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The use of Data Sorting Cases in C Language Teaching

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Abstract: the sorting of data is a very practical problem. In the learning of C language programming, by discussing the realization of various algorithms of data sorting, we can not only improve students' interest in learning, but also learn the use of arrays, which can be described as killing two birds with one stone.

Keywords: *C Language; Data; Sorting; Algorithm; Array*

I. INTRODUCTION

If students are familiar with the data sorting in C language, they will feel that it is easier for them to use the data sorting method in C teaching. Therefore, the rational use of data sorting cases, not only can promote students to master the array part of the content, but also can better train students' computational thinking ability, which is a very meaningful thing.

II. BRIEF INTRODUCTION OF DATA SORTING METHOD

The so-called data sorting is to adjust some disordered data into an ordered sequence. When sorting, it can be arranged according to the ascending order of keywords or descending order of keywords from small to large, which can be sorted according to specific application requirements.

There are many sorting methods in practical application, such as bubble sort, select sort, insert sort, quick sort, merge sort, Hill sort, heap sort and so on. In this paper, taking into account the actual acceptance of teaching students, the first three are selected as teaching cases to use, the following do a detailed introduction.

III. DESCRIPTION OF THREE COMMON SORTING ALGORITHMS AND C LANGUAGE CODE

Let's take 10 unordered integers: 5, 3, 9, 2, 7, 4, 1, 8, 6, 0 as examples, and sort them in ascending order. This paper introduces the algorithms and C language code of bubble, selection and insertion.

A. Bubble sorting

1. Description of bubble sort algorithm

Bubble sorting is to compare a group of adjacent numbers in pairs, the large number sinks (or the small number rises), and arranges the sequence of numbers after multiple rounds of comparison. The specific algorithm is described as follows:

(1) Save 10 integers to array a;

(2) Starting from the first number, compare the first two numbers. If the first number is greater than the later number, the values of the two array elements are exchanged until the last two numbers are compared. So far, the maximum number 9 has sunk to the bottom, that is, it is stored in the last array element a[9];

(3) Repeat step (2) and start from the first number. Compare the first nine numbers in turn to make the second largest number 8 sink, that is, store it in the array element a[8];

(4) Repeat step (2) and start from the first number. Compare the first eight numbers in turn to let the third largest number 7 sink, that is, store it in the array element a[7];

(5) It can be seen that after repeating step (2), we still start from the first number, and compare the previous seven, six, five, four, three, and two, and still sink the maximum number of the fourth, fifth, sixth, seventh, eighth, and ninth to the bottom, that is to say, they are stored in array elements a[6], a[5], a[4], a[3], a[2], and a[1], and the last number is placed in a[0], which is the smallest number. In other words, after nine bubble sorting, 10 unordered integers have been sorted in ascending order;

(6) Output 10 sorted integers.

2. Implementation of bubble sort c language code

```
#include <stdio.h>
int main(void)
{int a[10]={5,3,9,2,7,4,1,8,6,0},i,j,t;
  for(i=0;i<9;i++) //9 times sorting
       for(j=0;j<10-1-i;j++)
          if(a[j]>a[j+1])    //Pairwise comparison
             {t=a[j];a[j]=a[j+1];a[j+1]=t;}
  printf("the sorted data are as follows:\n");    //
  for(i=0;i<10;i++)
       printf("%d ",a[i]);
  return 0;
}
```

B. Selection sorting

1. Description of selection sorting algorithm

The sorting algorithm is to first find the smallest number in the array, then exchange its position with the first number, then find out the second smallest number in turn, exchange its position with the second number, and so on. Finally, the order is arranged. The ascending order of 10 integers is as follows:

(1) Save 10 integers to array a;
(2) Find the smallest number from 10 numbers and exchange it with the first number a[0];
(3) Repeat step (2) to find the second decimal from the remaining 9 numbers and exchange it with the second number a[1];
(4) Repeat step (2) and find the third, fourth, fifth, sixth, seventh, eighth and ninth decimals from the remaining eight, seven, six, five, four, three, and two, and exchange them with the third number a[2], the fourth number a[3], the fifth number a[4], the sixth number a[5], the seventh number a[6], the eighth number a[7], the ninth number a[8] for numerical exchange Put it in a[9], that is, the maximum number. So far, after 9 times of sorting, the ascending order of 10 integers is completed.

(5) Output 10 sorted integers.

2. Code implementation of selective sorting C language

```
#include <stdio.h>
int main(void)
{int a[10]={5,3,9,2,7,4,1,8,6,0},i,j,t,k;
 for(i=0;i<9;i++) //9 times sorting
      {k=i;
       for(j=i+1;j<10;j++)
        if(a[j]<a[k])   //Each number after the i-th number is compared to it
            k=j;
        if(k!=i)
           {t=a[k];a[k]=a[i];a[i]=t;}
      }
 printf("The ordered data are as follows:\n");
 for(i=0;i<10;i++)
      printf("%d ",a[i]);
 return 0;
}
```

C. Insert sort

1. Description of insertion sort algorithm

Insertion sorting method is more common in real life. For example, when playing cards, the cards in our left hand are inserted in order. When arranging the examinees' answers, they are inserted one by one according to the order. The algorithm for sorting 10 integers in ascending order is as follows:

(1) Save 10 integers to array a;
(2) First, select the first number a[0] in array A and put it into array element B[0]. Here, we use array B to store the ordered sequence;
(3) Insert the second number a [1] in the array a into the appropriate position in the array B according to the order from small to large. If a[1] is larger than B[0], it is inserted after B[0], that is, it is stored in B[1]. Otherwise, the value of B[0] is moved to B[1], and the value of a[1] is stored in B[0];
(4) Repeat step (3) to insert the remaining 8 numbers in array a into array B in the same way;
(5) Output 10 sorted integers.
2. Code implementation of insert sort c language

```
//Array A is the sequence to be sorted, and array B is the new sequence in order
#include <stdio.h>
int main(void)
{int a[10]={5,3,9,2,7,4,1,8,6,0},i,j;
 int b[10]={5},k;
//use the variable i to indicate the subscript of each element
//after the second element in the original sequence
for(i=1;i<10;i++)
{if(a[i]>=b[i-1]) //if the data to be inserted>=the last data in the new sequence
        b[i]=a[i];  //insert the data directly to the end of the new sequence
     else  //find the position to be inserted in the new sequence
        if(a[i]<=b[0])//insert to the front
          {for(k=i-1;k>=0;k--)
              b[k+1]=b[k];
           b[0]=a[i];  //insert the data to be inserted to the front
          }
     else     //insert the data to be inserted in the middle of the new sequence
         {for(j=i-1;j>=0;j--)
           if(a[i]<=b[j]&& a[i]>=b[j-1])
              {for(k=i-1;k>=j;k--)
                   //move the elements in the new sequence one bit in turn
                   b[k+1]=b[k];
 //insert the data to be inserted into the appropriate position
                   // in the new sequence
b[j]=a[i];
              }
         }
      }
 printf("The sorted data are as follows:\n");
 for(i=0;i<10;i++)
      printf("%d ",b[i]);
 return 0;
}
```

CONCLUSION

This case is convenient for students to understand the use of 10 integers, the algorithm can be extended to n integers, the code can be modified to the corresponding value. These cases not only exercise the students' learning of array, but also deepen the learning of cycle structure and selection structure, which can be called more comprehensive cases.

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