -(2\varepsilon + h) \end{bmatrix}$$

2.2 列主元 Gauss 消元法

列主元 Gauss 消元法是对顺序 Gauss 消元法的一种改进，顺序 Gauss 消元可行的充分必要条件是矩阵 A 的各阶顺序主子式不为 0，但是只要 $\det A \neq 0$ ，方程组 $Ax = b$ 就有解，故顺序 Gauss 消元本身具有局限性。列主元 Gauss 消元法对每个 $\{k, k = 1, 2, \dots, n-1\}$ 在消元前，选出 $\{|a_{kk}^{(k-1)}|, |a_{k+1,k}^{(k-1)}|, \dots, |a_{n,k}^{(k-1)}|\}$ 中绝对值最大的元素 $a_{mk}^{(k-1)}$ ，对 k 行和 m 行进行交换后，再做消元运算，由于 $\det A \neq 0$ ，可证 $\{a_{kk}^{(k-1)}, a_{k+1,k}^{(k-1)}, \dots, a_{n,k}^{(k-1)}\}$ 中至少有一个元素不为 0，因此，列主行消元总是可行的。

2.3 Gauss-Seidel 迭代法

Gauss-Seidel 迭代法与 jacobi 迭代步骤大致相同，其迭代的核心部分是计算迭代式的过程中，要及时将 $x_i^{(k+1)}$ 放到 $x_i^{(k)}$ 的位置上。

$$\begin{cases} x_1^{k+1} = x_1^k + x_2^k + \dots + x_n^k + b_1 \\ x_2^{k+1} = x_1^{k+1} + x_2^k + \dots + x_n^k + b_2 \\ \vdots \\ x_n^{k+1} = x_1^{k+1} + x_2^{k+1} + \dots + x_n^k + b_n \end{cases}$$

2.4 对实验结果的修正

事实上，对实验给定的待解方程组，部分初始值是已知的，若在计算过程中不对初值条件进行修正，将会产生较大误差，故根据已知条件 $y(0) = 0, y(1) = 1$ 对初始条件进行修正 $b[99] = ah^2 - \varepsilon - h$ 。

3 实验结果

未修正前， $\varepsilon = 1, 0.1, 0.01, 0.0001$ 的结果分别为

```
epsilon :1
Result of Gauss Elimination With Pivoting
-0.00283707 -0.00599604 -0.00842777 -0.01103828 -0.01366021
-0.0161664 -0.0195964 -0.02309528 -0.0267384 -0.0304476
-0.0375979 -0.0426572 -0.0481696 -0.0539867 -0.0594481
-0.0672417 -0.0739679 -0.0806276 -0.0872213 -0.0937497
-0.0452135 -0.0466133 -0.0479498 -0.0492235 -0.0504351
-0.0515352 -0.0526743 -0.0537032 -0.0546725 -0.0555826
-0.0564342 -0.0572278 -0.0579641 -0.0586496 -0.0592869
-0.0598345 -0.0603469 -0.0608048 -0.0612087 -0.061559
-0.0618564 -0.0621013 -0.0622943 -0.0624359 -0.0625266
-0.0625668 -0.0625572 -0.0624982 -0.0623902 -0.0622338
-0.0620294 -0.0617776 -0.0614787 -0.0611333 -0.0607419
-0.0603048 -0.0598225 -0.0592655 -0.0587241 -0.058109
-0.0574904 -0.0567489 -0.0559048 -0.0552185 -0.0543905
-0.0535213 -0.0526111 -0.0516604 -0.0506697 -0.0496392
-0.0485695 -0.0474608 -0.0463136 -0.0451282 -0.0439051
-0.0426446 -0.0413471 -0.0400123 -0.0386424 -0.037226
-0.0357894 -0.0343167 -0.0328246 -0.0313188 -0.029772
-0.0283025 -0.0264143 -0.0247329 -0.0230186 -0.0212718
-0.0194928 -0.017682 -0.0158395 -0.0139658 -0.0120611
-0.0101258 -0.00816013 -0.00616442 -0.00413897 -0.00208406
Acc : 1.06085
```

