



# 第5章 循环控制

## ——条件控制的循环



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# 选择循环的一般原则

- **for, while, do-while**
- **Just a general rule.**

循环次数已知	计数控制的循环 <b>for</b> 语句
循环次数未知 由一个给定的条件来控制	条件控制的循环 <b>while</b> 语句
循环体至少要执行一次	直到型循环 <b>do-while</b> 语句

# A Shopping street Game

## ➤ 购物街“看商品猜价格”游戏

Guess the price of a piece of goods ( an integer,  $[1, 100]$  )

Right: Congratulations!  
商品归你了!

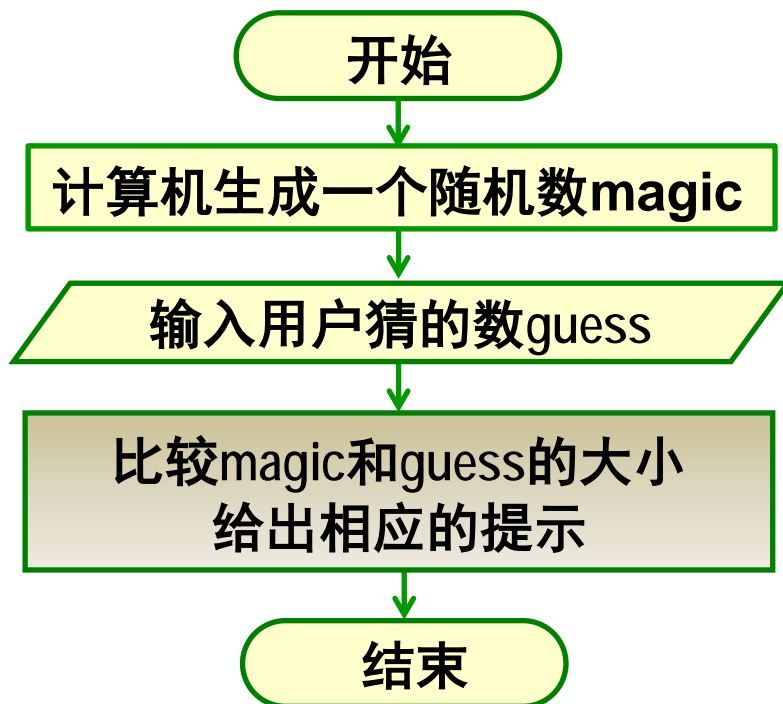
Wrong: greater or less?  
太大了! or 太小了!



