RC.CODE.C++

1 Basic information

1.1 Competition content

A. he competition will comprehensively test the contestants' technical implementation ability based on C++ software programming language, encourage innovation, cultivate practical skills, and problem-solving abilities.
B. The competition are participated by individuals.
C. The competition items are set with objective questions and programming questions.
D. All groups in the competition participate in answering questions on the designated platform using a computer.
E. The duration of each competition is 90 minutes.

1.2 Group setting

Programming event	programming language	Group division	Age requirement
C++ programming	C++	C++ - A	≤12 years old
	C++	C++ - B	≤18 years old

1.3 Competition topic

Group	Single Choice Question	Programming Questions	Competition time
C++ - A	5 questions totaling 300 points	5 questions, totaling 300 points	90 Min
C++ - B	5 questions totaling 300 points	5 questions, totaling 300 points	90 Min

2 Rules and scores

2.1 Competition rules

A. A. The competition requires contestants to use coding methods on the designated platform to complete the designated questions. During the answering process, it is prohibited to cut out the compiler or open other software and web pages. Otherwise, it will be considered cheating and the score will be cancelled.

B. Each contestant has only one chance to challenge, and those who fail to log in to the designated platform within the specified time will be considered as giving up the challenge.
C. In the preparation stage, contestants must complete the answer preparation according to the designated platform's prescribed steps and independently operate to enter the formal answer.
D. During the competition period, contestants are not allowed to leave the computer answering area.
E. During the competition period, contestants are not allowed to plagiarize others, cheat, or directly contact other contestants' computers. If there is a violation, the contestant will receive 0 points.
F. During the competition process, one is not allowed to seek help from others, interfere with other contestants' preparation and answering questions, or damage public equipment.
G. During the competition period, no communication software may be opened on the computer. Any violation will result in 0 points for the contestant.
H. During the competition period, contestants are not allowed to use communication, photography electronic devices such as mobile phones, phone watches, and external storage devices. Any violation will result in disqualification from the competition.
I. The interpretation of these rules belongs to the RC Organizing Committee.

2.2 Competition score

According to the completion status of the questions, as well as the comprehensive evaluation of completion degree and time, the more questions completed, the higher the completion degree, and the shorter the time, the higher the score of the contestants.

3 Equipment requirements

A. Bring your own computer, computer operating system: Mac OS, Windows 10 or above operating system; The browser should use Google Chrome (version 69.0 or above), Firefox, Internet Explorer 11 or above, and Chrome is recommended.
B. Bring your own smartphone.

4 Outline requirements

4.1 C++ - A requirements

A. Programming Basics:
   a. Sequential structure: understand program flow, basic input and output.
   b. Branching structure: if conditional statements, simple logical operations.
   c. Loop structure: for loop, while loop to solve repetitive tasks.
   d. Array: use arrays to store and access data sets.
   e. String: basic string operations, such as concatenation, searching for characters, etc.
B. Mathematical knowledge:
   a. Algebra: addition, subtraction, multiplication and division of integers.
   b. Geometry: understand the representation of points and line segments in the coordinate system.
   c. Function: recognize linear functions and their graphs.
C. Algorithms:
   a. Simulation: implement the function directly according to the description of the question.
   b. Enumeration: use loops to exhaust possibilities to find the answer.

4.2 C++ - B requirements

A. Program Basics:
   a. Sequential structure: understand program flow, basic input and output.
   b. Branch structure: if conditional statement, simple logical operation.
   c. Loop structure: for loop, while loop to solve repetitive tasks.
   d. Array: use array to store and access data collection, advanced application of multidimensional array.
   e. String: basic string operation, such as concatenation, character search, etc. Advanced string processing, including advanced operations such as substring extraction.
   f. Structure definition and use.
   g. Branch structure and loop structure involve more complex logical judgment and nested use.
   h. Multi-keyword sorting and de-duplicate sorting skills.
   i. Strengthen the concept of custom functions and recursive calls; introduction to file operations.
B. Data structure:
   a. Set/map/pair: master associative containers set/map and data pairs.
   b. Stack/queue: use stack/queue in the standard library to complete specific tasks.
   c. Linked list: basic linked list node creation and traversal.

