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7 月 31 日（金）第 13 回数値解析Ｉ 提出課題 19TM054 浅野 駿介

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＜作成プログラム＞

```
#include<stdio.h>
#include<math.h>
#define N 4

//行列を出力する関数
void print_matrixA(double A[][N + 1]) {

	for (int i = 0; i < N; i++) {
		for (int j = 0; j < N + 1; j++) {
			printf("%lf ", A[i][j]);
		}
		printf(" ¥n");
	}
	printf(" ¥n");
}

void print_matrixX2(double X[]) {
	for (int i = 0; i < N; i++) {
		printf(",%lf ", X[i]);
	}
	printf(" ¥n");
}

double check_err(double newX[], double X[]) {

	double max_err = 0.0;

	for (int i = 0; i < N; i++) {
		if (fabs(newX[i] - X[i]) > max_err)
			max_err = fabs(newX[i] - X[i]);
	}
	return(max_err);
```

```
}

void my_jacobi(double A[][N + 1], double X[], int kmax, double err) {
	double newX[N];

	int i, j;
	int k = 0;

	for (k = 0; k < kmax; k++) {
		printf("%d", k);//何回目かの計算か
		print_matrixX2(X);//k 回目の結果を出力

		for (i = 0; i < N; i++) {

			newX[i] = A[i][N] / A[i][i];

			for (j = 0; j < N; j++) {

				//i と j の大小で場合分け
				if (j < i)
					newX[i] = newX[i] - A[i][j] * X[j] / A[i][i];
				if (j > i)
					newX[i] = newX[i] - A[i][j] * X[j] / A[i][i];
			}
		}

		//許容誤差内で収まったかどうか判断する
		if (check_err(newX, X) < err)
			k = kmax;

		for (i = 0; i < N; i++) {
			X[i] = newX[i];
		}
	}
}
```

```
void main() {

	//行列の値
	double A[N][N + 1] = { {8.0,1.0,2.0,1.0,40.0},
	                        {2.0,4.0,1.0,-2.0,20.0},
	                        {2.0,0.0,6.0,1.0,21.0},
	                        {1.0,3.0,-2.0,8.0,17.0} };

	//初期解
	double X[N] = { 0.0,0.0,0.0,0.0 };

	//関数を呼び出す
	print_matrixA(A);
	my_jacobi(A, X, 100, 0.00001);
}
```

＜出力結果＞

・初期解をすべて 0 とした時

```
8.000000 1.000000 2.000000 1.000000 40.000000
2.000000 4.000000 1.000000 -2.000000 20.000000
2.000000 0.000000 6.000000 1.000000 21.000000
1.000000 3.000000 -2.000000 8.000000 17.000000

0-->0.000000 0.000000 0.000000 0.000000
1-->5.000000 5.000000 3.500000 2.125000
2-->3.234375 2.687500 1.479167 0.500000
3-->4.231771 3.263021 2.338542 1.082682
4-->3.872152 2.840820 1.908963 0.957031
5-->4.048028 3.065199 2.049778 1.052914
6-->3.972791 2.989999 1.975172 0.981991
7-->4.009708 3.010807 2.012071 1.000944
8-->3.995513 2.992600 1.996606 0.997752
9-->4.002054 3.001968 2.001870 1.002487
10-->3.998976 2.999749 1.998901 0.999473
11-->4.000372 3.000524 2.000429 0.999947
12-->3.999834 2.999680 1.999885 0.999864
```

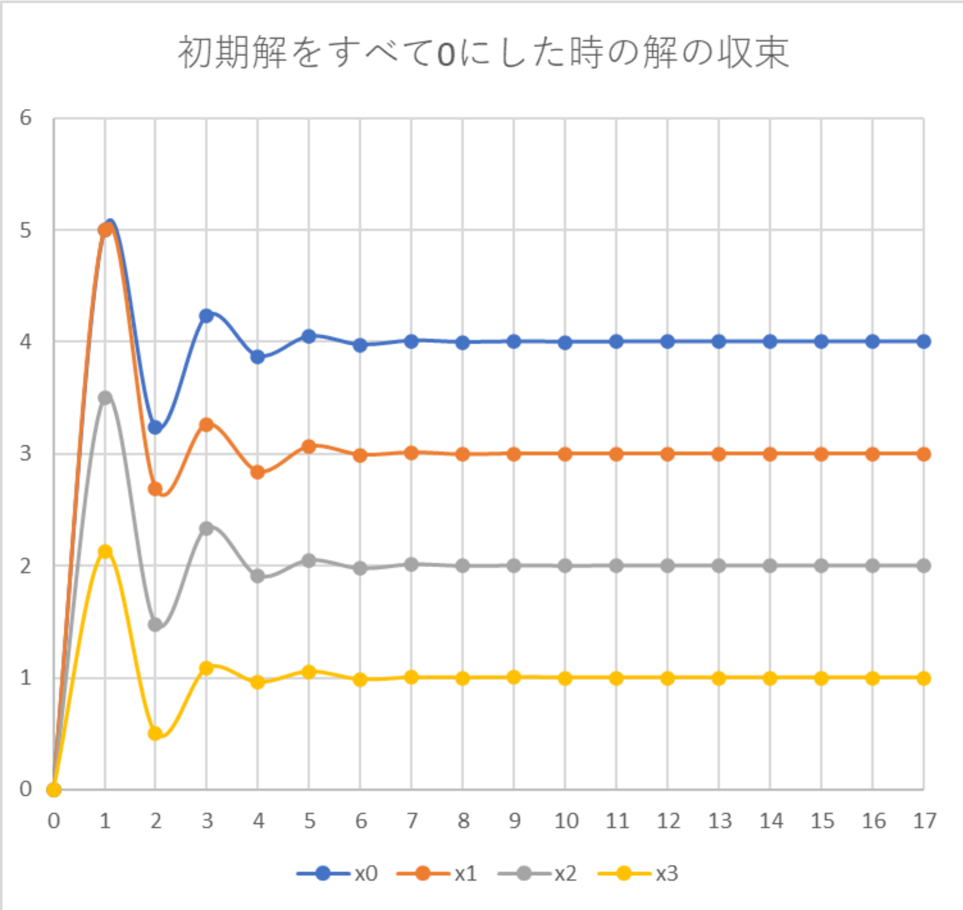
13-->4.000086 3.000044 2.000078 1.000112