# Shopping street Game—Guess a number

## ■ 猜数游戏

- 核心操作就是比较两个数的大小
- 两个数比较大小会有几种情况呢？



猜多个数，10次猜  
不对就猜下一个数

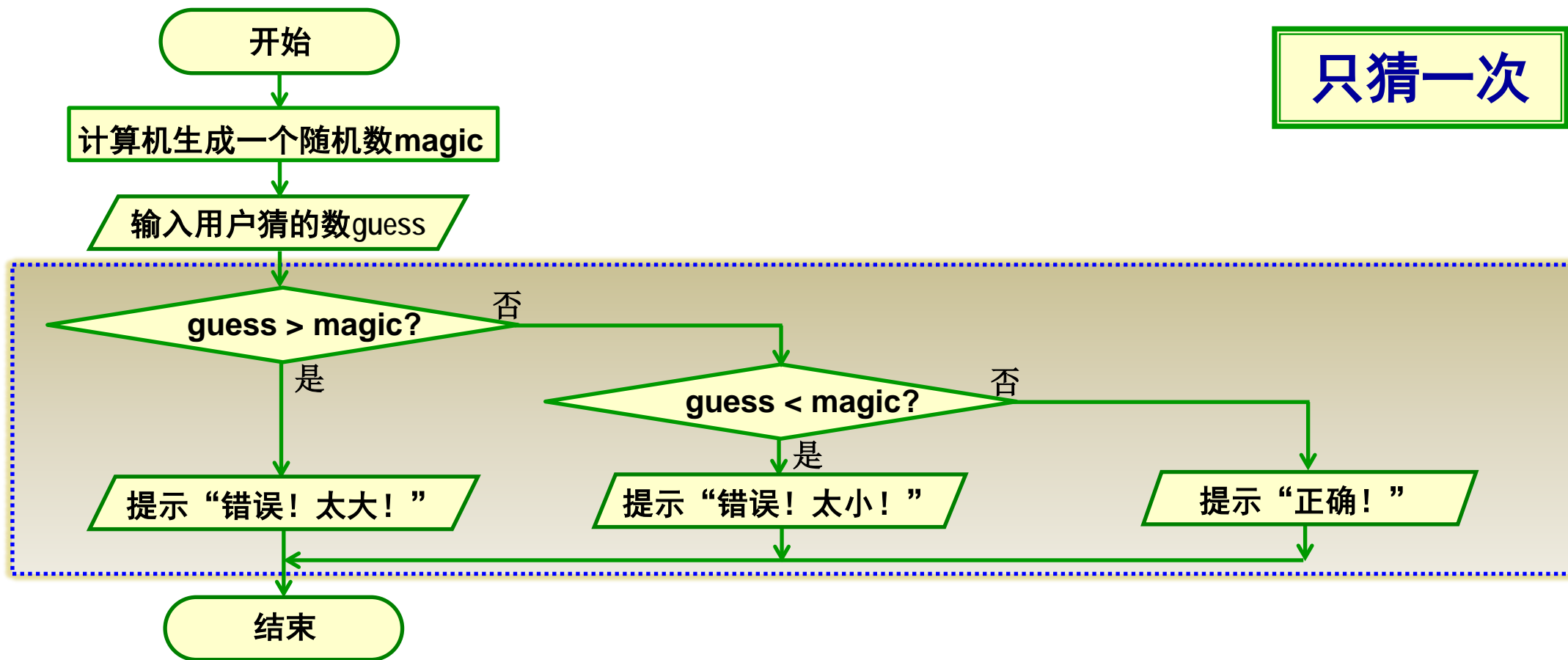
最多猜10次

直到猜对为止

