Research on Recursive and Non-Recursive Algorithm Solving a Question from "Blue Bridge Cup" National Software Competition in China

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Abstract

Coaching for the Blue Bridge Cup competition requires much effort. It is enlightening for students to study the solutions of typical competition questions. A strange game for the Blue Bridge Cup competition, Carrying on the topic detail decomposition.The recursive algorithm and non-recursive algorithm are given.

Keywords

Blue Bridge Cup, Software Competition, Non-Recursive Algorithm.

1. Introduction

The Blue Bridge Cup Competition is hosted by the personnel exchange centre of the Ministry of Industry and Information Technology. It is an important competition item of college education and teaching reform ,and innovative talent training. After years of development, the competition has attracted more than 1,400 universities, including Peking University, Tsinghua University, Shanghai Jiao Tong University, Fudan University, Nanjing University, Harbin Institute of Technology and other well-known universities to participate.The total number of competitors has exceeded 300,000. It has become the leading IT professional competition in China.

This paper introduces the content and characteristics of the Blue Bridge Cup competition and studies two solutions of a blank filling problem for peer reference.

2. Basic Content and Features of the Competition

The current Blue Bridge Cup competition, because of the epidemic reason, the 11th provincial competition was divided into two batches. The 11th competition was held in July 2020 and October 2020, respectively. The School of Information Engineering of our school sent 16 players to participate in the Blue Bridge Cup competition in Jiangsu. One of the students won the first prize in the B group of C language in the Jiangsu competition area, then advanced to the national finals. After four hours of fierce competition, the student won the third prize in the final national competition.

The Blue Bridge Cup software competition not only requires students to master the knowledge points, but also requires students to have ability of information acquisition, understanding, processing, problem analysis and innovation, In order to transform relevant knowledge into specific methods to solve problems, which is what is needed to cultivate innovative talents.

3. The Topic Content

The Title is The Strange Game.

A TV station held a low carbon life Grand Prix. The scoring rules for the title are rather strange:

Each contestant has to answer ten questions (numbered from 1 to 10); The later the question, the more difficult it. If the answer is correct, the current score will be doubled. If answer the question

incorrectly, the player will lose the same points as the question number. (The contestant must answer the question. If he/she does not answer, he/she will be treated as an error.).

Each contestant has a starting point of 10 points.

A winner scored 100 points. If the player was not allowed to watch the game, how to figure out which question he or she got right and which one she got wrong?

If the correct answers are counted as 1 and the wrong answers as 0, the answers to the 10 questions can be represented by a string containing only 1 and 0. For example, 0010110011 is a possible case.

The job is to figure out all the possibilities. Each answer takes up one line.

The order of multiple answers is ignored.

4. Analyze and Understand the Problem

To get it right, so there are only ten questions, and each problem must be solved. If the answer is correct, the score is multiplied by 2. If the answer is wrong, the score corresponding to the current question number is deducted. According to the test cases in the question, the scoring process of the use cases is shown in Table 1.

Table 1. Calculation details of the answers

Topic serial number	Answering question mark	Score before answering	Score after the answer
1	0(error)	10	10-1=9
2	0(error)	9	9-2=7
3	1(correct)	7	7*2=14
4	0(error)	14	14-4=10
5	1(correct)	10	10*2=20
6	1(correct)	20	20*2=40
7	0(error)	40	40-7=33
8	0(error)	33	33-8=25
9	1(correct)	25	25*2=50
10	1(correct)	50	50*2=100

The above table illustrates the specific situation of the answer score for the corresponding programming algorithm.

5. Solve the Problem Recursively

The recursion calls a total of 10 levels and stops at the eleventh level.

Design the exit and form of recursion. The recursive function is called competition, which has two parameters; one is an integer variant named step, the other is an integer variant named sum. Recursive answer calls are shown in Figure 1.
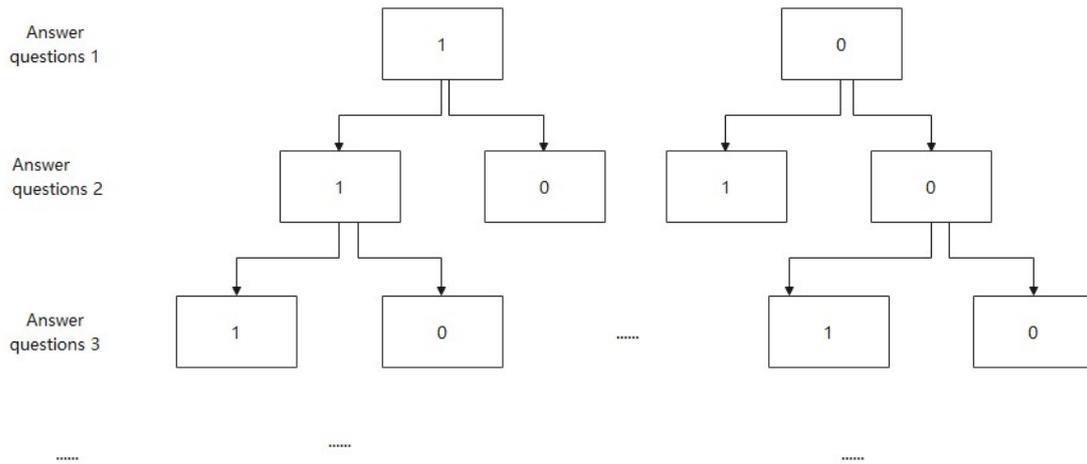
Figure 1. Recursive call analysis

