实验九 结构体、共用体实验

9.1 基本结构体实验

【实验内容】

试利用结构体类型编程，实现输入一个学生的数学期中和期末成绩，然后计算并输出其平均成绩

（1） 基本实现方法，在 main 函数中定义结构体，并实现功能

（2） 定义结构体指针进行操作

（3） 在 main 外建立结构体，构建函数 foo，向 foo 函数传递结构体成员作为参数

（4） 在 main 外建立结构体，并构建没有参数和返回值的函数 foo

（5） 在 main 外建立结构体，构建传递结构体指针并返回 void 的函数 foo

（6） 在 main 外建立结构体，构建传递结构体指针并返回结构体指针的函数 foo

【实验目的】

本实验通过一系列的步骤，从最基本的结构体建立开始，一步一步地完善整个结构体的操作，从而完整的掌握结构体的内容

【实验平台】

PC 机、ubuntu 操作系统，gcc 等工具

【实验步骤】

1、 基本实现方法，在 main 函数中定义结构体，并实现功能

struct-1.c

```
#include <stdio.h>



int main(int argc, char **argv)

{

    struct results

    {

    float interim_results;

    float end_results;

    float average_scores;

    }student;
```

```
        printf("Input interim_results:");

        scanf("%f",&student.interim_results);

        printf("Input end_results:");

        scanf("%f",&student.end_results);



        student.average_scores = (student.interim_results + student.end_results) / 2;



        printf("%.2f\n", student.average_scores);



        return 0;

}
```

编译：

gcc –o struct-1 stuct-1.c

执行：

./struct-1

Input interim_results:12

Input end_results:16

14.00

2、 定义结构体指针进行操作

struct-1.c

```
#include <stdio.h>

#include <stdlib.h>



int main(int argc, char **argv)

{

        struct results

        {

        float interim_results;

        float end_results;
```

```
        float average_scores;

        };



        struct results *student = malloc(sizeof(struct results));



        printf("Input interim_results:");

        scanf("%f",&student->interim_results);

        printf("Input end_results:");

        scanf("%f",&student->end_results);



        student->average_scores = (student->interim_results + student->end_results) / 2;



        printf("%.2f\n", student->average_scores);



        return 0;

}
```

编译：
gcc –o struct-2 stuct-2.c
执行：
./struct-2
Input interim_results:12
Input end_results:16
14.00

3、 在 main 外建立结构体，构建函数 foo，向 foo 函数传递结构题成员作为参数

struct-3.c

```
#include <stdio.h>

#include <stdlib.h>
```

```
struct results

{

	float interim_results;

	float end_results;

	float average_scores;

};



int foo(float *interim_results, float *end_results, float *average_scores)

{

	*average_scores = (*interim_results + *end_results) / 2;



	return 0;

}



int main(int argc, char **argv)

{



	struct results *student = malloc(sizeof(struct results));



	printf("Input interim_results:");

	scanf("%f", &student->interim_results);

	printf("Input end_results:");

	scanf("%f", &student->end_results);



	foo(&student->interim_results, &student->end_results, &student->average_scores);
```

```
	printf("The average socres is:%.2f\n", student->average_scores);



	return 0;

}
```

编译：

gcc –o struct-3 stuct-3.c

执行：

./struct-3

Input interim_results:21

Input end_results:32

The average socres is:26.50

4、 在 main 外建立结构体，并构建没有参数和返回值的函数 foo

struct-4.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

	float interim_results;

	float end_results;

	float average_scores;

};



void foo()

{

	struct results *student = malloc(sizeof(struct results));



	printf("Input interim_results:");

	scanf("%f", &student->interim_results);
```

```
	printf("Input end_results:");

	scanf("%f", &student->end_results);



	student->average_scores = (student->interim_results + student->end_results) / 2;



	printf("The average socres is:%.2f\n", student->average_scores);

}



int main(int argc, char **argv)

{

	foo();



	return 0;