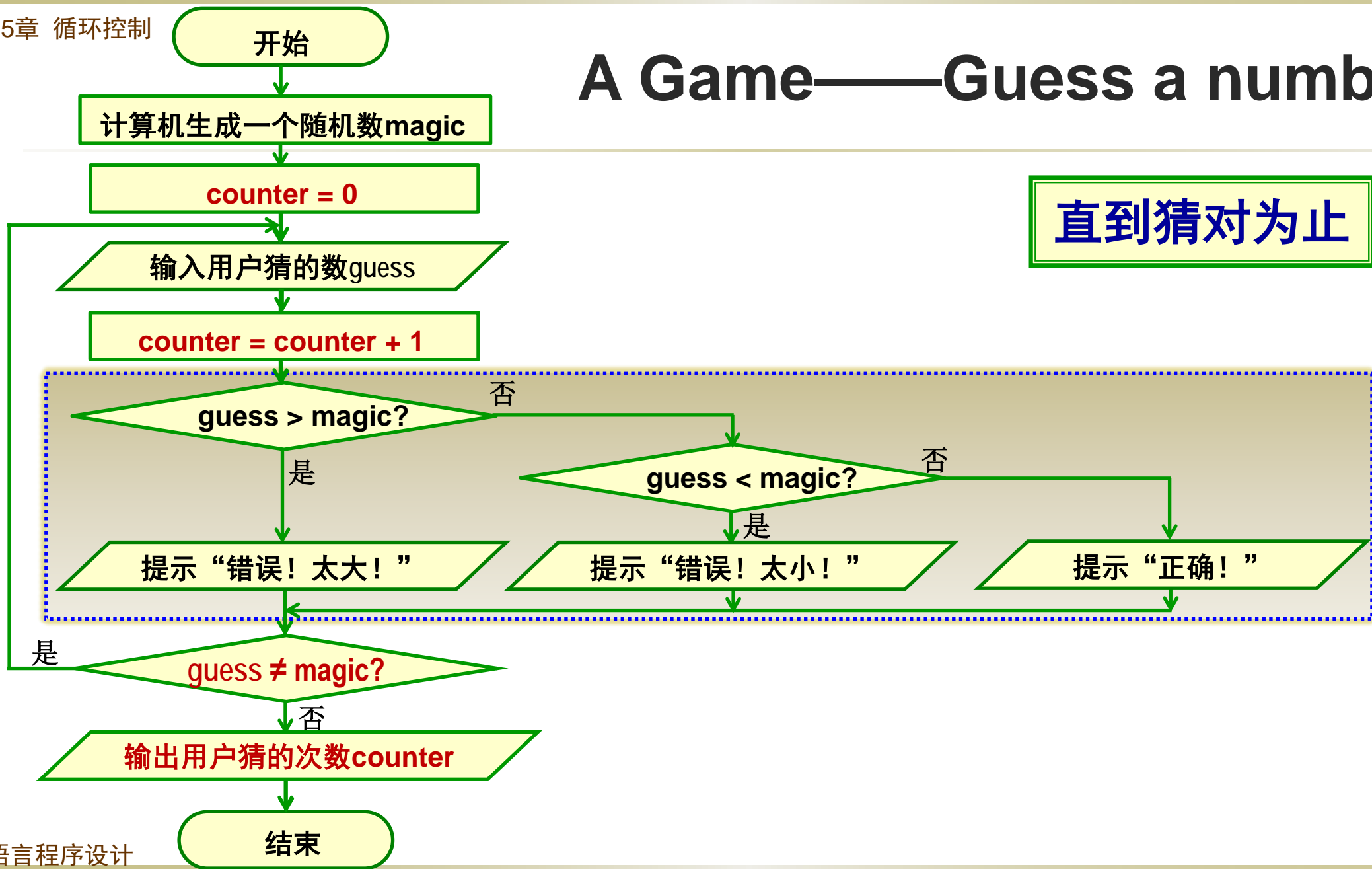
只猜一次

# A Game——Guess a number

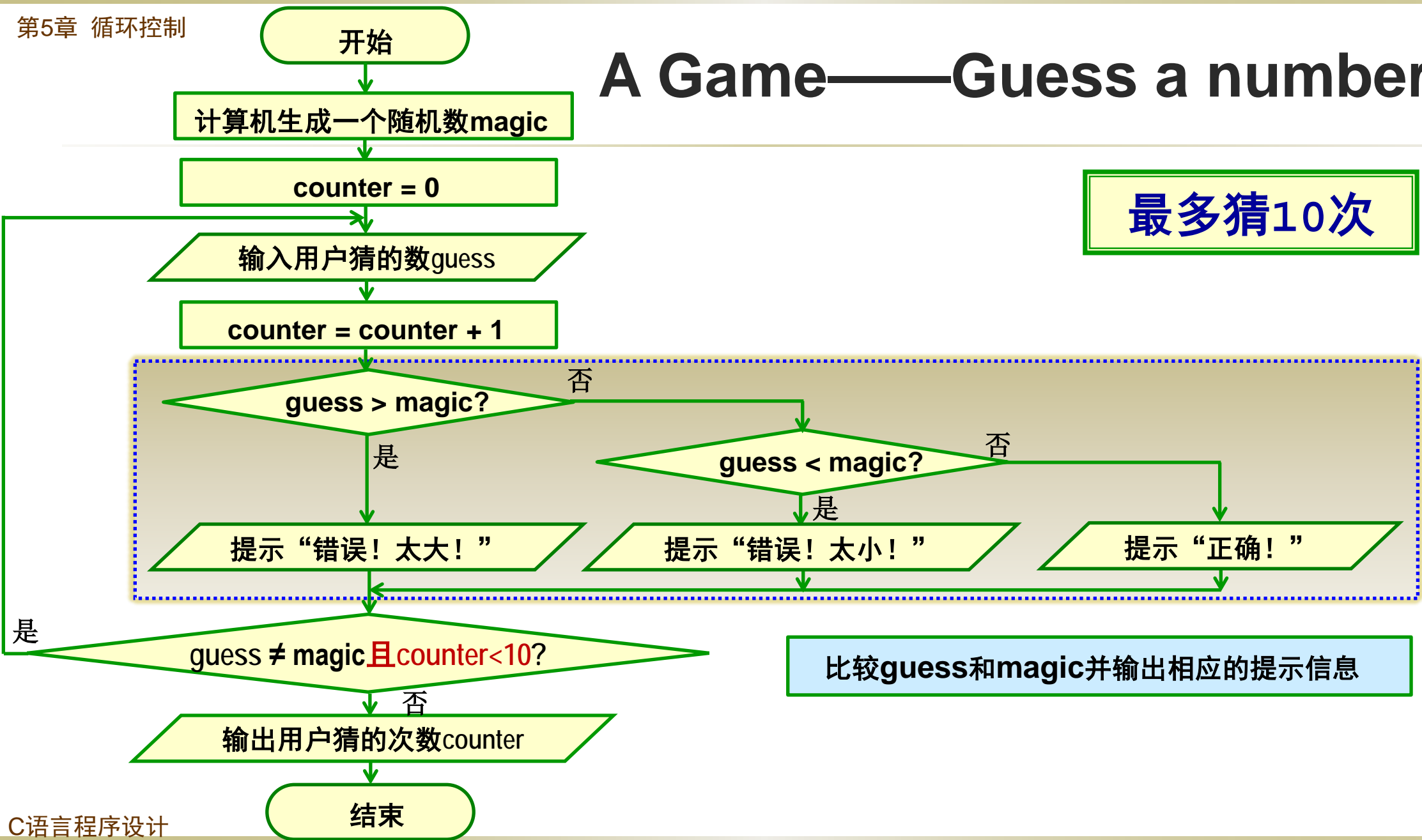
只猜一次



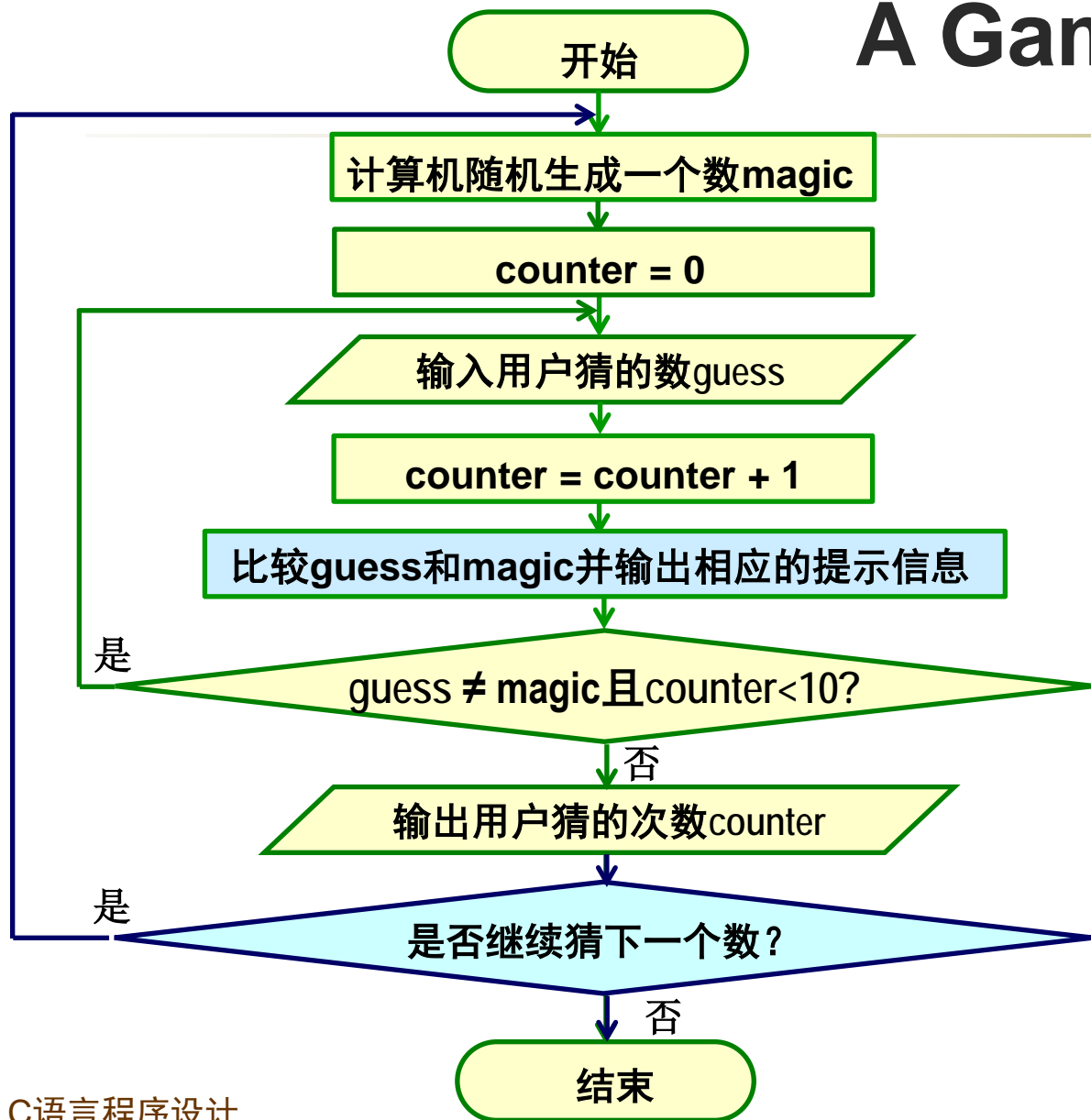
