

プログラミング 2 レポート 課題第 1 回

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1 課題 1-1

1.1 誤っている箇所

26 行目、readInteger 関数に引数として変数のアドレスを渡さないといけないのに、変数の中身、しかも初期化もされていないようなものを渡そうとしている。

6 行目、scanf の引数として変数のアドレスを渡さないといけないのに、あろうことか main 関数の i の中身を渡そうとしている。

27 行目、引数 2 つ目は整数型の値を渡さないといけないのに、i のアドレスを渡している。

1.2 source

```
#include <stdio.h>

void readInteger(int *i)    /* この行は正しいものとする */
{
    printf("input integer: ");
    scanf("%d", i);
}

void writeFile(char *filename, int i)    /* この行は正しいものとする */
{
    FILE *fp = fopen(filename, "w"); /* この行は正しいものとする */
    if ( fp == NULL ) /* この行は正しいものとする */
    {
        fprintf(stderr, "Error: cannot open file: %s\n", filename); /* この行は正しいものとする */
        return;
    }

    fprintf(fp, "input: %d\n", i);
    fclose(fp);
}

int main(void)
{
    int i;    /* この行は正しいものとする */

    readInteger( &i );
    writeFile( "test.txt", i );

    return 0;
}
```

1.3 result

```
s1811433@7C202-P048:~/prog2/01/01kadai$ cc -o a1-1 a1-1.c
s1811433@7C202-P048:~/prog2/01/01kadai$ ./a1-1
input integer: 100
s1811433@7C202-P048:~/prog2/01/01kadai$ cat test.txt
input: 100
s1811433@7C202-P048:~/prog2/01/01kadai$
s1811433@7C202-P048:~/prog2/01/01kadai$ ./a1-1
input integer: 114514
s1811433@7C202-P048:~/prog2/01/01kadai$ cat test.txt
input: 114514
s1811433@7C202-P048:~/prog2/01/01kadai$
```

2 課題 1-2

2.1 source

```
#include <stdio.h>

void QuoAndRem(int a, int b, int *c, int *d);

int main(){
    int a, b, c, d;

    printf("Input two positive number:");
    scanf("%d %d", &a, &b);

    while(a<=0 || b<=0){

        printf("Input two POSITIVE number!!!");
        scanf("%d %d", &a, &b);}

    QuoAndRem(a, b, &c, &d);
    printf("Quotient is %d \nRemainder is %d\n", c, d);

    return 0;
}

void QuoAndRem(int a, int b, int *c, int *d){
    *c = a / b;
    *d = a % b;
}
```

2.2 result

```
s1811433@7C202-P048:~/prog2/01/01kadai$ cc -o a1-2 a1-2.c
s1811433@7C202-P048:~/prog2/01/01kadai$ ./a1-2
Input two positive number:5 2
Quotient is 2
Remainder is 1
```

```
si1811433@7C202-P048:~/prog2/01/01kadai$ ./a1-2
Input two positive number:-1 3
Input two POSITIVE number!!!:0 2
Input two POSITIVE number!!!:6 3
Quotient is 2
Remainder is 0
si1811433@7C202-P048:~/prog2/01/01kadai$
```