}
```

编译：

gcc –o struct-4 stuct-4.c

执行：

./struct-4

Input interim_results:21

Input end_results:32

The average socres is:26.50

5、 在 main 外建立结构体，构建传递结构体指针并返回 void 的函数 foo

struct-5.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

	float interim_results;
```

```
        float end_results;
        float average_scores;
};

void foo(struct results *student)
{
        printf("Input interim_results:");
        scanf("%f", &student->interim_results);
        printf("Input end_results:");
        scanf("%f", &student->end_results);

        student->average_scores = (student->interim_results + student->end_results) / 2;
}

int main(int argc, char **argv)
{
        struct results *student = malloc(sizeof(struct results));

        foo(student);

        printf("The average socres is:%.2f\n", student->average_scores);

        return 0;
}
```

编译：

gcc –o struct-5 stuct-5.c

执行：

./struct-5
Input interim_results:21
Input end_results:32
The average socres is:26.50

6、 在 main 外建立结构体，构建传递结构体指针并返回结构题指针的函数 foo

struct-6.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

        float interim_results;

        float end_results;

        float average_scores;

};



struct results *foo()

{

        struct results *student = malloc(sizeof(struct results));



        printf("Input interim_results:");

        scanf("%f", &student->interim_results);

        printf("Input end_results:");

        scanf("%f", &student->end_results);



        student->average_scores = (student->interim_results + student->end_results) / 2;
```

```
        return student;

}



int main(int argc, char **argv)

{

        struct results *student;



        student = foo();



        printf("The average socres is:%.2f\n", student->average_scores);



        return 0;

}
```

编译：

gcc –o struct-6 stuct-6.c

执行：

./struct-6

Input interim_results:21

Input end_results:32

The average socres is:26.50

9.2 结构体指针实验

【实验内容】

试利用指向结构体的指针编制一个程序，实现输入 3 个学生的学号、数学期中和期末成绩，然后计算其平均成绩并输出成绩表

【实验目的】

本实验主要是要熟悉结构体指针的使用方法，以及在函数之间传递结构体指针的功能。

【实验平台】

PC 机、ubuntu 操作系统，gcc 等工具

【实验步骤】

1、定义结构体数组，进行操作

struct-1.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

	int id;

	float interim_results;

	float end_results;

	float average_scores;

};



int main()

{

	int i;

	struct results student[3];



	for(i=0; i<3; i++)

	{

		printf("Input ID:");

		scanf("%d",&student[i].id);

		printf("Input interim results:");

		scanf("%f",&student[i].interim_results);

		printf("Input end results:");

		scanf("%f",&student[i].end_results);

		student[i].average_scores = (student[i].interim_results + student[i].end_results) / 2;
```

```
    }



    printf("##########################################\n");

    printf("ID\tinterim\tend\taverage\n");

    for(i=0; i<3; i++)

    {

        printf("%d\t%.2f\t%.2f\t%.2f\n",student[i].id, student[i].interim_results,

            student[i].end_results, student[i].average_scores);

    }

    printf("##########################################\n");



    return 0;

}
```

编译：

gcc –o struct-1 stuct-1.c

执行：

./struct-1

Input ID:1

Input interim results:67

Input end results:87

Input ID:2

Input interim results:98

Input end results:67

Input ID:3

Input interim results:98

Input end results:78

##

ID	interim	end	average
1	67.00	87.00	77.00
2	98.00	67.00	82.50
3	98.00	78.00	88.00

##

2、定义结构体指针，进行操作

struct-2.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

	int id;

	float interim_results;

	float end_results;

	float average_scores;

};



int main()

{

	int i;

	struct results student[3], *p = student;



	for(i=0; i<3; i++)

	{

		printf("Input ID:");

		scanf("%d",&p->id);

		printf("Input interim results:");

		scanf("%f",&p->interim_results);

		printf("Input end results:");

		scanf("%f",&p->end_results);

		p->average_scores = (p->interim_results + p->end_results) / 2;

		p++;
```

```
    }



    p = student;

    printf("##########################################\n");

    printf("ID\tinterim\tend\taverage\n");

    for(i=0; i<3; i++)

    {

        printf("%d\t%.2f\t%.2f\t%.2f\n",p->id, p->interim_results,

                p->end_results, p->average_scores);

        p++;