(a)

```
epsilon :1
Result of Gauss Seidel Iteration
-0.0028487 -0.00561977 -0.00831401 -0.0109322 -0.0134752
-0.0159437 -0.0183385 -0.0206604 -0.0229101 -0.0250884
-0.027196 -0.0292337 -0.0312021 -0.033102 -0.0349341
-0.0366991 -0.0383977 -0.040036 -0.0415984 -0.0431015
-0.0445415 -0.0459182 -0.0472324 -0.0484848 -0.0496761
-0.0508068 -0.0518777 -0.0528892 -0.0538421 -0.0547308
-0.055574 -0.0563544 -0.0570783 -0.0577465 -0.0583594
-0.0589177 -0.0594219 -0.0598725 -0.0602701 -0.0606152
-0.0609182 -0.0611498 -0.0613405 -0.0614936 -0.0615711
-0.0616119 -0.0616639 -0.0616472 -0.0614426 -0.0612904
-0.0610912 -0.0608454 -0.0605534 -0.0602157 -0.0598328
-0.0594051 -0.0589329 -0.0584168 -0.0578572 -0.0572544
-0.056609 -0.0559213 -0.0551916 -0.0544205 -0.0536083
-0.0527554 -0.0518622 -0.050929 -0.0499663 -0.0489444
-0.0478936 -0.0468945 -0.0458772 -0.0448122 -0.0437066
-0.0426704 -0.0416294 -0.0394819 -0.0381355 -0.0367494
-0.0353299 -0.0338755 -0.0323863 -0.0308628 -0.0293052
-0.0277139 -0.0260892 -0.0244314 -0.0227407 -0.0210175
-0.0192621 -0.0174748 -0.0156559 -0.0138056 -0.0119243
-0.0100122 -0.00806959 -0.00609681 -0.0040941 -0.00206174
Acc : 1.05997
```

(b)

```
epsilon :0.1
Result of Gauss Elimination With Pivoting
-0.0409121 -0.0778504 -0.110594 -0.140089 -0.166447
-0.199595 -0.210871 -0.229432 -0.24585 -0.260321
-0.273022 -0.284114 -0.293743 -0.302042 -0.309132
-0.315123 -0.320115 -0.324199 -0.327456 -0.329963
-0.331788 -0.332992 -0.333632 -0.33376 -0.333421
-0.332658 -0.331911 -0.330013 -0.328196 -0.326091
-0.323722 -0.321114 -0.318288 -0.315265 -0.312062
-0.308696 -0.305181 -0.301531 -0.297759 -0.293875
-0.289889 -0.285811 -0.28105 -0.274412 -0.273105
-0.267835 -0.264307 -0.259628 -0.255301 -0.250781
-0.246122 -0.241478 -0.236811 -0.232095 -0.227362
-0.222695 -0.217826 -0.213026 -0.208209 -0.203375
-0.198525 -0.193663 -0.188787 -0.1839 -0.179003
-0.174097 -0.169182 -0.16429 -0.15933 -0.154394
-0.149452 -0.144505 -0.139583 -0.134697 -0.129836
-0.124672 -0.119705 -0.114735 -0.109762 -0.104787
-0.0998092 -0.0948296 -0.0898481 -0.0848649 -0.0798802
-0.0748941 -0.0699008 -0.0649183 -0.0599288 -0.0549383
-0.0493469 -0.0443548 -0.0393619 -0.0343684 -0.0293743
-0.0243797 -0.0193845 -0.014389 -0.009393 -0.00439667
Acc : 1.25635
```