# A Game——Guess a number



## A Game——Guess a number



# A Game——Guess a number

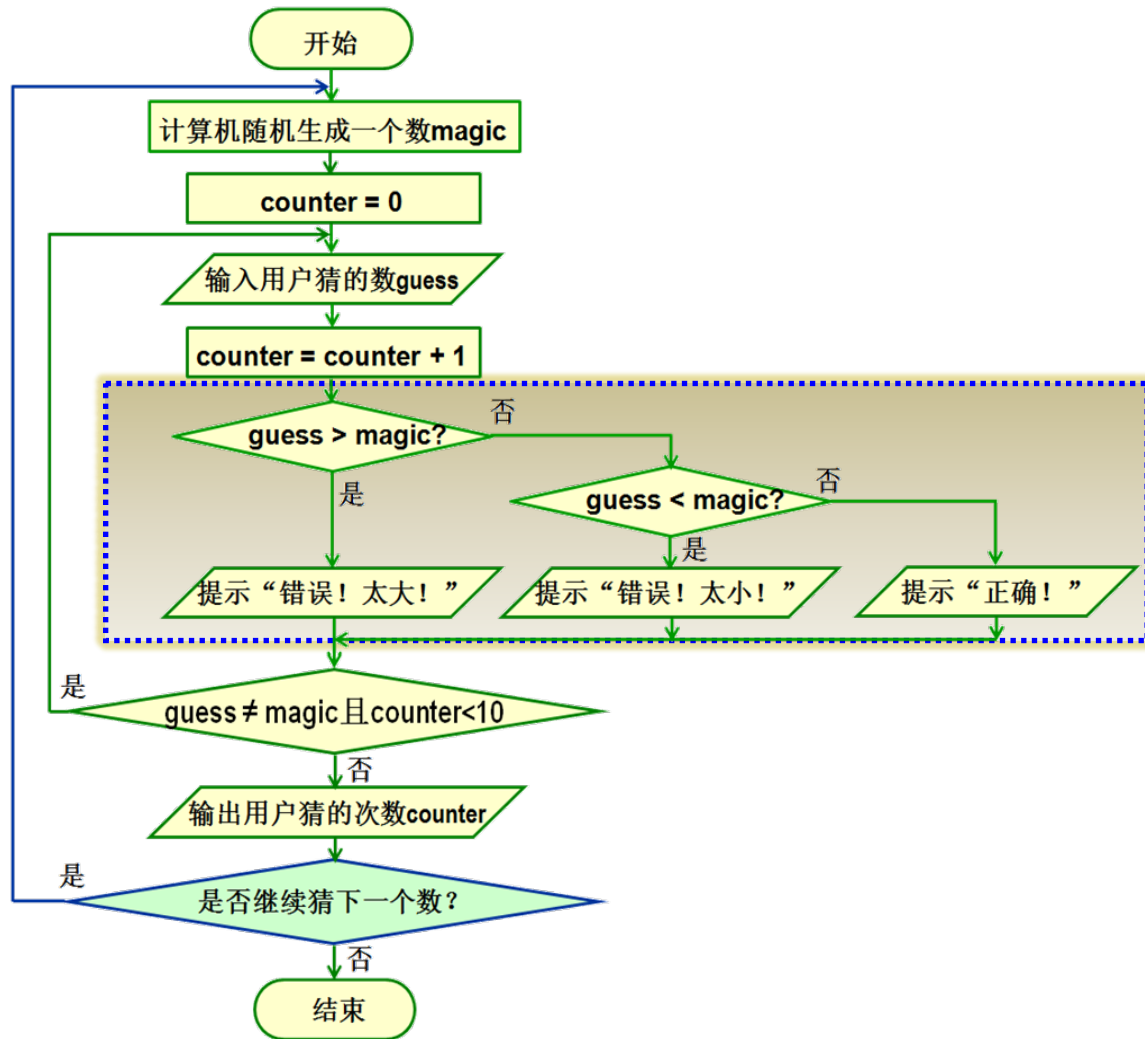
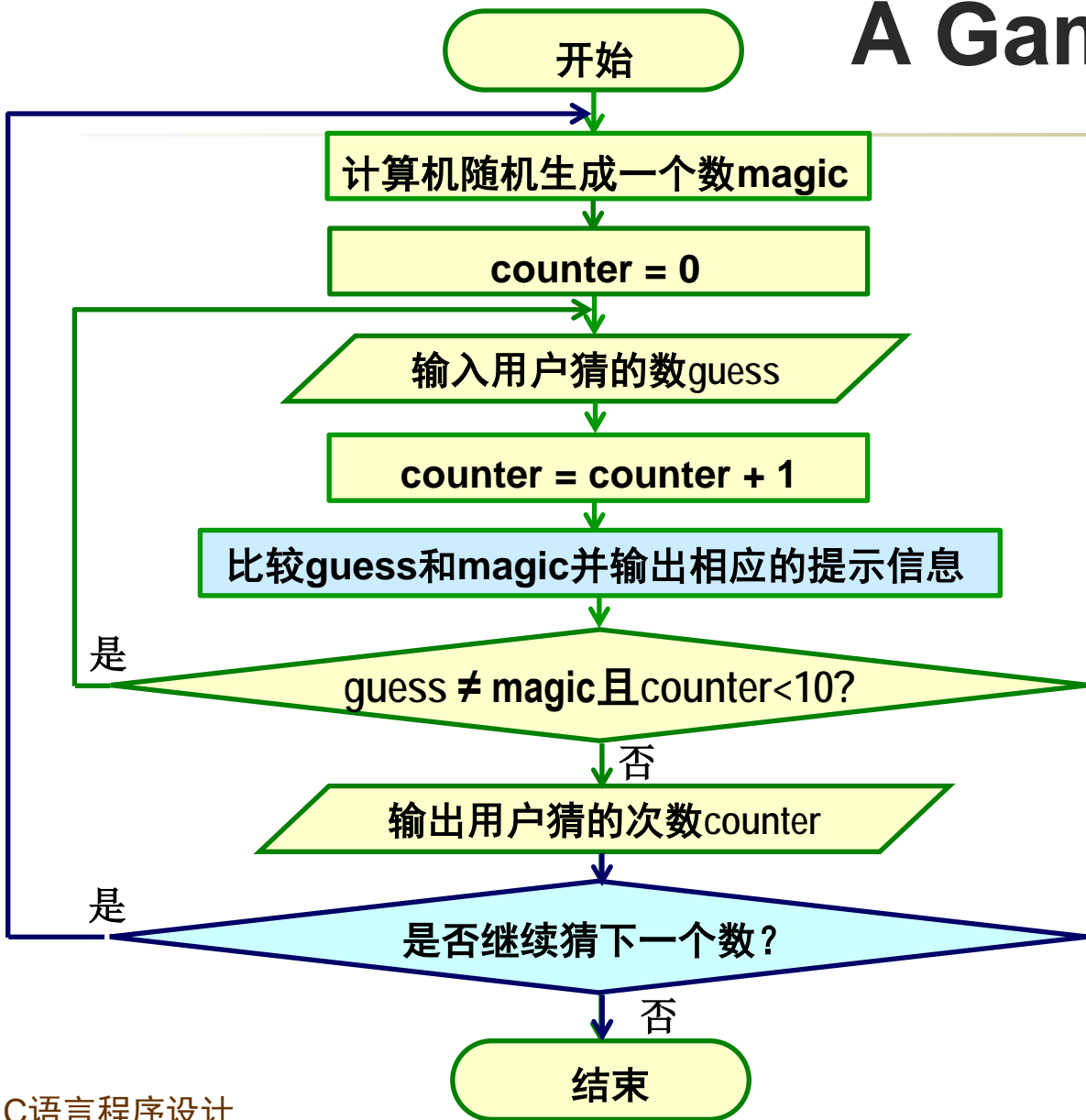


