**Huazhong University of Science and Technology**

**"Computer Fundamentals and Programming (C++)"**

**experimental report**

**Experiment name: the fourth hands-on experiment Experiment hours: 10**

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**Experiment date: 2016/12/3 Teacher's signature:**

**1. Purpose of the experiment**

* Master the definition, input, output and basic operations of one-dimensional arrays.
* Master the definition, input, output and basic operations of two-dimensional arrays.
* Master the storage and access of strings.
* The ability to use array processing to solve practical problems.

**2. Experimental content**

**1. reader program**

1) #include <iostream>

#include <cmath>

using namespace std;

int main( )

{

const int n=5;

int i,a [n];

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

{ cin >> a[i];

cout<<a[i];

}

return 0;

} **Run the above program , correct the errors, and explain the reasons for the errors.**

**Only constants can be used when defining arrays.**

2) #include <iostream>

#include <cmath>

using namespace std;

int main( )

{

int i;

int a[ 6]={0,1,2,3,4,5};

for(i= 0; i <= 5; i++)

cout<<a[i];

return 0;

} **Run the above program , whether the result is correct, if not, please correct it and explain the reason.**

**The number of defined array elements is too small, and the access is out of bounds. 5 — >6**

3) #include <iostream>

using namespace std;

int main( )

{

char rstr [10]="abcdefgh",dstr[10];

int i;

for( i=0; rstr[i]!='\0'; i++) //loop condition can be written as rstr1[i]!=0; or rstr1

dstr[i]=rstr[i];

dstr[i]='\0';

cout<<" Output string dstr: "<<dstr<<endl;

return 0;

}

**The function of the above program is to copy the string rstr to the target string dstr, whether the result of running the program is correct, if not, please correct it, and explain the reason.**

4) #include <iostream>

using namespace std;

int main( )

{

char name1 [ ] ={'a','b','c','d','\0'};

char name2 [ ] = "abcd";

for( int i=0;i<4;i++)

cout<<name1[i];

cout<<endl;

cout<<name1<<endl;

cout<<name2<<endl;

return 0;

}

**Run the above program, compare the similarities and differences of the three outputs, and explain the reasons.**

5) #include <iostream>

using namespace std;

int main( )

{

int a [5]={1,2,3,4,5};

int \* p = a;

for( int i=0;i<5;i++) //1

cout<<a[i];

cout<<endl;

cout<<a[ 0]<< a[1]<<a[2]<<a[3]<<a[4]<<endl; //2

cout<<\*p<<\*(p+ 1) <<\*(p+2)<<\*(p+3)<<\*(p+4)<<endl; //3

for(i= 0;i <5;i++) //4

cout<<\*(p+i);

cout<<endl;

for(i= 0;i <5;i++) //5

{

cout<<\*p;

p++;

}

cout<<endl;

}

On the basis of the above statement, please use 5 ways to output the array a

**programming questions**

1) Define a one-dimensional array containing 10 elements, input and output the value of each element, and find the maximum and minimum values and their subscripts.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

using namespace std;

int main( )

{

int a[ 10];

int i;

int min,max ,minn,maxn;

cout<<" Please enter the value of each element"<<endl;

for(i= 0;i <=9;i++)

cin>>a[i];

min = a[ 0];

max = a[ 0];

minn=maxn=0;

for(i= 0;i <=9;i++)

{

if(a[i]<min)

min=a[i];

if(a[i]>max)

max=a[i];

}

for(i= 0;i <=9;i++)

{

cout<<"a["<<i+1<< "] is "<<a[i]<<" " ;

}

cout<<endl;

cout<<" The minimum value is:"<<min<<endl;

cout<<" The number is:";

for(i= 0;i <10;i++)

if(a[i]==min)

cout<<i+1<<"";

cout<<endl;

cout<<" The maximum value is:"<<max<<endl;

cout<<" The number is:";

for(i= 0;i <10;i++)

if(a[i]==max)

cout<<i+1<<"";

cout<<endl;

}

1. Description of the algorithm idea to solve this problem

Define an array, input data, find the maximum and minimum and output, and finally judge the subscript (this can solve the problem of subscript output when there are multiple minimum values)

1. Records of debugging process (including errors and modification process)

no errors

Added tabs during debugging (to make data look neater)

1. Summarize the knowledge points or algorithms used in this question

array, judgment, loop

2) Write a program that defines A two-dimensional array with 5 rows and 4 columns, and assign values to the elements of the first 4 rows and 4 columns, calculate the sum of the first 4 rows and columns of the two-dimensional array, and put the sum of each column in the position of the last row of each column, and then output the two dimensional array (output in row-column format).

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

using namespace std;

int main( )

{

int i,j ;

int a[ 4][5];

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

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

cin>>a[i][j];

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

for(j= 0,a [i][4]=0;j<=3;j++)

a[i][ 4]+ =a[i][j];

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

{

for(j= 0;j <=4;j++)

cout<<a[i][ j]<< ' ';

cout<<endl;

}

}

1. Description of the algorithm idea to solve this problem

Define a two-dimensional array, input, sum, output.

