1 随机数结合计数器的均匀性测试

本实验假设所有代码文件放在同一文件夹中。请按照要求，产生可执行文件，并给出每一个步骤的截图。以下要求使用 Linux 或者 Windows 的 GCC 工具。

1.1 均匀性测试

以下包括代码和操作。

1.1.1 `main.c` 文件

```c
#include <stdio.h>
#include <time.h> // 支持time()函数
#include <stdlib.h> // 支持伪随机数操作
#include <limits.h>

typedef unsigned long long uLL;

int main()
{
    srand(time(NULL)); // 布置种子
    printf("RAND_MAX: %d\n", RAND_MAX);

    // 以下为计数器
    uLL counter0 = 0, counter1 = 0, counter2 = 0, counter3 = 0,
        counter4 = 0, counter5 = 0, counter6 = 0, counter7 = 0,
        counter8 = 0, counter9 = 0;

    uLL sequence_length = ULLONG_MAX >> 36; // 随机序列的长度
    for(uLL i = 0; i < sequence_length; i++) //
        循环sequence_length次，从而产生多个随机数
    {
       int d; // 用于保存生成的伪随机数
       d = rand() % 10; // 获得下一个0-9之间的伪随机数
       switch (d)
       {
          case 0:
```

```
24              counter0++;
25              break;
26          case 1:
27              counter1++;
28              break;
29          case 2:
30              counter2++;
31              break;
32          case 3:
33              counter3++;
34              break;
35          case 4:
36              counter4++;
37              break;
38          case 5:
39              counter5++;
40              break;
41          case 6:
42              counter6++;
43              break;
44          case 7:
45              counter7++;
46              break;
47          case 8:
48              counter8++;
49              break;
50          case 9:
51              counter9++;
52      }
53  }
54  printf("having generated %llu psudorandom numbers.\n",
        sequence_length);
55  printf("occurrences of 0: %d, frequency: %.5lf\n",
        counter0, (double)counter0 / sequence_length);
56  printf("occurrences of 1: %d, frequency: %.5lf\n",
        counter1, (double)counter1 / sequence_length);
57  printf("occurrences of 2: %d, frequency: %.5lf\n",
        counter2, (double)counter2 / sequence_length);
58  printf("occurrences of 3: %d, frequency: %.5lf\n",
```

```
        counter3, (double)counter3 / sequence_length);
59    printf("occurrences of 4: %d, frequency: %.5lf\n",
        counter4, (double)counter4 / sequence_length);
60    printf("occurrences of 5: %d, frequency: %.5lf\n",
        counter5, (double)counter5 / sequence_length);
61    printf("occurrences of 6: %d, frequency: %.5lf\n",
        counter6, (double)counter6 / sequence_length);
62    printf("occurrences of 7: %d, frequency: %.5lf\n",
        counter7, (double)counter7 / sequence_length);
63    printf("occurrences of 8: %d, frequency: %.5lf\n",
        counter8, (double)counter8 / sequence_length);
64    printf("occurrences of 9: %d, frequency: %.5lf\n",
        counter9, (double)counter8 / sequence_length);
65    return 0;
66  }
```

1. 根据以上代码产生可执行文件，并把产生的文件命名为 `main.exe`。运行 `main.exe`，记下输出并获得 `0-9` 各个数字出现的频数和频率。
2. 把上述运行和记录的步骤重复 4 次，从而一共得到 5 次实验结果。然后计算 `0-9` 各个数字出现的平均频率。
3. 从以上实验步骤的结果中，你得到什么结论?

1.2 实验报告写作要求

1. 步骤详细;
2. 表述简明;
3. 图文并茂;
4. 逻辑流畅。