猜多个数，10次猜  
不对就猜下一个数

嵌套循环



# A Game——Guess a number



# 程序实现猜数游戏的关键

## ■ 随机函数rand()

- \* `magic = rand();`
- \* 产生`[0,RAND_MAX]`间的随机数
- \* `RAND_MAX`在`stdlib.h`中定义，不大于双字节整数的最大值32767
- \* `#include <stdlib.h>`

## ■ 产生`[0,99]` 之间的随机数

- \* `magic = rand()%100;`

## ■ 产生`[1,100]` 之间的随机数

- \* `magic = rand()%100 + 1;`

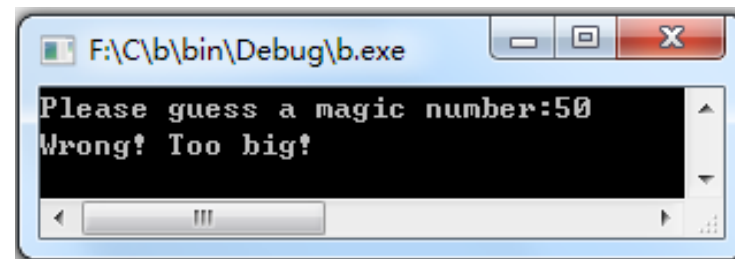
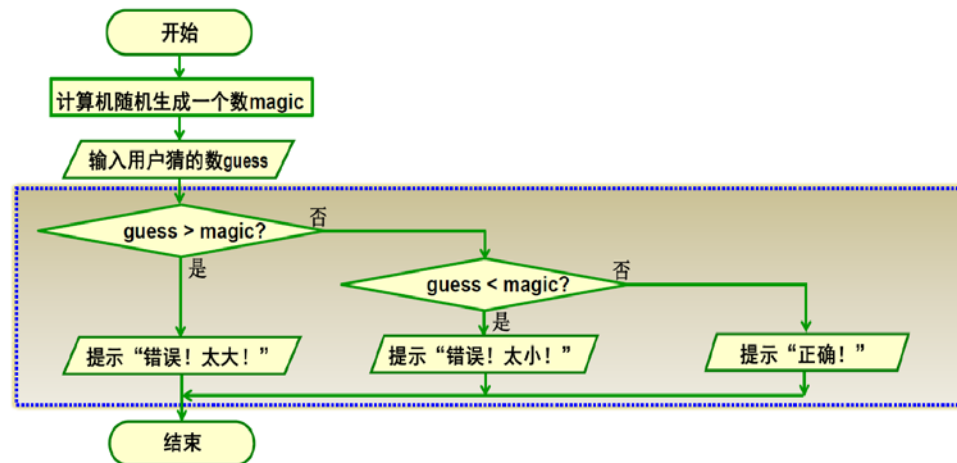
怎样模拟计算机想一个数？



```
#include <stdlib.h>
#include <stdio.h>
int main()
{
    int magic;          /*计算机"想"的数*/
    int guess;          /*人猜的数*/
    magic = rand()%100 + 1;
    printf("Please guess a magic number:");
    scanf("%d", &guess);

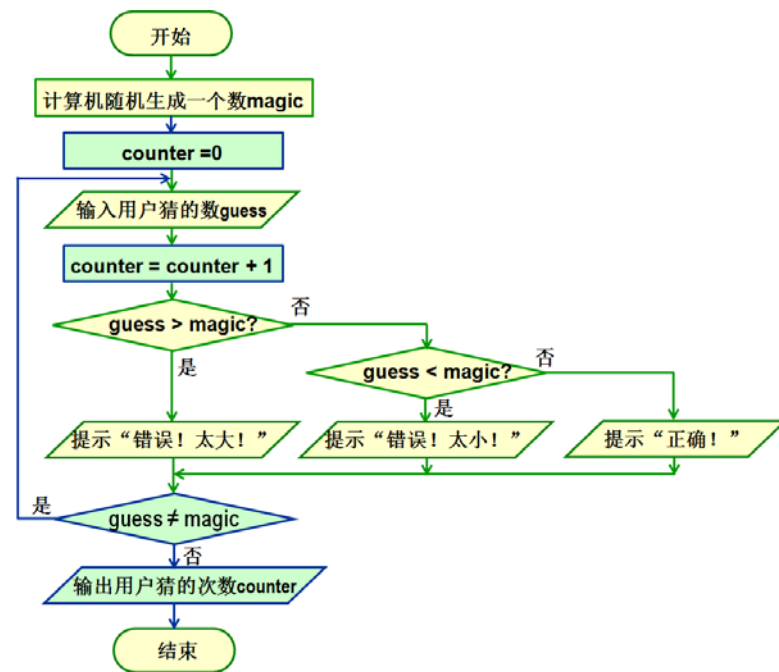
    if (guess > magic)
    {
        printf("Wrong! Too big!\n");
    }
    else if (guess < magic)
    {
        printf("Wrong! Too small!\n");
    }
    else
    {
        printf("Right! \n");
        printf("The number is:%d \n", magic);
    }
    return 0;
}
```

只猜一次



## 直到猜对为止

```
#include <stdlib.h>
#include <stdio.h>
int main()
{
    int  magic;
    int  guess;
    int  counter;    /*记录人猜次数的计数器变量*/
    magic = rand() % 100 + 1;
    counter = 0;      /*计数器变量count初始化为0*/
    do{
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter++;    /*计数器变量count加1*/
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic);
    printf("counter = %d \n", counter);
    return 0;
}
```



F:\C\b\bin\Debug\b.exe

```
Please guess a magic number:50
Wrong! Too big!
Please guess a magic number:40
Wrong! Too small!
Please guess a magic number:42
Right!
counter = 3
```

# 猜数游戏用到的库函数

- 函数rand()产生的是伪随机数

```
#include <stdio.h>
#include <stdlib.h>
int main()
{
    int i;
    for (i=0; i<10; i++)
    {
        printf("%d\n", rand());
    }
    return 0;
}
```



```
F:\C\test\bin\Debu...
41
18467
6334
26500
19169
15724
11478
29358
26962
24464
Press any key to continue
```