3 課題 1-3

3.1 source

```
#include <stdio.h>
#include <math.h>

double determinant2x2(double a, double b, double c, double d);
void mult2x2(double a0, double b0, double c0, double d0,
             double a1, double b1, double c1, double d1,
             double *a2, double *b2, double *c2, double *d2);
int invert2x2(double a0, double b0, double c0, double d0,
             double *a1, double *b1, double *c1, double *d1);
int eigenvalues2x2(double a, double b, double c, double d,
                  double *lambda0, double *lambda1);
void eigenvectors2x2(double a, double b, double c, double d,
                    double e0, double e1,
                    double *v0, double *v1, double *v2, double *v3);

int main(){
    double a0, b0, c0, d0, a1, b1, c1, d1, a2, b2, c2, d2, lambda0, lambda1;
    double v0, v1, v2, v3;
    int MUSCLE; //To put in the values of returns

    printf("Input> ");
    scanf("%lf %lf %lf %lf", &a0, &b0, &c0, &d0);

    printf("matrix A:\n  %lf, %lf\n  %lf, %lf\n\n", a0, b0, c0, d0);

    printf("Input> ");
    scanf("%lf %lf %lf %lf", &a1, &b1, &c1, &d1);

    printf("matrix B:\n  %lf, %lf\n  %lf, %lf\n\n", a1, b1, c1, d1);

    printf("a.\ndeterminantA: %lf\n\n", determinant2x2(a0, b0, c0, d0));

    mult2x2(a0, b0, c0, d0, a1, b1, c1, d1, &a2, &b2, &c2, &d2);
    printf("b.\nAxB:\n  %lf, %lf\n  %lf, %lf\n\n", a2, b2, c2, d2);

    if(invert2x2(a0, b0, c0, d0, &a1, &b1, &c1, &d1) == 0){
        printf("c.\nA^-1:\n  not invertible\n");
    }
    else{
```

```
    printf("c.\nA^-1:\n  %lf, %lf\n  %lf, %lf\n\n", a1, b1, c1, d1);
    mult2x2(a0, b0, c0, d0, a1, b1, c1, d1, &a2, &b2, &c2, &d2);
    printf("A*A^-1:\n  %lf, %lf\n  %lf, %lf\n\n", a2, b2, c2, d2);
}

MUSCLE = eigenvalues2x2(a0, b0, c0, d0, &lambda0, &lambda1);
printf("d.\neigenvalues of matrix A: (# of non-zero:%d)\n", MUSCLE);
if(MUSCLE == 2){
    printf("  %lf, %lf\n\n", lambda0, lambda1);
}
else if(MUSCLE == 1){
    printf("  %lf\n\n", lambda0);
}
else{
    printf("  Eigenvalues don't exist.\n\n");
}

printf("e.\n");
if(MUSCLE == 2){
    eigenvectors2x2(a0, b0, c0, d0, lambda0, lambda1, &v0, &v1, &v2, &v3);
    printf("eigenvectors:\n  (%lf, %lf), (%lf, %lf)\n\n", v0, v1, v2, v3);
}
else if(MUSCLE == 1){
    eigenvectors2x2(a0, b0, c0, d0, lambda0, lambda0, &v0, &v1, &v2, &v3);
    printf("eigenvectors:\n  (%lf, %lf), (%lf, %lf)\n\n", v0, v1, v2, v3);
}
else{
    printf("eigenvector doesn't exist.\n\n");
}

return 0;
}

double determinant2x2(double a, double b, double c, double d){
    return a*d-b*c;
}

void mult2x2(double a0, double b0, double c0, double d0,
             double a1, double b1, double c1, double d1,
             double *a2, double *b2, double *c2, double *d2){
    *a2 = a0*a1 + b0*c1;
    *b2 = a0*b1 + b0*d1;
    *c2 = c0*a1 + d0*c1;
    *d2 = c0*b1 + d0*d1;
}

int invert2x2(double a0, double b0, double c0, double d0,
              double *a1, double *b1, double *c1, double *d1){
    double k= determinant2x2(a0, b0, c0, d0);

    if(k == 0){
        return 0;
    }
    else{
        *a1 = d0 / k;
        *b1 = -b0 / k;
        *c1 = -c0 / k;
```

```
        *d1 = a0 / k;
        return 1;
    }
}

int eigenvalues2x2(double a, double b, double c, double d,
                  double *lambda0, double *lambda1){
    double l = (a-d)*(a-d)+4*b*c; //This is Discriminant

    if(l > 0){
        *lambda0= (a+d + sqrt(l))/2;
        *lambda1= (a+d - sqrt(l))/2;

        return 2;
    }
    else if(l == 0){
        *lambda0= (a+d)/2;

        return 1;
    }
    else{
        return 0;
    }
}

void eigenvectors2x2(double a, double b, double c, double d,
                    double e0, double e1,
                    double *v0, double *v1, double *v2, double *v3){
    if(a == d && c == 0 && b == 0){
        *v0 = 1;
        *v1 = 0;
        *v2 = 1;
        *v3 = 0;
    }
    else{
        int m0 = (a-e0)*(a-e0) + b*b;
        int m1 = (a-e1)*(a-e1) + b*b;

        *v0 = b / m0; // m can't be 0 because unit vector's case was already excluded
        *v1 = -*v0*(a-e0) / b; // b can't be 0 in this case because of the existence of eigenvectors
        *v2 = b / m1;
        *v3 = -*v1*(a-e1) / b;
    }
}
}
```