C. Mathematical knowledge:
   a. Function: including quadratic function and inverse proportional function.
   b. Equation: solving quadratic equation and equation application problems.
   c. Combination counting: preliminary understanding of permutation and combination concepts.

D. Algorithm::
   a. Simulation: directly implement the function according to the description of the question.
   b. Enumeration: use loops to exhaust possibilities to find the answer.
   c. Introduction to high-precision operation.
   d. Application of divide-and-conquer thinking.
   e. Simple application of greedy algorithm;
   f. Sorting algorithms include but are not limited to merge sort and quick sort;

5 RC.CODE.C++ Sample question example

【C++ - A 】Sample question example

一、Multiple choice questions (20 points each)

1、The correct expression among the following is ( )

A. 7++

B. (a+b)++

C. ++(a+b)

D. ++x

Answer D

2、If we define int a=2, b=2, the value of the following expression is 6 ( )

A. a*(++b)

B. a*(b++)

C. a+b

D. a*b

Answer A

3、When t is of type int and before entering the following loop, the value of t is 0. Which of the following statements is correct? ( )

while(t=1){…}

A. The value of the loop condition expression is 0
B. The value of the loop condition expression is 1
C. The loop condition expression is illegal
D. None of the above is correct
Answer B

4、Among the following 4 numbers expressed in different bases, the one with the largest value is（ ）
A. Octal number 52
B. Decimal number 44
C. Hexadecimal number 2F
D. Binary number 101000
Answer C

5、The structure that organizes data according to the "first in, last out" principle is（ ） L = []
A. Queue
B. Stack
C. Doubly linked list
D. Binary tree
Answer B

二、Programming questions (total score 300 points)

1、Programming Question 1 (40 point)

Programming Implementation: Sorting

Title description:
Input three positive integers and output them in ascending order.

Input description:
Input three positive integers separated by a space
Output description:
Output three positive integers in ascending order and separated by a space

Sample input:
15 8 10
Sample output:
8 10 15

Scoring Criteria:

10 point: correctly output a set of data;

10 point: correctly output two sets of data;

10 point: correctly output three sets of data;

10 point: correctly output four sets of data;

2、Programming Question 2 (40 point)

Programming Implementation: freight

Title description:

When taking a plane, if the luggage exceeds the specified weight, the luggage will be checked in and a check-in fee will be charged.

The following is the luggage check-in fee of a certain airline:

The luggage weight is within 20 kg (including 20) and is charged at 10 yuan per kilogram. The part exceeding 20 kg is charged at 15 yuan per kilogram.

Please write a program to calculate the fee for checked luggage given the total weight of the luggage (unit: kg).

Input description:

Enter a positive integer N (5<N<200) as the total weight of the luggage (unit: kg)

Output description:

Output the fee for checking N kg of luggage

Sample input: 10

Sample output: 100

Scoring Criteria:

10 point: correctly output a set of data;

10 point: correctly output two sets of data;

10 point: correctly output three sets of data;

10 point: correctly output four sets of data;

3、Programming Question 3 (60 point)

Programming Implementation: Find the sum of prime numbers

Title description:

Given a positive integer N, calculate the sum of all prime numbers between 2 and N.

For example: If N is equal to 10, the prime numbers between 2 and N are 2, 3, 5, and 7, and the sum of all prime numbers is equal to 17 (2 + 3 + 5 + 7).

Input description:

Input a positive integer N (2<N<101)

Output description:

Output an integer representing the sum of all prime numbers between 2 and N (including 2 and N)

Sample input: 10

Sample output: 17

Scoring Criteria:

15 point: correctly output a set of data;

15 point: correctly output two sets of data;

15point: correctly output three sets of data;

15 point: correctly output four sets of data.