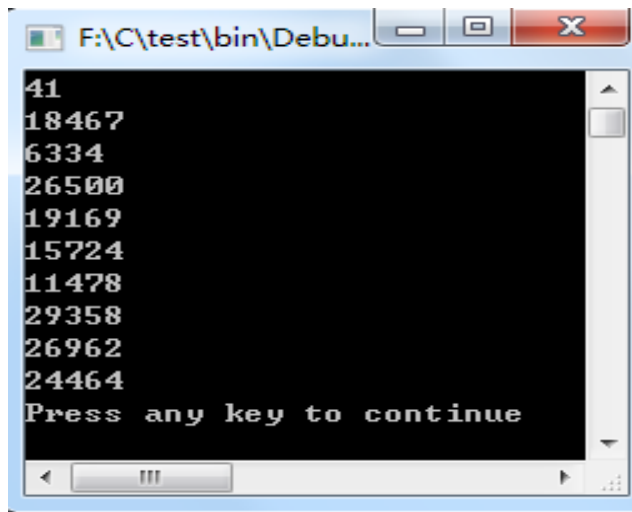
为什么每次运行机器所想的数都是一样呢？



# 猜数游戏用到的库函数

- 函数rand( )产生的是**伪随机数**

```
#include <stdio.h>
#include <stdlib.h>
int main()
{
    int i;
    for (i=0; i<10; i++)
    {
        printf("%d\n", rand());
    }
    return 0;
}
```



```
F:\C\test\bin\Debu...
41
18467
6334
26500
19169
15724
11478
29358
26962
24464
Press any key to continue
```

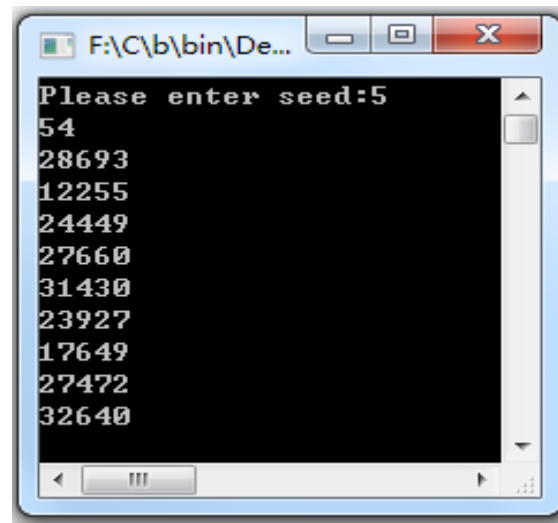
如何使生成的随机数足够随机呢？



# 猜数游戏用到的库函数

```
#include <stdio.h>
#include <stdlib.h>
int main()
{
    int i;
    unsigned int seed;
    printf("Please enter seed:");
    scanf("%u", &seed);
    srand(seed);
    for (i=0; i<10; i++)
    {
        printf("%d\n", rand());
    }
    return 0;
}
```

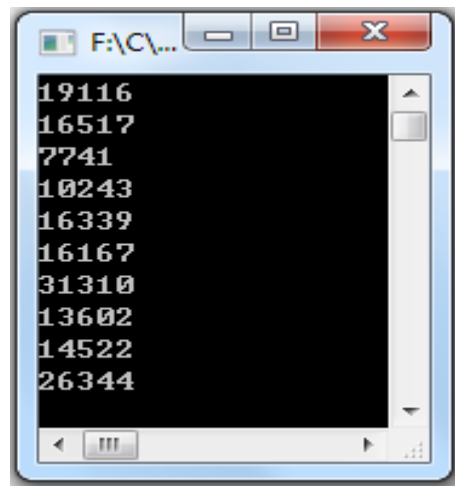
为rand( )设置随机数种子,  
使产生的随机数“随机化”



# 猜数游戏用到的库函数

```
#include <stdio.h>
#include <stdlib.h>
#include <time.h>
int main()
{
    int i;
    srand(time(NULL));
    for (i=0; i<10; i++)
    {
        printf("%d\n", rand());
    }
    return 0;
}
```

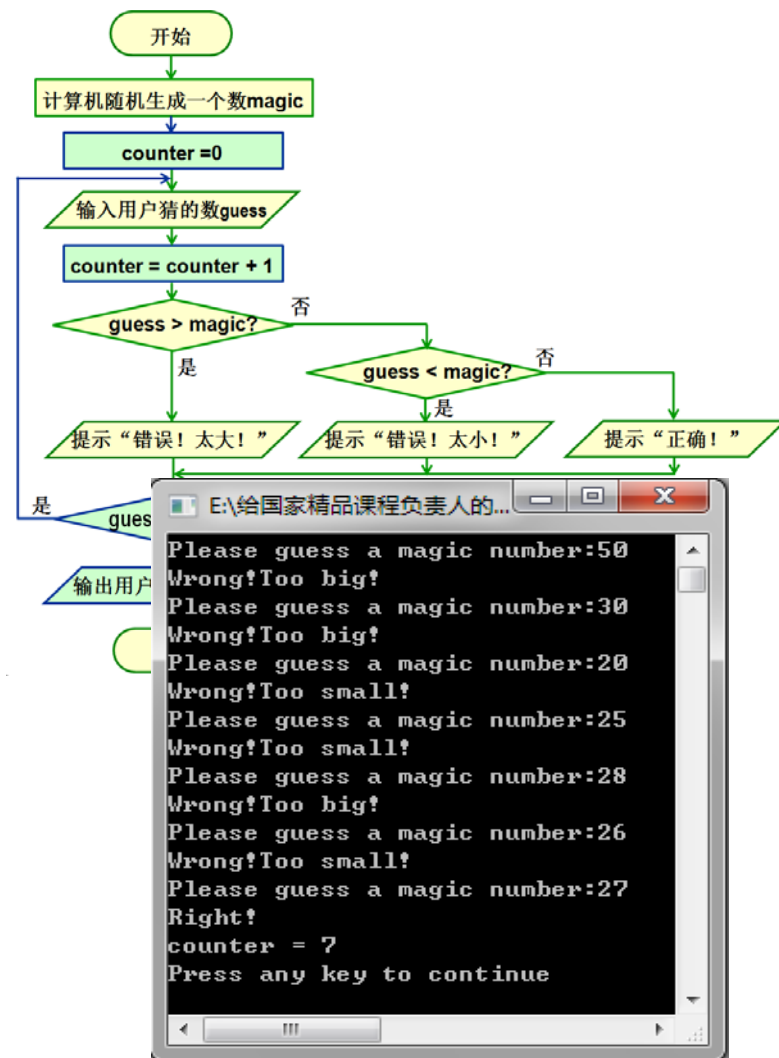
- 改用系统时间作为随机数种子更好
- 用函数 `time()` 获得系统时间
  - 两种方法—函数参数，函数返回值
  - 用 `NULL` 作为函数参数，使其仅能从返回值取得系统时间，便于将函数写到表达式中