3.2 result

```
s1811433@7C202-P046:~/prog2/01/01kadai$ cc -o a1-3 a1-3.c -lm
s1811433@7C202-P046:~/prog2/01/01kadai$ ./a1-3
Input> 1 2 3 4
matrix A:
1.000000, 2.000000
3.000000, 4.000000
```

```
Input> 5 6 7 8
matrix B:
5.000000, 6.000000
7.000000, 8.000000

a.
determinantA: -2.000000

b.
AxB:
19.000000, 22.000000
43.000000, 50.000000

c.
A^-1:
-2.000000, 1.000000
1.500000, -0.500000

A*A^-1:
1.000000, 0.000000
0.000000, 1.000000

d.
eigenvalues of matrix A: (# of non-zero:2)
5.372281, -0.372281

e.
eigenvectors:
(0.086957, 0.190099), (0.400000, -0.130435)

s1811433@7C202-P046:~/prog2/01/01kadai$ ./a1-3
Input> 1 0 0 1
matrix A:
1.000000, 0.000000
0.000000, 1.000000

Input> 1 2 3 4
matrix B:
1.000000, 2.000000
3.000000, 4.000000

a.
determinantA: 1.000000

b.
AxB:
1.000000, 2.000000
3.000000, 4.000000

c.
A^-1:
1.000000, -0.000000
-0.000000, 1.000000

A*A^-1:
1.000000, 0.000000
0.000000, 1.000000
```

```
d.
eigenvalues of matrix A: (# of non-zero:1)
1.000000

e.
eigenvectors:
(1.000000, 0.000000), (1.000000, 0.000000)

s1811433@7C202-P046:~/prog2/01/01kadai$ ./a1-3
Input> 2 0 0 2
matrix A:
2.000000, 0.000000
0.000000, 2.000000

Input> 2 3 4 5
matrix B:
2.000000, 3.000000
4.000000, 5.000000

a.
determinantA: 4.000000

b.
AxB:
4.000000, 6.000000
8.000000, 10.000000

c.
A^-1:
0.500000, -0.000000
-0.000000, 0.500000

A*A^-1:
1.000000, 0.000000
0.000000, 1.000000

d.
eigenvalues of matrix A: (# of non-zero:1)
2.000000

e.
eigenvectors:
(1.000000, 0.000000), (1.000000, 0.000000)

s1811433@7C202-P046:~/prog2/01/01kadai$ ./a1-3
Input> 1 2 3 6
matrix A:
1.000000, 2.000000
3.000000, 6.000000

Input> 2 3 4 5
matrix B:
2.000000, 3.000000
4.000000, 5.000000

a.
```

```
determinantA: 0.000000

b.
AxB:
10.000000, 13.000000
30.000000, 39.000000

c.
A^-1:
not invertible

d.
eigenvalues of matrix A: (# of non-zero:2)
7.000000, 0.000000

e.
eigenvectors:
(0.050000, 0.150000), (0.400000, -0.075000)

s1811433@7C202-P046:~/prog2/01/01kadai$ ./a1-3
Input> 1 -1 4 1
matrix A:
1.000000, -1.000000
4.000000, 1.000000

Input> 2 3 4 5
matrix B:
2.000000, 3.000000
4.000000, 5.000000

a.
determinantA: 5.000000

b.
AxB:
-2.000000, -2.000000
12.000000, 17.000000

c.
A^-1:
0.200000, 0.200000
-0.800000, 0.200000

A*A^-1:
1.000000, 0.000000
0.000000, 1.000000

d.
eigenvalues of matrix A: (# of non-zero:0)
Eigenvalues don't exist.

e.
eigenvector doesn't exist.

s1811433@7C202-P046:~/prog2/01/01kadai$
```