4、Programming Question 4 (60 point)

Programming Implementation: Find the length of descending subsequence

Title description:

There is a set of integer sequences of length N. Find the longest descending subsequence containing the Kth integer from the sequence and output the length of the subsequence (a descending subsequence means that the numbers in the sequence are decreasing from left to right, that is, the number on the right is smaller than the number on the left, and if they are equal, they are not considered decreasing).

For example: the integer sequence of length 5 is [4, 6, 2, 4, 8], and K is 2.
The second integer is 6, and the longest descending subsequence containing 6 is [6, 4, 2], so the length is 3.

Input description:

In the first line, input two positive integers N (2<N<100) and K (0<K≤N), which represent the length of the integer sequence and the number of elements to be included respectively

In the second line, input N integer sequences (−1000<integer<1000), with a space between integers

Output description:

Output the length of the longest descending subsequence containing the Kth element

Sample input:

5 2

4 6 2 4 8

Sample output:

3

Scoring Criteria:

15 point: correctly output a set of data;

15 point: correctly output two sets of data;

15point: correctly output three sets of data;

15 point: correctly output four sets of data.

5、Programming Question 5 (100 point)

Programming Implementation: Minimum

Title description:

Given a string containing only numbers, with a length of N (5<N≤20), and a positive integer M (1≤M≤5). Use M multiplication signs to insert into the string, and the two multiplication signs cannot be adjacent. After insertion, a multiplication formula is generated. Find a way to insert the multiplication formula with the smallest value, and output the result. (The multiplication sign cannot be placed at the beginning or end of the string)

Note:

Insertion position: The multiplication sign can be inserted between numbers, but not at the beginning or end of the string, that is, the multiplication sign can only be placed between two numbers.

Adjacent multiplication signs: The inserted multiplication signs cannot be adjacent, which means that there must be at least one number between the two

multiplication signs.

For example, the string is 123456, and 2 multiplication signs are inserted.

The insertion methods are:

1×2×3456=6912

1×23×456=10488

1×234×56=13104

1×2345×6=14070

12×3×456=16416

12×34×56=22848

12×345×6=24840

123×4×56=27552

123×45×6=33210

1234×5×6=37020

Among them, the second multiplication formula has the smallest value, which is 6912.

Input description:

In the first line, enter two positive integers N (5<N≤20) and M (1≤M≤5), where N represents the length of the string and M represents the number of multiplication signs. There is a space between the two positive integers.

In the second line, enter a string of length N that contains only numbers, indicating that a string with M multiplication signs is to be inserted.

Output description:

Output an integer representing the minimum result.

Sample input:

6 2

123456

Sample output:

6912

Scoring Criteria:

25 point: correctly output a set of data;

25 point: correctly output two sets of data;

25point: correctly output three sets of data;

25 point: correctly output four sets of data.

【C++ - B】Sample question example

一、Multiple choice questions (20 points each, total score 100 points)

1、Which of the following is not a basic data type in C++? ( )

A. int
B. float
C. string
D. char
Answer C

2、In C++, which symbol is used to represent a comment? ( )

A. //
B. /* */
C. #
D. Both A and B are correct
Answer D

3、Which of the following options is a standard library function used for output in C++? ( )

A. input()
B. print()
C. cout
D. output()
Answer C

4、Which of the following statements about C++ structures is correct? ( )

A structure can only contain member variables, not member functions
B structure cannot inherit from another structure
C structure can contain static member variables
D structure cannot contain constructors
Answer C

5、Execute the following code, the output result is ( )

```
#include <iostream>
using namespace std;
int f(int k)
{
    if (k <= 2)
    {
        return 1;
    }
    return 2 * f(k - 2) + f(k - 1);
}
int main()
{
    int n = 7;
    cout << f(n);
    return 0;
}
```

A. 21
B. 41
C. 43
D. 45

Answer C

二、Programming questions (total score 300 points)

1、Programming Question 1 (40 point)

Programming Implementation:：Find the number of digits

Title description:

Given a positive integer N (1<N<200), output how many digits N is.