14-->3.999961 2.999994 1.999953 0.999992

15-->4.000014 3.000027 2.000014 0.999995

16-->3.999994 2.999987 1.999996 0.999992

17-->4.000004 3.000000 2.000004 1.000005



初期解を適当な値としたとき

8.000000 1.000000 2.000000 1.000000 40.000000

2.000000 4.000000 1.000000 -2.000000 20.000000

2.000000 0.000000 6.000000 1.000000 21.000000

1.000000 3.000000 -2.000000 8.000000 17.000000

0-->5.000000 2.000000 7.000000 9.000000

1-->1.875000 5.250000 0.333333 2.500000

2-->3.947917 5.229167 2.458333 0.005208

3-->3.731120 2.414062 2.183160 0.285156

4-->4.116808 2.731228 2.208767 1.299127

5-->3.944014 3.038968 1.911210 1.138380

6-->4.000029 3.119381 1.995599 0.970188

7-->3.989904 2.986180 2.004959 0.954128

8-->4.006222 2.980872 2.011011 1.007684

9-->3.998678 2.997979 1.996645 1.009148

10-->3.999948 3.006074 1.998916 1.000085

11-->3.999501 3.000339 2.000003 0.997458

12-->4.000275 2.998978 2.000590 0.999936

13-->3.999988 2.999683 1.999919 1.000497

14-->3.999998 3.000274 1.999921 1.000100

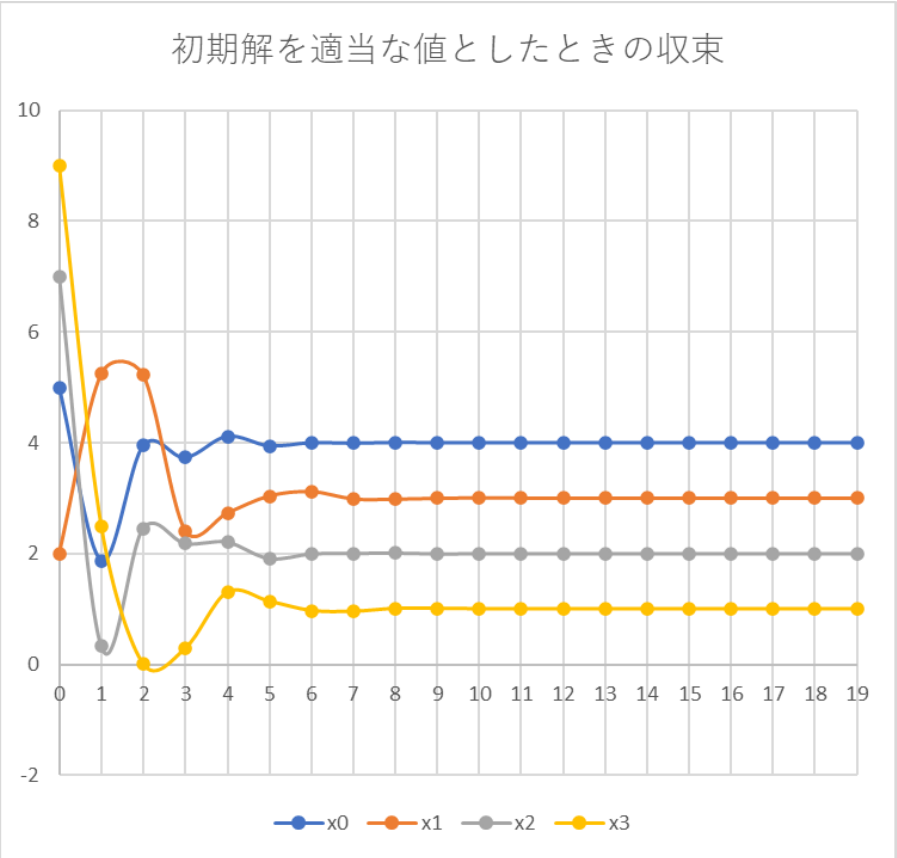
15-->3.999973 3.000071 1.999984 0.999878

16-->4.000010 2.999956 2.000029 0.999973

17-->4.000001 2.999974 2.000001 1.000022

18-->4.000000 3.000010 1.999996 1.000010

19-->3.999999 3.000006 1.999998 0.999995



＜理解した内容、感想、注意点など＞

・行列の対角成分が同じ行のその他の成分の絶対値の和よりも大きければ解の値が収束することが多い.

・初期解と本当の解の差が大きいと計算回数が多くなる.