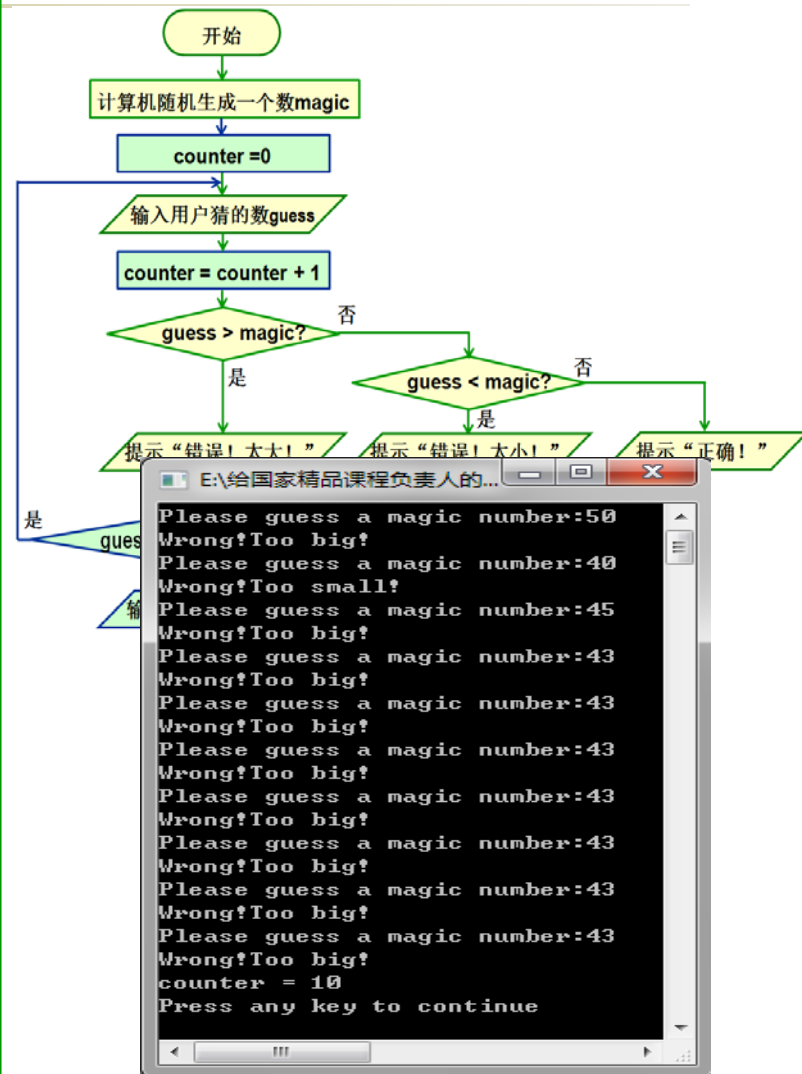
## 直到猜对为止

```
#include <stdlib.h>
#include <stdio.h>
#include <time.h>
int main()
{
    int magic;
    int guess;
    int counter;
    srand(time(NULL));
    magic = rand() % 100 + 1;
    counter = 0;
    do{
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic);
    printf("counter = %d \n", counter);
    return 0;
}
```



```
#include <stdlib.h>
#include <stdio.h>
#include <time.h>
int main()
{
    int magic;
    int guess;
    int counter;
    srand(time(NULL));
    magic = rand() % 100 + 1;
    counter = 0;
    do{
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic)&& counter < 10);
    printf("counter = %d \n", counter);
    return 0;
}
```

最多猜10次



## 猜多个数

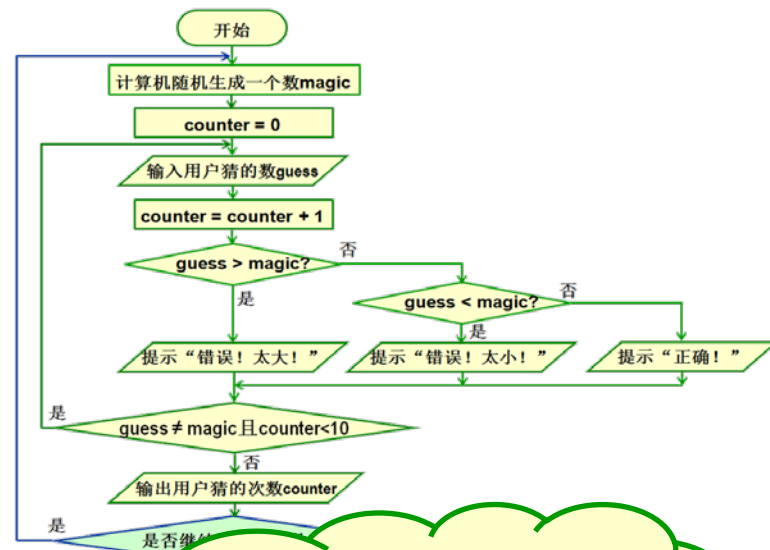
```

.....
srand(time(NULL));
do{

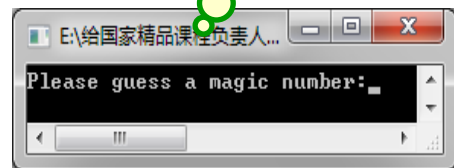
    magic = rand() % 100 + 1;
    counter = 0;
    do{

        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter ++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic && counter < 10);
    printf("counter = %d\n", counter);
    printf("Do you want to continue(Y/N or y/n)?\n");
    scanf(" %c", &reply);
}while ((reply == 'Y') || (reply == 'y'));