(c)

```
epsilon :0.1
Result of Gauss Seidel Iteration
-0.0403732 -0.0775778 -0.110491 -0.139957 -0.166291
-0.199777 -0.210674 -0.229217 -0.245621 -0.26008
-0.272771 -0.283854 -0.293476 -0.301769 -0.308855
-0.314843 -0.319834 -0.323917 -0.327175 -0.329683
-0.331809 -0.332716 -0.33336 -0.333491 -0.333187
-0.332399 -0.331257 -0.329764 -0.327854 -0.325854
-0.323492 -0.32089 -0.318071 -0.315055 -0.311888
-0.308499 -0.304991 -0.301348 -0.297582 -0.293704
-0.289725 -0.285554 -0.281499 -0.277267 -0.272966
-0.268902 -0.264181 -0.259707 -0.255186 -0.250621
-0.246018 -0.241378 -0.236707 -0.232005 -0.227277
-0.222524 -0.217749 -0.212954 -0.208141 -0.20331
-0.198465 -0.193606 -0.188734 -0.18385 -0.178956
-0.174053 -0.169141 -0.164221 -0.159294 -0.15436
-0.149421 -0.144476 -0.139526 -0.134571 -0.129613
-0.124651 -0.119685 -0.114717 -0.109745 -0.104772
-0.0997953 -0.0948169 -0.0898306 -0.0848545 -0.0798709
-0.0748858 -0.0698993 -0.0649116 -0.0599229 -0.0549331
-0.0499424 -0.0449509 -0.0399586 -0.0349657 -0.0299721
-0.0249779 -0.0199832 -0.014988 -0.00999239 -0.00499638
Acc : 1.2562
```

(d)

```

epsilon :0.01
Result of Gauss Elimination With Pivoting
-0.2475      -0.36875      -0.426875      -0.453438      -0.464219
-0.467109     -0.466055     -0.463027     -0.459014     -0.454507
-0.449783     -0.444877     -0.432938     -0.434969     -0.429985
-0.424992     -0.419996     -0.414998     -0.409999     -0.405
-0.4          -0.395         -0.39         -0.385        -0.38
-0.375        -0.37         -0.365        -0.36         -0.355
-0.35         -0.345        -0.34         -0.335        -0.33
-0.325        -0.32         -0.315        -0.31         -0.305
-0.3          -0.295        -0.29         -0.285        -0.28
-0.275        -0.27         -0.265        -0.26         -0.255
-0.25         -0.245        -0.24         -0.235        -0.23
-0.225        -0.22         -0.215        -0.21         -0.205
-0.2          -0.195        -0.19         -0.185        -0.18
-0.175        -0.17         -0.165        -0.16         -0.155
-0.15         -0.145        -0.14         -0.135        -0.13
-0.125        -0.12         -0.115        -0.11         -0.105
-0.1          -0.095        -0.09         -0.085        -0.08
-0.075        -0.07         -0.065        -0.06         -0.055
-0.05         -0.045        -0.04         -0.035        -0.03
-0.025        -0.02         -0.015        -0.01         -0.005

Acc : 1.30666

```

(e)

```

epsilon :0.01
Result of Gauss Seidel Iteration
-0.247493     -0.36874         -0.426865     -0.453428     -0.46421
-0.467102     -0.466049     -0.463023     -0.45901     -0.454504
-0.449751     -0.444875     -0.432937     -0.434968     -0.429984
-0.424992     -0.419996     -0.414998     -0.409999     -0.404999
-0.4          -0.395         -0.39         -0.385        -0.38
-0.375        -0.37         -0.365        -0.36         -0.355
-0.35         -0.345        -0.34         -0.335        -0.33
-0.325        -0.32         -0.315        -0.31         -0.305
-0.3          -0.295        -0.29         -0.285        -0.28
-0.275        -0.27         -0.265        -0.26         -0.255
-0.25         -0.245        -0.24         -0.235        -0.23
-0.225        -0.22         -0.215        -0.21         -0.205
-0.2          -0.195        -0.19         -0.185        -0.18
-0.175        -0.17         -0.165        -0.16         -0.155
-0.15         -0.145        -0.14         -0.135        -0.13
-0.125        -0.12         -0.115        -0.11         -0.105
-0.1          -0.095        -0.09         -0.085        -0.08
-0.075        -0.07         -0.065        -0.06         -0.055
-0.05         -0.045        -0.04         -0.035        -0.03
-0.025        -0.02         -0.015        -0.01         -0.005

Acc : 1.30666