Input description:

Input a positive integer N (1<N<200)

Output description:

Output an integer indicating how many digits N is

Sample input: 11

Sample output: 2

Scoring Criteria:

10 point: correctly output a set of data;

10 point: correctly output two sets of data;

10 point: correctly output three sets of data;

10 point: correctly output four sets of data.

2、Programming Question 2 (40 point)

Programming Implementation: Spelling Words

Title description:

The English words for four kinds of fruits are Apple, Banana, Cherry, and Date. The teacher prompts the first letter of each word and asks the students to spell the corresponding word.

Please write a program:

When the uppercase letter input is "A", it outputs "Apple";

When the uppercase letter input is "B", it outputs "Banana";

When the uppercase letter input is "C", it outputs "Cherry";

When the uppercase letter input is "D", it outputs "Date".

Input description:

Enter any uppercase letter from A, B, C, D

Output description:

Output a string representing the English word corresponding to the uppercase letter (the first letter of the word is capitalized)

Sample input: A

Sample output: Apple

Scoring Criteria:

10 point: correctly output a set of data;

10 point: correctly output two sets of data;

10 point: correctly output three sets of data;

10 point: correctly output four sets of data.

3、Programming Question 3 (60 point)

Programming Implementation: Judging numbers

Title description:

Given a positive integer N (100≤N＜100000), count the number of positive integers between 100 and N (including 100 and N) that meet the following

conditions:

1) The unit digit of the positive integer is not 3;

2) The tens digit of the positive integer is not 5;

3) The hundreds digit of the positive integer is not 7.

Input description:

Input a positive integer N (100≤N＜100000)

Output description:

Output how many positive integers between 100 and N (including 100 and N) meet the conditions

Sample input: 110

Sample output: 10

Scoring Criteria:

15 point: correctly output a set of data;

15 point: correctly output two sets of data;

15point: correctly output three sets of data;

15 point: correctly output four sets of data.

4、Programming Question 4 (60 point)

Programming Implementation: Calculation 24

Title description:

"Calculate 24" is a classic number game.

The rules of the game are: pick out 4 numbers from the natural numbers between 1 and 10 (the 4 numbers are different and the order is random), perform addition, subtraction, and multiplication (the number of times and types of a certain operation are not limited), and the result of the operation must be equal to 24. Multiplication has a higher priority than addition and subtraction, and brackets cannot be used in the formula, and the order of the numbers must remain unchanged.

Example:

If the 4 numbers given are: 10, 2, 4, 8, there are two solutions (10+2+4+8=24, 10*2-4+8=24), then output 2

If the 4 numbers given are: 7, 2, 3, 6, there are zero solutions, then output 0

Input description:

Input four positive integers between 1 and 10 and separate them with a space (the four positive integers are different)

Output description:

Output how many operation solutions have the result of 24

Sample input: 10 2 4 8

Sample output: 2

Scoring Criteria:

15 point: correctly output a set of data;

15 point: correctly output two sets of data;

15point: correctly output three sets of data;

15 point: correctly output four sets of data.

5、Programming Question 5 (100 point)

Programming Implementation:

Title description:

A classmate in the class has made a plan to improve his ability. On the kth day, he must complete k questions, otherwise he will be lazy.

The student has now found a question bank with a total of n sets of questions, and each set of questions has a certain number of questions. But he is very picky. He will only use each set of questions once, and can only use the questions in one set of questions every day, and then that set of questions will be abandoned. For each set of questions, he does not have to complete all the questions in the question list.

Then the question is, how many days will this student do questions before being lazy?

Input description:

The first line, 1 number is n, indicating how many sets of questions there are

The second line, n integers a1, a2, . . . , an, respectively indicate how many questions there are in each set of questions

Output description:

Output a line, the maximum number of days this student does questions before being lazy

Sample input:

4

3 1 4 1

Sample output:

3

Scoring Criteria:

25 point: correctly output a set of data;

25 point: correctly output two sets of data;

25point: correctly output three sets of data;

25 point: correctly output four sets of data.