From the shallower to the deeper explanations C star triangle pattern in output display

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Abstract. This paper mainly for non-computer science students, contact the cycle structure of C language program design of the knowledge points in the first time, appear many times, circulation structure is also the most basic problem: the output display star triangle shape. Use from the shallower to the deeper in to explain the problem, in order to guide students thinking, method using the graphical method is simple to derive the solution to such a problem, after the actual teaching practice and achieved good results.

Keywords: C language; triangle; graphical method; progressive approach.

1. Introduction

Language C is a high-level programming language, which is developed on the basis of assembly language. Because Language C has the characteristics of not only low-level language but also high-level language, each major set the Language C course in Mechanical College of Inner Mongolia Nationality University. Language C is a common programming language that is object-oriented. With the characteristics of high efficiency, flexible functionality, convenient portability, Language C course is opened in every major in university.

Loop structure belongs to the important basic knowledge in the C program design and almost every program will use cycle. So it is important for the course to learn the knowledge of loop structure well. Loop structure is closely related with the later chapters. According to my six rounds of Language C teaching experience, the majority of students cannot master the loop well and always recite the example programs. When they take the test, slightly modified cycle programs will make them answer the question wrongly.

The course of Language C program design has only thirty class hours in the machinery manufacturing and automation. According to my teaching experience, if the teacher directly explains the various examples in the order of teaching materials, the teaching effect is unsatisfactory and most students reflect vague understanding about it. Therefore improving teaching methods and means is necessary. The article adopts the method of going from the shallower to the deeper and gradually inspiring to explain the loop structure. Outputting multiple lines of asterisks with different shapes is a typical example about loop structure and this article takes such problem as an example to explain the loop structure by the method of going from the shallower to the deeper and gradually inspiring.

Before explaining the loop structure, let students program to output and display the pattern in Figure 1. Because print () function is learned first, students mostly use this function to complete this subject. The program is as follows:

```
Int main()
{
printf(“*****”);
printf(“*****”);
printf(“*****”);
printf(“*****”);
printf(“*****”);
}
```

*****
*****
*****
*****
*****

Fig.1 Asterisks of 5 lines and 5 columns

Now change the topic as "Output asterisks of 200 lines and 5columns".The majority of students can achieve the function by inputting print () 200 times. However, it is easier to introduce the loop structure. Using the following few loop lines can achieve the function of 200 lines with sequential statement.

```
Int main()
{
Int i=1;
While(i<=200)
{
printf("*****");
i++;
}
}
```

Introducing the concept of loop by this example can propel each student to think and understand this knowledge profoundly. Outputting the asterisk pattern of 5 lines and 5 columns is the simplest and most basic loop problems. On the basis of this, the topic is modified to "output a right triangle asterisk pattern of five lines and five columns, shown in Figure 2". Beginners often feel difficult because they cannot find the start points. The textbook usually provides the answers directly instead of detailed solving process. For students, they just see the answers and get a little. When they meet the same problem, they still can't solve it. Therefore, it is necessary to change the traditional teaching means to the method of going from the shallower to the deeper and gradually inspiring.

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Fig.2 Asterisk pattern of right triangle

This article will present how to solve the loop problem. By observing the it is easy to find the law about the number of asterisks in every line. So as long as the relationship between lines about the number of asterisks is known, the problem can be solved. When the first line is output, one asterisk is displayed; when the second line is output, two asterisks is displayed; by that analogy, it is ended until the fifth line. That is, the line number is the same as the number of asterisks in this line. The relationships is shown as Table 1.

Table 1 relationship between line number and the number of asterisks

line number	the number of asterisks
i	j
1	1
2	2
3	3
4	4
5	5
the relationship	i=j

The relationship can help students quickly write the program and it is as follows:

```
Int main()
{
Int i=1,j=1;
for(i=1;i<=5;i++)
for(j=1;j<=i;j++)
printf(“*”);

}
```

```
*****
****
***
**
*
```

Fig.3 Pattern of upside-down right triangle

After two answers to the above questions, the students have a deeper understanding of the the loop. In order to allow students to masterfully use this knowledge, this topic can be modified on this basis again and changed as “output the pattern of figure 3”. The solving idea on the upside-down right triangle is the same as the above topic. First the relationship between line number and number of asterisks is found and then one line loop nested one column loop can display the pattern.The relationship is shown in Table 2.

Table 2 relationship between line number and number of asterisks

Line number	Number of asterisks
i	j
1	5
2	4
3	3
4	2
5	1
The relationship	J=5;j>=I;j--

The relationship make the program easier and the codes are as follows:

```
Int main()
{
Int i=1,j=1;
for(i=1;i<=5;i++)
for(j=5;j>=I;j--)
printf(“*”);
}
```

If the teachers use the method of going from the shallower to the deeper and gradually inspiring to explain the loop structure, students mainly have deep impression on the knowledge. The effect will be better than explaining the textbook examples and the solution of outputting all kinds of asterisks is teacher to students.

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