    }

    printf("##########################################\n");



    return 0;

}
```

编译：

gcc –o struct-2 stuct-2.c

执行：

./struct-2

Input ID:1

Input interim results:67

Input end results:87

Input ID:2

Input interim results:98

Input end results:67

Input ID:3

Input interim results:98

Input end results:78

##

ID	interim	end	average
1	67.00	87.00	77.00
2	98.00	67.00	82.50
3	98.00	78.00	88.00

##

3、编写 printp 函数 ，实现成绩打印功能，传递结构体数组为其参数

struct-3.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

        int id;

        float interim_results;

        float end_results;

        float average_scores;

};



void printp(struct results student[])

{

        int i;



        printf("##########################################\n");

        printf("ID\tinterim\tend\taverage\n");

        for(i=0; i<3; i++)

        {

        printf("%d\t%.2f\t%.2f\t%.2f\n",student[i].id, student[i].interim_results,

                        student[i].end_results, student[i].average_scores);

        }

        printf("##########################################\n");
```

```
}


int main()
{
        int i;
        struct results student[3];


        for(i=0; i<3; i++)
        {
        printf("Input ID:");
        scanf("%d",&student[i].id);
        printf("Input interim results:");
        scanf("%f",&student[i].interim_results);
        printf("Input end results:");
        scanf("%f",&student[i].end_results);
        student[i].average_scores = (student[i].interim_results + student[i].end_results) / 2;
        }


        printp(student);


        return 0;
}
```

编译：

gcc –o struct-3 stuct-3.c

执行：

./struct-3

Input ID:1

Input interim results:67

Input end results:87
Input ID:2
Input interim results:98
Input end results:67
Input ID:3
Input interim results:98
Input end results:78
##
ID interim end average
1 67.00 87.00 77.00
2 98.00 67.00 82.50
3 98.00 78.00 88.00
##
4、同上，传递结构体指针为其函数参数

struct-4.c

```
#include <stdio.h>

#include <stdlib.h>



struct results

{

        int id;

        float interim_results;

        float end_results;

        float average_scores;

};



void printp(struct results *student)

{

        int i;



        printf("##########################################\n");
```

```
        printf("ID\tinterim\tend\taverage\n");
        for(i=0; i<3; i++)
        {
        printf("%d\t%.2f\t%.2f\t%.2f\n",student->id, student->interim_results,
                        student->end_results, student->average_scores);
        student++;
        }
        printf("#########################################\n");
}

int main()
{
        int i;
        struct results *swap, *student = malloc(sizeof(struct results) * 3);
        swap = student;

        for(i=0; i<3; i++)
        {
        printf("Input ID:");
        scanf("%d",&student->id);
        printf("Input interim results:");
        scanf("%f",&student->interim_results);
        printf("Input end results:");
        scanf("%f",&student->end_results);
        student->average_scores = (student->interim_results + student->end_results) / 2;
        student++;
```

```
    }


    student = swap;


    printp(student);


    return 0;
}
```

编译：

gcc –o struct-4 stuct-4.c

执行：

./struct-4

Input ID:1

Input interim results:67

Input end results:87

Input ID:2

Input interim results:98

Input end results:67

Input ID:3

Input interim results:98

Input end results:78

##

ID	interim	end	average
1	67.00	87.00	77.00
2	98.00	67.00	82.50
3	98.00	78.00	88.00

##

9.3 共用体实验

【实验内容】

设有一个 unsigned int 整数，现要分别将其前 2 字节和后 2 字节相加，并输出结果。

【实验目的】

通过本实验掌握共用体的基本用法

【实验平台】

PC 机、ubuntu 操作系统，gcc 等工具

【实验步骤】

1、通过共用体实现上述功能，熟练掌握共用体的使用方法

union.c

```
#include <stdio.h>



union

{

        struct

        {

        unsigned short low;

        unsigned short high;

        }x;



        unsigned int y;

}num;



int main()

{

        num.y = 0x11223344;



        printf("0x%x\n", num.x.low + num.x.high);



        return 0;

}
```

编译：

gcc –o union union.c

执行：
./union
0x4466