```



若格式不匹配，  
输入了非数字  
字符？



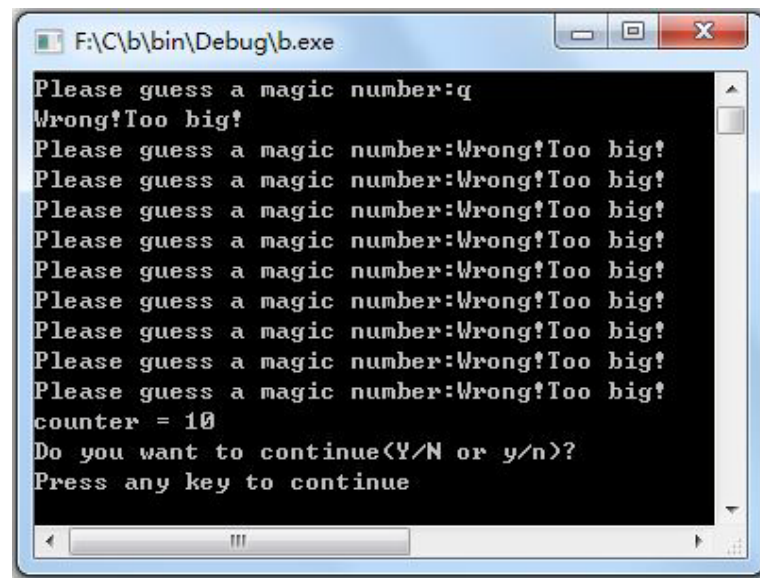
## 猜多个数

```
.....
srand(time(NULL));
do{

    magic = rand() % 100 + 1;
    counter = 0;

    do{

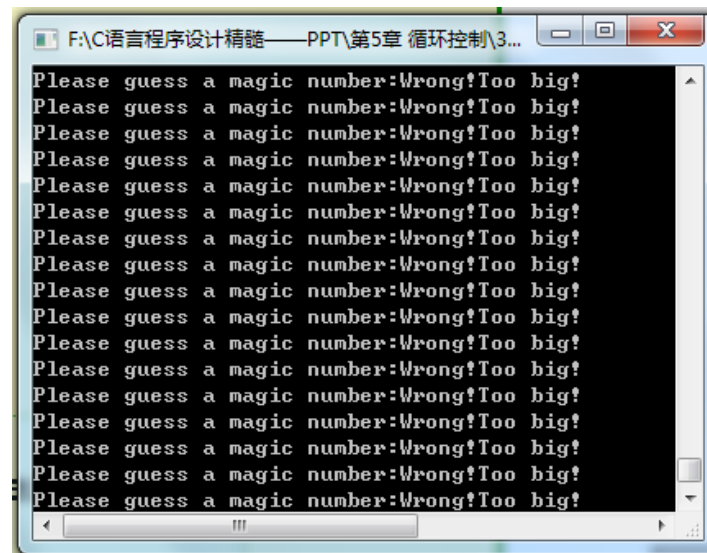
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter ++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic && counter < 10);
    printf("counter = %d\n", counter);
    printf("Do you want to continue(Y/N or y/n)?\n");
    scanf(" %c", &reply);
}while ((reply == 'Y') || (reply == 'y'));
```



```
F:\C\b\bin\Debug\b.exe
Please guess a magic number:q
Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
Please guess a magic number:Wrong! Too big!
counter = 10
Do you want to continue(Y/N or y/n)?
Press any key to continue
```

## 直到猜对为止

```
#include <stdlib.h>
#include <stdio.h>
#include <time.h>
int main()
{
    int magic;
    int guess;
    int counter;
    srand(time(NULL));
    magic = rand() % 100 + 1;
    counter = 0;
    do{
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic);
    printf("counter = %d \n", counter);
    return 0;
}
```



```
F:\C语言程序设计精髓——PPT\第5章 循环控制\3...
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Right!\n
```

**scanf()**按指定格式读取缓冲区中的数据，若读取失败，则缓冲区中的非数字字符不会被读走，因不等而一直处于判断、读取、判断、读取、...（死机）

```

.....
srand(time(NULL));
do{
    magic = rand() % 100 + 1;
    counter = 0;
    do{
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter ++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic && counter < 10);
    printf("counter = %d\n", counter);
    printf("Do you want to continue(Y/N or y/n)?\n");
    scanf(" %c", &reply);
}while ((reply == 'Y') || (reply == 'y'));

```

如何判断处理  
输入的非数字  
字符?

猜多个数

```

F:\C语言程序设计精髓——PPT\第5章 循环控制...
Please guess a magic number:y
Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
Please guess a magic number:Wrong!Too big!
counter = 10
Do you want to continue(Y/N or y/n)?
Please guess a magic number:

```

这个为什么没有死机?  
缓冲区中的非数字字符  
被谁读走了?

## 猜多个数

```

.....
srand(time(NULL));
do{

    magic = rand() % 100 + 1;
    counter = 0;
    do{
        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter ++;
        if (getchar() != '\n')
            ;//空语句
        else
            printf("Right!\n");
    }while (guess != magic && counter < 10);
    printf("counter = %d\n", counter);
    printf("Do you want to continue(Y/N or y/n)?\n");
    scanf(" %c", &reply);
}while ((reply == 'Y') || (reply == 'y'));

```

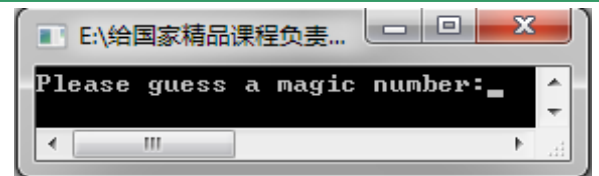
**scanf() 返回值为  
正确读入的数据项数**

```

ret = scanf("%d", &guess);
while (ret != 1)
{
    while (getchar() != '\n');
    printf("Please guess a magic number:");
    ret = scanf("%d", &guess);
}
counter ++;

```

**清除输入缓冲区中的残留  
数据，然后提示重新输入**





# 讨论

```
.....
srand(time(NULL));
do{

    magic = rand() % 100 + 1;
    counter = 0;
    do{

        printf("Please guess a magic number:");
        scanf("%d", &guess);
        counter ++;
        if (guess > magic)
            printf("Wrong! Too big!\n");
        else if (guess < magic)
            printf("Wrong! Too small!\n");
        else
            printf("Right!\n");
    }while (guess != magic && counter < 10);
    printf("counter = %d\n", counter);
    printf("Do you want to continue(Y/N or y/n)?\n");
    scanf(" %c", &reply);

}while ((reply == 'Y') || (reply == 'y'));
```

改成 `(reply != 'N') && (reply != 'n')`  
后的执行效果是否完全一样?