```

(f)

```

epsilon :0.0001
Result of Gauss Elimination With Pivoting
-0.495      -0.49495      -0.49         -0.485        -0.48
-0.475      -0.47         -0.465        -0.46         -0.455
-0.45        -0.445       -0.44         -0.435        -0.43
-0.425      -0.42         -0.415        -0.41         -0.405
-0.4         -0.395       -0.39         -0.385        -0.38
-0.375      -0.37         -0.365        -0.36         -0.355
-0.35        -0.345       -0.34         -0.335        -0.33
-0.325      -0.32         -0.315        -0.31         -0.305
-0.3         -0.295       -0.29         -0.285        -0.28
-0.275      -0.27         -0.265        -0.26         -0.255
-0.25        -0.245       -0.24         -0.235        -0.23
-0.225      -0.22         -0.215        -0.21         -0.205
-0.2         -0.195       -0.19         -0.185        -0.18
-0.175      -0.17         -0.165        -0.16         -0.155
-0.15        -0.145       -0.14         -0.135        -0.13
-0.125      -0.12         -0.115        -0.11         -0.105
-0.1         -0.095       -0.09         -0.085        -0.08
-0.075      -0.07         -0.065        -0.06         -0.055
-0.05        -0.045       -0.04         -0.035        -0.03
-0.025      -0.02         -0.015        -0.01         -0.005

Acc : 1.31139

```

(g)

```

epsilon :0.0001
Result of Gauss Seidel Iteration
-0.495      -0.49495      -0.49         -0.485        -0.48
-0.475      -0.47         -0.465        -0.46         -0.455
-0.45        -0.445       -0.44         -0.435        -0.43
-0.425      -0.42         -0.415        -0.41         -0.405
-0.4         -0.395       -0.39         -0.385        -0.38
-0.375      -0.37         -0.365        -0.36         -0.355
-0.35        -0.345       -0.34         -0.335        -0.33
-0.325      -0.32         -0.315        -0.31         -0.305
-0.3         -0.295       -0.29         -0.285        -0.28
-0.275      -0.27         -0.265        -0.26         -0.255
-0.25        -0.245       -0.24         -0.235        -0.23
-0.225      -0.22         -0.215        -0.21         -0.205
-0.2         -0.195       -0.19         -0.185        -0.18
-0.175      -0.17         -0.165        -0.16         -0.155
-0.15        -0.145       -0.14         -0.135        -0.13
-0.125      -0.12         -0.115        -0.11         -0.105
-0.1         -0.095       -0.09         -0.085        -0.08
-0.075      -0.07         -0.065        -0.06         -0.055
-0.05        -0.045       -0.04         -0.035        -0.03
-0.025      -0.02         -0.015        -0.01         -0.005

Acc : 1.31139

```

(h)

修正后, $\varepsilon = 1, 0.1, 0.01, 0.0001$ 的结果分别为

epsilon :1				
Result of Gauss Elimination With Pivoting				
0.0127309	0.0253852	0.0379038	0.0504073	0.0628965
0.0752522	0.0875351	0.0997458	0.111885	0.123954
0.136952	0.147882	0.159743	0.171535	0.183201
0.19492	0.206613	0.218341	0.229504	0.240803
0.252239	0.263512	0.274723	0.285873	0.296961
0.307989	0.318958	0.329868	0.340719	0.351512
0.362247	0.372926	0.383549	0.394116	0.404628
0.415085	0.425489	0.435838	0.446135	0.45638
0.465512	0.476713	0.486803	0.496843	0.506833
0.516773	0.526665	0.536508	0.546303	0.556051
0.565752	0.575406	0.585014	0.594576	0.604094
0.613566	0.622994	0.632379	0.64172	0.651018
0.660273	0.669487	0.678658	0.687788	0.696878
0.708927	0.718439	0.727905	0.737285	0.746728
0.750578	0.759392	0.768169	0.776908	0.78561
0.794275	0.802905	0.811498	0.820055	0.828578
0.837065	0.845518	0.853937	0.862322	0.870674
0.878992	0.887277	0.89553	0.903751	0.911194
0.920097	0.928223	0.936318	0.944382	0.952416
0.95042	0.958395	0.966339	0.974255	0.982142