The full code for the recursive solution is as follows:

```cpp
#include <iostream>
using namespace std;
int ans[12];
void competition(int sum,int step){
    if(step==11){
        if(sum==100){
            for(int i=1 ;i<11 ;i++){
                printf("%d",ans[i]);
            }
            puts("");
        }
    }
    else{
        ans[step]=0;
        competition (sum-step,step+1);   // wrong answer
        ans[step]=1;
        competition (sum*2,step+1);   //correct answer
    }
}
int main(){
    competition (10,1);
    return 0;
}
```

6. Solve the Problem with Non-Recursive Brute Force

One int array named dati [12] is declared in main function, where dati[0] is not used, and dati[11] is also not used. In order to store the answer marks, '0' means the wrong answer, and '1' means correct answer.

Some peers use the nested ten-layer cycle to enumerate all the answers, however the idea of this paper is to study the expression range of ten-bit unsigned binary from 0 to 1023 and convert the accessed decimal value into binary. The flow chart of decimal to binary (10-bit) is shown in Figure 2, and the use of array is the key.
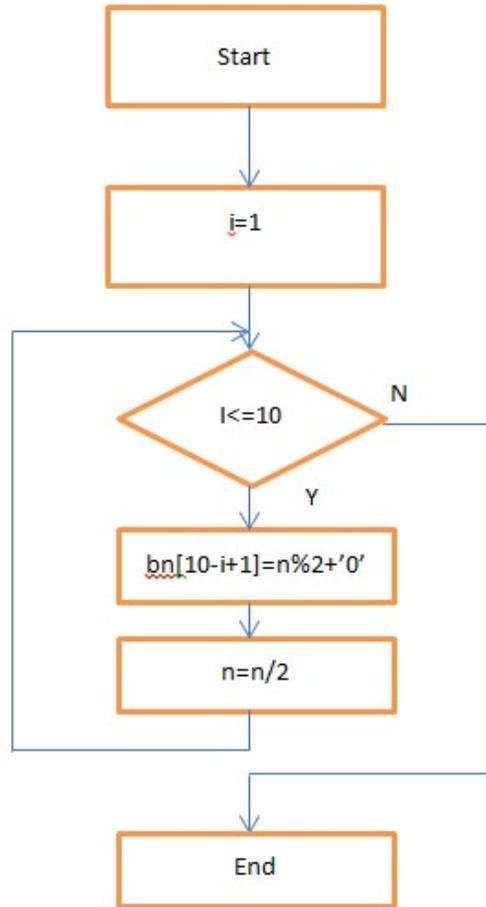

Figure 2. Decimal to binary flow chart

Then according to the rule of scoring score write score judgment function. Referring to Table 1, the score function of the design calculation is shown as follows.

int getResult(char *bn).

```
{
    int score=10;
    int i;
    for(i=1; i<=10;i++)
    {
        if(bn[i]=='0') score=score-i;
        else if(bn[i]=='1') score=score*2;

    }
    return score;
}
```

Finally, the main function is designed. The code is as follows.

```
int main ().
{
    char dati[12];
    int score;
    int num;
    score=10;
    for(num=0;num<=1023;num++)
    {
        change(dati,num);
        score=getResult(dati);
        if(score==100)
        {
            print(dati);
            printf("\n");
        }
    }
}.
```

Finally, run the program, and the result is shown in Figure 3.

Figure 3. Running results

7. Conclusion

Blue Bridge Cup Program Competition has received more and more attention in recent years, and there are nearly tens of thousands of contestants participating in it every year. To guide the contestants to give full play to their strengths and achieve achievements requires continuous research on the competition questions. This paper is just a blank for a recursive and non-recursive solution to do the demonstration; I hope to give peer reference. In the future, we will pay more attention to the more difficult questions and hope to get advice and guidance from the peers.

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