1. Records of the debugging process (including errors and modifications?)

no error, no modification;

1. Summarize the knowledge points or algorithms used in this question

**3)** Program to output 10 rows of Yanghui triangles. ( Using a two-dimensional array and using each coefficient equal to the sum of its upper two coefficients requires output in the format of an isosceles triangle )

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

#include <iomanip>

using namespace std;

int main( )

{

int a[ 11][11]={0};

int i,j ;

a[ 1][1]=1;

for(i= 2;i <=10;i++)

for(j= 1;j <=i;j++)

a[i][ j]= a[i-1][j-1]+a[i-1][j];

for(i= 1;i <=10;i++)

{

for( int k=0;k<= 9 -i;k++)

cout<<" ";

for(j= 1;j <=i;j++)

cout<<setw( 6)<< a[i][j];

cout<<endl;

}

}

1. Description of the algorithm idea to solve this problem

Define the array, find the recursion, output and control the format

1. Records of the debugging process (including errors and modifications)

no error

When modifying, the number of spaces at the beginning of the output line is changed

1. Summarize the knowledge points or algorithms used in this question

Loop, two-dimensional array operation, output format control;

**4) Program** to insert a string into the specified position of another string.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

using namespace std;

int main( )

{

char a[100 ],b [100],c[100];

int j,i ;

cout<<" Please enter the original string:";

cin>>a;

cout<<" Please enter the inserted string:";

cin>>b;

cout<<" Please enter the position to insert";

cin>>j;

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

c[i]=a[i];

for (;b [ij];i++)

c[i]=b[ij];

for (;i <100;i++)

c[i]=a[ij];

cout<<" The inserted string is: "<<c<<endl;

}

1. Description of the algorithm idea to solve this problem

Define three strings and do three rounds of assignment;

1. Records of the debugging process (including errors and modifications)

The third assignment error caused the insertion to be replaced, and it was normal after changing the subscript

1. Summarize the knowledge points or algorithms used in this question

array, assignment, loop

**5)** Find whether there is data 89 in the **sequence** { 12 45 67 78 89 90 234 789 900}, if there is, delete it, otherwise it will show that the number does not exist.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

using namespace std;

int main( )

{

int flag=0;

int a[ ]={12,45,67,78,89,90,234,789,900};

for( int i=0;a[i] !=0&&a[i+1]!=0 ;i++)

if(a[i]==89)

{

for (;a [i];i++)

a[i]=a[i+1];

flag=1;}

if(flag==0)

cout<<" The number does not exist"<<endl;

for( int i=0;a[i];i++)

cout<<"a"<<i<<"="<<a[i]<<"";

}

1. Description of the algorithm idea to solve this problem

If it exists, the subsequent values are all equal to the value of the latter item. At this time, the last number becomes zero (the default is zero outside the array), and a non-zero value can be output when outputting.

1. Records of the debugging process (including errors and modifications?)

no errors, no modification

1. Summarize the knowledge points or algorithms used in this question

**array, judgment**

**6) Insert a number 80** into an ordered sequence { 12 45 67 78 89 90 234 789 900}, and the sequence is still ordered after insertion.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

using namespace std;

int main( )

{

int \* p,n ,i,j,bulabula;

int a[ ]={12,45,67,78,89,90,234,789,900};

for(i= 0;a [i];i++);

i--;

p = new int[i];

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

\*(p+ j)= a[j];

cout<<" The original number is listed as: "<<endl;

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

cout<<"a"<<j<<"="<<\*(p+ j)<< ' ';

cout<<endl;

i++;

cout<<" Please enter the number to be inserted"<<endl;

cin>>n;

\*(p+ i)= n;

for(j= i;j >=0;j--)

if(\*(p+ j)< \*(p+j-1))

{

bulabula=\*(p+j);

\*(p+ j)= \*(p+j-1);

\*(p+j- 1)= bulabula;

}

else break;

cout<<" The array after insertion is: "<<endl;

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

cout<<"a"<<j<<"="<<\*(p+ j)<< ' ';

cout<<endl;

}

1. Description of the algorithm idea to solve this problem

Insert first and then sort by adjustment

1. Records of the debugging process (including errors and modifications?)

no errors, no modification

1. Summarize the knowledge points or algorithms used in this question

**array, pointer**

**7)** Rewrite textbook example 5.23 (search for a book among 10 books) requires sorting first and then searching in half.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

#include <cstring>

using namespace std;

int main( )

{

char t[ 20];

char name[10][ 200]= {"Calculus", "Basic programming", "audio-audio course", "comprehensive course", "new vision", "study guide", "linear algebra", "advanced Mathematics", "English Level 4 Vocabulary", "Safety Warning Education"};

int j,i ,min;

for(j= 0;j <10;j++)

{

min=j;

for(i=j+ 1;i <10;i++)

{

if(strcmp(name[min ],name [i])>0)

{min=i;

strcpy( t,name [j]);

strcpy(name[j ],name [min]);

strcpy(name[min ],t );