Acc : 0.010442

(i)

epsilon :1				
Result of Gauss Seidel Iteration				
0.0126923	0.0253086	0.0378495	0.0503016	0.0627087
0.0750284	0.0872799	0.0994452	0.111557	0.123693
0.135589	0.147456	0.159528	0.171648	0.183745
0.194375	0.20594	0.217441	0.228978	0.24052
0.251564	0.262814	0.274002	0.28513	0.296196
0.307207	0.318157	0.32905	0.339884	0.350662
0.361383	0.372049	0.382559	0.393214	0.403716
0.414164	0.424559	0.434901	0.445192	0.455431
0.465619	0.475757	0.485845	0.495883	0.505873
0.515814	0.525707	0.535552	0.545351	0.555103
0.564809	0.574469	0.584084	0.593654	0.60318
0.612662	0.6221	0.631496	0.640848	0.650159
0.659428	0.668555	0.677841	0.686987	0.696092
0.705157	0.714183	0.72317	0.732118	0.741027
0.748999	0.758733	0.767529	0.776289	0.785012
0.793698	0.802349	0.810964	0.819544	0.828089
0.838599	0.845075	0.853517	0.861925	0.8703
0.878642	0.886951	0.895227	0.903472	0.911684
0.919865	0.928015	0.936133	0.944221	0.952279
0.960306	0.968304	0.976271	0.98421	0.992119

Acc : 0.00963603

(j)

epsilon :0.1				
Result of Gauss Elimination With Pivoting				
0.050003	0.0959148	0.138107	0.176919	0.212656
0.2456	0.276003	0.304996	0.33009	0.354176
0.376827	0.3979	0.416639	0.434675	0.451526
0.467299	0.482093	0.495997	0.509051	0.521449
0.533139	0.54422	0.554748	0.564774	0.574343
0.583497	0.592273	0.600705	0.608826	0.616663
0.624242	0.631587	0.638718	0.645656	0.652417
0.659013	0.665475	0.671798	0.678001	0.684095
0.690089	0.695993	0.701815	0.707562	0.713241
0.718859	0.72442	0.72993	0.735394	0.740816
0.746199	0.751548	0.756804	0.762152	0.767414
0.772652	0.777869	0.783065	0.788244	0.793407
0.798555	0.803689	0.808811	0.813922	0.819023
0.824115	0.829198	0.834274	0.839343	0.844406
0.849463	0.854515	0.859562	0.864605	0.869643
0.874679	0.879711	0.88474	0.889767	0.894791
0.899813	0.904833	0.909851	0.914888	0.919883
0.924896	0.929909	0.93492	0.93993	0.944939
0.949948	0.954956	0.959963	0.964969	0.969975
0.97498	0.979985	0.984989	0.989993	0.994997

Acc : 0.0133884

(k)

epsilon :0.1				
Result of Gauss Seidel Iteration				
0.0499691	0.0958504	0.138015	0.176802	0.212518
0.245442	0.275828	0.303906	0.329888	0.353962
0.376304	0.397099	0.416402	0.434433	0.4518
0.467051	0.481844	0.495747	0.508841	0.521201
0.532892	0.543975	0.554507	0.564536	0.574109
0.583267	0.592048	0.600485	0.608611	0.616454
0.624038	0.631388	0.638526	0.645469	0.652237
0.658844	0.665306	0.671635	0.677844	0.683944
0.689944	0.695654	0.701681	0.707434	0.713113
0.718741	0.724308	0.729823	0.735292	0.740718
0.746106	0.751459	0.756781	0.762073	0.767339
0.772581	0.777801	0.783002	0.788184	0.79335
0.798501	0.803639	0.808764	0.813878	0.818981
0.824076	0.829162	0.83424	0.839311	0.844376
0.849435	0.854469	0.859538	0.864622	0.869623
0.87466	0.879694	0.884724	0.889752	0.894777
0.899801	0.904822	0.909841	0.914858	0.919874
0.924889	0.929902	0.934914	0.939925	0.944935
0.949944	0.954952	0.95996	0.964967	0.969973
0.974978	0.979984	0.984988	0.989993	0.994996

