伪随机数程序的分析

2022 年 8 月 16 日

1. 已知如下程序的输出列在它的后面，阅读后面一个程序 `main.c`，并结合所给的伪随机数表，回答相应问题。

```c
#include <stdio.h>
#include <stdlib.h>
int main()
{
    for(int s = 1; s <= 20; s++)
    {
        srand(s);
        printf("with seed %d, the respective psudorandom number sequence:\n", s);
        for(int i = 1; i <= 10; i++)
        {
            int n = rand();
            printf("%d\t", n);
        }
        printf("...\n");
    }

    for(int s = 51; s <= 60; s++)
    {
        srand(s);
        printf("with seed %d, the respective psudorandom number sequence:\n", s);
        for(int i = 1; i <= 10; i++)
        {
            int n = rand();
            printf("%d\t", n);
        }
        printf("...\n");
```

```
    }

    for(int s = 101; s <= 110; s++)
    {
        srand(s);
        printf("with seed %d, the respective psudorandom number sequence:\n", s);
        for(int i = 1; i <= 10; i++)
        {
            int n = rand();
            printf("%d\t", n);
        }
        printf("...\n");
    }
    return 0;
}
```

```
with seed 1, the respective psudorandom number sequence:
41      18467   6334    26500   19169   15724   11478   29358   26962   24464   ...
with seed 2, the respective psudorandom number sequence:
45      29216   24198   17795   29484   19650   14590   26431   10705   18316   ...
with seed 3, the respective psudorandom number sequence:
48      7196    9294    9091    7031    23577   17702   23503   27217   12168   ...
with seed 4, the respective psudorandom number sequence:
51      17945   27159   386     17345   27504   20815   20576   10960   6020    ...
with seed 5, the respective psudorandom number sequence:
54      28693   12255   24449   27660   31430   23927   17649   27472   32640   ...
with seed 6, the respective psudorandom number sequence:
58      6673    30119   15745   5206    2589    27040   14722   11216   26492   ...
with seed 7, the respective psudorandom number sequence:
61      17422   15215   7040    15521   6516    30152   11794   27727   20344   ...
with seed 8, the respective psudorandom number sequence:
64      28170   311     31103   25835   10443   497     8867    11471   14195   ...
with seed 9, the respective psudorandom number sequence:
68      6151    18175   22398   3382    14369   3609    5940    27982   8047    ...
with seed 10, the respective psudorandom number sequence:
```

```
71      16899   3272    13694   13697   18296   6722    3012    11726   1899    ...
with seed 11, the respective psudorandom number sequence:
74      27648   21136   4989    24011   22223   9834    85      28238   28519   ...
with seed 12, the respective psudorandom number sequence:
77      5628    6232    29052   1558    26150   12947   29926   11981   22371   ...
with seed 13, the respective psudorandom number sequence:
81      16376   24096   20348   11872   30076   16059   26999   28493   16223   ...
with seed 14, the respective psudorandom number sequence:
84      27125   9192    11643   22187   1235    19171   24071   12236   10075   ...
with seed 15, the respective psudorandom number sequence:
87      5105    27056   2938    32501   5162    22284   21144   28748   3927    ...
with seed 16, the respective psudorandom number sequence:
90      15854   12153   27002   10048   9089    25396   18217   12491   30547   ...
with seed 17, the respective psudorandom number sequence:
94      26602   30017   18297   20363   13015   28509   15290   29003   24399   ...
with seed 18, the respective psudorandom number sequence:
97      4582    15113   9592    30677   16942   31621   12362   12747   18251   ...
with seed 19, the respective psudorandom number sequence:
100     15331   209     888     8224    20869   1966    9435    29258   12103   ...
with seed 20, the respective psudorandom number sequence:
103     26079   18073   24951   18538   24795   5078    6508    13002   5955    ...
with seed 51, the respective psudorandom number sequence:
205     31600   14807   17250   10610   15452   3260    14066   573     11973   ...
with seed 52, the respective psudorandom number sequence:
208     9580    32671   8545    20925   19379   6373    11139   17085   5824    ...
with seed 53, the respective psudorandom number sequence:
211     20329   17767   32608   31239   23306   9485    8212    828     32444   ...
with seed 54, the respective psudorandom number sequence:
214     31077   2863    23904   8786    27232   12597   5284    17340   26296   ...
with seed 55, the respective psudorandom number sequence:
218     9057    20727   15199   19100   31159   15710   2357    1083    20148   ...
with seed 56, the respective psudorandom number sequence:
221     19806   5823    6494    29415   2318    18822   32198   17595   14000   ...
with seed 57, the respective psudorandom number sequence:
```

```
224     30554   23688   30558   6962    6244    21935   29271   1339    7852    ...
with seed 58, the respective psudorandom number sequence:
228     8535    8784    21853   17276   10171   25047   26343   17850   1704    ...
with seed 59, the respective psudorandom number sequence:
231     19283   26648   13148   27591   14098   28160   23416   1594    28324   ...
with seed 60, the respective psudorandom number sequence:
234     30031   11744   4443    5137    18025   31272   20489   18105   22176   ...
with seed 101, the respective psudorandom number sequence:
368     11964   23279   7999    2051    15181   27811   31542   6953    32249   ...
with seed 102, the respective psudorandom number sequence:
371     22713   8375    32063   12365   19107   30923   28615   23464   26101   ...
with seed 103, the respective psudorandom number sequence:
374     693     26240   23358   22680   23034   1268    25688   7208    19953   ...
with seed 104, the respective psudorandom number sequence:
378     11441   11336   14653   227     26961   4380    22761   23719   13805   ...
with seed 105, the respective psudorandom number sequence:
381     22190   29200   5949    10541   30887   7492    19833   7463    7657    ...
with seed 106, the respective psudorandom number sequence:
384     170     14296   30012   20856   2046    10605   16906   23975   1509    ...
with seed 107, the respective psudorandom number sequence:
388     10919   32160   21307   31170   5973    13717   13979   7718    28129   ...
with seed 108, the respective psudorandom number sequence:
391     21667   17256   12603   8717    9900    16830   11052   24230   21981   ...
with seed 109, the respective psudorandom number sequence:
394     32415   2353    3898    19031   13826   19942   8124    7973    15833   ...
with seed 110, the respective psudorandom number sequence:
397     10396   20217   27961   29346   17753   23055   5197    24485   9685    ...
```

以下为 main.c 程序。

```c
#include <stdio.h>
#include <stdlib.h>
int main()
{
    srand(3);
    for(int i = 0; i < 10; i += 2)
```

```
    {
        int n = rand();
        printf("%d\t", n);
    }
    printf("\n");
    srand(15);
    printf("%d\n", rand());
    srand(103);
    for(int i = 0; i < 8; i++)
    {
        int n = rand();
        if(i < 3)
        {
            continue;
        }
        printf("%d\t", n);
    }
    printf("\n");
    return 0;
}
```

1. 根据以上程序的运行，请写出输出结果。
2. 如果需要从 rand() 函数获取 7999，需要进行什么操作?
3. 如何最快从 rand() 中获得不小于 1000 且不大于 5000 的伪随机数?
4. 种子设置为何值时，最快获得两个小于 1000 的伪随机数?