}}

}

int high,low ,mid;

low=0;

high=9;

char s[ 21];

cout<<" Please enter the title of the book you are looking for"<<endl;

cin. getline (s,21);

mid=(low+high)/2;

while(strcmp(name[mid ],s )!=0&&low<=high)

{

if(strcmp(name[mid ],s )<0)

low=mid+1;

else high=mid-1;

mid=(high+low)/2;

}

if(strcmp(name[mid ],s )==0)

cout<<" found, and the subscript is"<<mid+1<<endl;

else cout<<" Not found!"<<endl;

return 0;

}

1. Description of the algorithm idea to solve this problem

Sort first, find later

1. Records of the debugging process (including errors and modifications?)

Because the title of the book is too long, it cannot be displayed normally, and an error is reported (the title of the book was shortened later)

1. Summarize the knowledge points or algorithms used in this question

Overall assignment and sorting of character arrays

8) **(Optional question)** There are currently 10 students, the final exam has 5 courses. Find the total score and average score of each student, and output according to the total score from high to low. **(Refer to Textbook Example 5.25 Shipment Problem)**

**Require:**

1. The original code of the program. **(Paste directly here)**
2. Description of the algorithm idea to solve this problem
3. Records of the debugging process (including errors and modifications?)
4. Summarize the knowledge points or algorithms used in this question

**9)** Write the functions for calculating the perimeter and area of the known 3 sides respectively. Then write the main program, the main program is required to determine the circumference or area according to the user's choice , and output the result.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

#include <cmath>

using namespace std;

double l( double,double ,double);

double s( double,double ,double);

double l( double a, double b, double c)

{

int l=a+b+c;

return l;

}

double s( double a, double b, double c)

{

int p,s ;

p=a+b+c;

p/=2;

s=p\*(p- a)\* (pb)\*(pc);

s=sqrt(s);

return s;

}

int main( )

{

int chos;

double a,b ,c;

cout<<" Please enter the length of the three sides:";

cin>>a>>b>>c;

if(a+b<=c||a+c<=b||b+c<=a)

cout<<" These three sides do not form a triangle";

else

{

cout<<" What information do you want?"<<endl;

cout<<"1 —area 2 —perimeter 3 —both are required"<<endl;

cin>>chos;

if(chos==1)

cout<<" The area of the triangle is"<<s( a,b ,c)<<endl;

if(chos==2)

cout<<" The perimeter of the triangle is"<<l( a,b ,c)<<endl;

if(chos==3)

cout<<" The area of the triangle is"<<s( a,b ,c)<<endl;

cout<<" The perimeter of the triangle is"<<l( a,b ,c)<<endl;

}

}

1. Description of the algorithm idea to solve this problem

judgment, function;

1. Records of the debugging process (including errors and modifications?)

no bugs, no modifications

4) Summarize the knowledge points or algorithms used in this question

**custom function**

**10) Optional questions**

Enter 2 strings from the keyboard, and judge whether the shorter string is a substring of the other string.

**Require:**

1. The original code of the program. **(Paste directly here)**

#include <iostream>

using namespace std;

int main( )

{

int la,lb ; //a,b length

int flag=0;

int i,j ,k;

char a[100 ],b [100]; //a,b.

cout<<" Please enter the string a"<<endl;

cin. getline (a,100);

cout<<" Please enter the string b"<<endl;

cin. getline (b,100);

for(la= 0;a [la];la++)

;

for(lb= 0;b [lb];lb++)

;

if(la==lb)

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

{

if(a[i ]!= b[i])

break;

if(i==la)

flag=1;

}

if(la<lb)

{

for(j= 0;j <=lb;j++)

if(a[ 0]== b[j])

{for(k= 0;k <=la;k++)

{if(a[k ]!= b[j+k])

break;}

if(k==la)

flag=2;

}}

if(lb<la)

{

for(j= 0;j <=la;j++)

if(b[ 0]== a[j])

{for(k= 0;k <=lb;k++)

{if(b[k ]!= a[j+k])

break;}

if(k==lb)

flag=3;

}}

if(flag==0)

cout<<" String a, b does not contain relationship"<<endl;

if(flag==1)

cout<<" String a, b are exactly the same"<<endl;

if(flag==2)

cout<<" string a is a sub-column of string b"<<endl;

if(flag==3)

cout<<" String b is a sub-column of string a"<<endl;

}

1. Description of the algorithm idea to solve this problem

Define and input a string, use a loop to find the length of the string, and sequentially judge whether the longer string is the same as the shorter string;

1. Records of the debugging process (including errors and modifications?)

no error

At the beginning, it only judged whether the short string is a sub-column of a longer string, and later added the information of the sub-column that is exactly the same and who is whose;

1. Summarize the knowledge points or algorithms used in this question

loop, flag variable;

**3. Suggestions for improving the content, methods and means of this experiment, as well as experimental experience**

**Experimental experience includes** : 1) Which knowledge points have been mastered

Custom function, two-element array.

2) Which knowledge points are difficult

none

1. Suggestions for Lectures

none

1. Suggestions for remediation of lack of knowledge

none