Algorithm Design CS3201
Term project:
Name: Irfan Lasman
ID: 5826801

Problem: 1353. Milliard Vasya's Function

Description:

Vasya is the beginning mathematician. He decided to make an important contribution to the science and to become famous all over the world. But how can he do that if the most interesting facts such as Pythagor's theorem are already proved? Correct! He is to think out something his own, original. So he thought out the Theory of Vasya's Functions. Vasya's Functions (VF) are rather simple: the value of the Nth VF in the point S is an amount of integers from 1 to N that have the sum of digits S. You seem to be great programmers, so Vasya gave you a task to find the milliard VF value (i.e. the VF with $N = 10^9$) because Vasya himself won't cope with the task. Can you solve the problem?

Requirements for this problem:

Input:
Integer S (1 ≤ S ≤ 81).
Output:
The milliard VF value in the point S.

Time limit: 1.0 second
Memory limit: 64 MB

Problem Author: Denis Musin
Problem Source: USU Junior Championship March'2005

Difficulty: 106

Code:

```cpp
Project > C++ Solution.cpp > ⬡ solve(int, int)
1  ∨ #include <cstdio>
2     #include <cstring>
3
4     using namespace std;
5
6     int memo[10][82];
7
```

Line:1,2 - Include the library that we are going to preprocess by include line 1 and 2
Line: 4 - imports the entirety of the **std** namespace.
Line: 6 - Declare memo 2D array with size of [10] [82].
It's mean that we create an array with 10 rows and 82 columns
(10*82 = 820 elements can be store in it)

Code:

```
 8  ∨ int solve(int D, int S){
 9        if(S<0) return 0;
10        if(D==0) return (S==0? 1 : 0);
11
12        int &ret = memo[D][S];
13
14  ∨     if(ret==-1){
15            ret = 0;
16
17            for(int i = 0;i<=9;++i)
18                ret += solve(D-1,S-i);
19        }
20
21        return ret;
22  }
```

Explanation is on next page.

Line: 8 – Create a method name solve with 2 parameter which is integer D and S.

Line: 9 – Check whether S is less than zero of not. If yes than we return zero.

Line: 10 - Check if D is equal to 0 or not. If yes than we check S again and if S is 0 we return 1 if not than we will return 0 instead.

Line: 12 - Declare a variable name ret which will return to be integer. and it store value of array memo with parameter D and S .

Line: 14 - Check if ret's value is equal to -1

Line: 15 - if ret's value is -1 than we set ret = 0.

Line: 17 - Create a for loop which will loop from 0 to 9.

Line: 18 - In the loop, we do a recursion with solve by decrease The value of D by 1 and S by I . Then we store in ret until the loop is done.

Line: 21 - After everything is done, we return method solve with ret.

Code:

```
24    int main(){
25        int S;
26        scanf("%d",&S);
27
28        memset(memo,-1,sizeof(memo));
29        printf("%d\n",solve(9,S)+(S==1? 1 : 0));
30
31        return 0;
32    }
```