Acc : 0.0133334

(l)

```

epsilon :0.01
Result of Gauss Elimination With Pivoting
0.2525      0.38125      0.448125      0.484063      0.504531
0.517266     0.526133     0.533066     0.539033     0.544517
0.549788     0.554879     0.55994      0.56497      0.569985
0.574992     0.579996     0.584998     0.589999     0.595
0.6          0.605       0.61        0.615       0.62
0.625       0.63       0.635      0.64       0.645
0.65       0.655      0.66       0.665      0.67
0.675      0.68       0.685      0.69       0.695
0.7        0.705      0.71       0.715      0.72
0.725      0.73       0.735      0.74       0.745
0.75       0.755      0.76       0.765      0.77
0.775      0.78       0.785      0.79       0.795
0.8        0.805      0.81       0.815      0.82
0.825      0.83       0.835      0.84       0.845
0.85       0.855      0.86       0.865      0.87
0.875      0.88       0.885      0.89       0.895
0.9        0.905      0.91       0.915      0.92
0.925      0.93       0.935      0.94       0.945
0.95       0.955      0.96       0.965      0.97
0.975      0.98       0.985      0.99       0.995
Acc : 0.0342812

```

(m)

```

epsilon :0.01
Result of Gauss Seidel Iteration
0.2525      0.38125      0.448125      0.484062      0.504531
0.517266     0.526133     0.533066     0.539033     0.544517
0.549788     0.554879     0.55994      0.56497      0.569985
0.574992     0.579996     0.584998     0.589999     0.595
0.6          0.605       0.61        0.615       0.62
0.625       0.63       0.635      0.64       0.645
0.65       0.655      0.66       0.665      0.67
0.675      0.68       0.685      0.69       0.695
0.7        0.705      0.71       0.715      0.72
0.725      0.73       0.735      0.74       0.745
0.75       0.755      0.76       0.765      0.77
0.775      0.78       0.785      0.79       0.795
0.8        0.805      0.81       0.815      0.82
0.825      0.83       0.835      0.84       0.845
0.85       0.855      0.86       0.865      0.87
0.875      0.88       0.885      0.89       0.895
0.9        0.905      0.91       0.915      0.92
0.925      0.93       0.935      0.94       0.945
0.95       0.955      0.96       0.965      0.97
0.975      0.98       0.985      0.99       0.995
Acc : 0.0342812

```

(n)

```

epsilon :0.0001
Result of Gauss Elimination With Pivoting
0.495099     0.504951      0.51        0.515       0.52
0.525       0.53       0.535      0.54       0.545
0.55       0.555      0.56       0.565      0.57
0.575      0.58       0.585      0.59       0.595
0.6        0.605      0.61       0.615      0.62
0.625      0.63       0.635      0.64       0.645
0.65       0.655      0.66       0.665      0.67
0.675      0.68       0.685      0.69       0.695
0.7        0.705      0.71       0.715      0.72
0.725      0.73       0.735      0.74       0.745
0.75       0.755      0.76       0.765      0.77
0.775      0.78       0.785      0.79       0.795
0.8        0.805      0.81       0.815      0.82
0.825      0.83       0.835      0.84       0.845
0.85       0.855      0.86       0.865      0.87
0.875      0.88       0.885      0.89       0.895
0.9        0.905      0.91       0.915      0.92
0.925      0.93       0.935      0.94       0.945
0.95       0.955      0.96       0.965      0.97
0.975      0.98       0.985      0.99       0.995
Acc : 0.0651735

```

(o)

```

epsilon :0.0001
Result of Gauss Seidel Iteration
0.495099     0.504951      0.51        0.515       0.52
0.525       0.53       0.535      0.54       0.545
0.55       0.555      0.56       0.565      0.57
0.575      0.58       0.585      0.59       0.595
0.6        0.605      0.61       0.615      0.62
0.625      0.63       0.635      0.64       0.645
0.65       0.655      0.66       0.665      0.67
0.675      0.68       0.685      0.69       0.695
0.7        0.705      0.71       0.715      0.72
0.725      0.73       0.735      0.74       0.745
0.75       0.755      0.76       0.765      0.77
0.775      0.78       0.785      0.79       0.795
0.8        0.805      0.81       0.815      0.82
0.825      0.83       0.835      0.84       0.845
0.85       0.855      0.86       0.865      0.87
0.875      0.88       0.885      0.89       0.895
0.9        0.905      0.91       0.915      0.92
0.925      0.93       0.935      0.94       0.945
0.95       0.955      0.96       0.965      0.97
0.975      0.98       0.985      0.99       0.995
Acc : 0.0651735

```

(p)

4 实验分析

在执行解线性方程组的算法之前，首先考虑该方程组是否有已知的初始值，若有则需要做相应的修正，否则将产生较大的误差。