Line: 24 - Create main() to run our code.
Line: 25 - Declare integer type name S
Line: 26 - Read and integer from user's keyboard and store it in S.
Line: 28 - memset() function is used to fill the array with specified value that we put in.

```
void* memset( void* str, int ch, size_t n);
Parameters
str[] : Pointer to the object to copy the character.
ch : The character to copy.
n : Number of bytes to copy.
Return value :
The memset() function returns str, the pointer to the destination string.
```
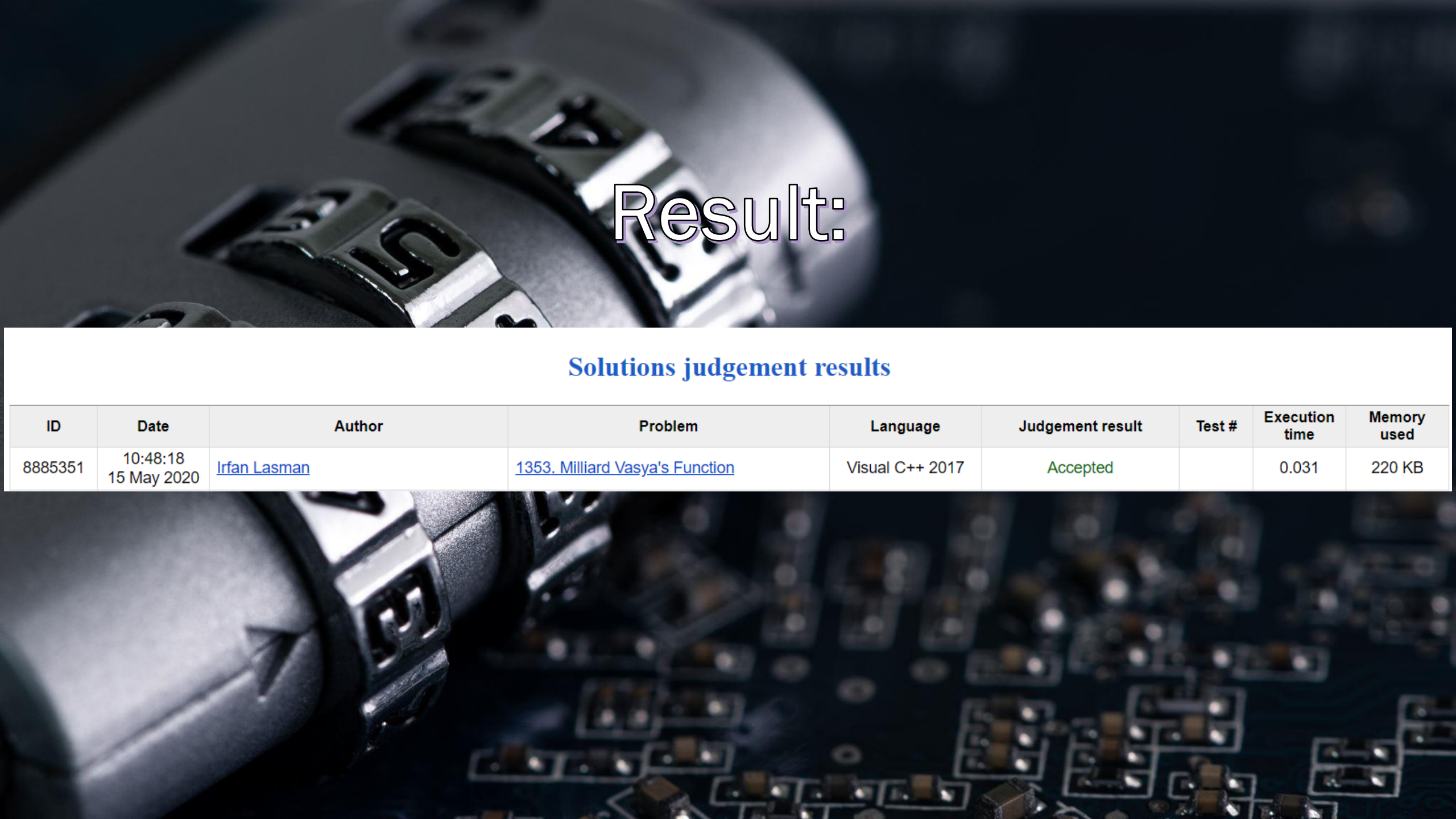
**Above is template of memset and its parameters
Line: 29 - print the value Milliard Vasya's Function that we enter.
Line: 30 - return 0 at the end of main().

Result:

Solutions judgement results

ID	Date	Author	Problem	Language	Judgement result	Test #	Execution time	Memory used
8885351	10:48:18 15 May 2020	Irfan Lasman	1353. Milliard Vasya's Function	Visual C++ 2017	Accepted		0.031	220 KB

References:

❖ http://timus.coach/problem.aspx?space=1&num=1353

❖ https://github.com/marioyc/Online-Judge-Solutions/blob/master/Timus%20Online%20Judge/1353%20-%20The%20milliard%20Vasya's%20function.cpp

❖ https://www.geeksforgeeks.org/memset-in-cpp/

Thank you!