散列

散列函数：随机数

09-B2

As I have said so many times, God doesn't play dice with the world.

- A. Einstein

那妇人道：“不好，不好！我这里有一方手帕，你顶在头上，遮了脸，撞个天婚，教我女儿从你跟前走过，你伸开手扯倒那个就把那个配了你罢。”

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（伪）随机数法

❖ 循环：$\mathrm{rand}(x + 1) = [a \times \mathrm{rand}(x)] \% M$ //M素数，$a \% M \neq 0$

$a = 7^5 = 16{,}807 = \boxed{100000110100111}_b$

$M = 2^{31} - 1 = 2{,}147{,}483{,}647 = 01111111\ \boxed{11111111}\ 11111111\ \boxed{11111111}_b$

❖ 径取：$\mathrm{hash}(key) = \mathrm{rand}(key) = [\mathrm{rand}(0) \times a^{key}] \% M$

种子：$\mathrm{rand}(0) = ?$

❖ 把难题推给伪随机数发生器，但是...

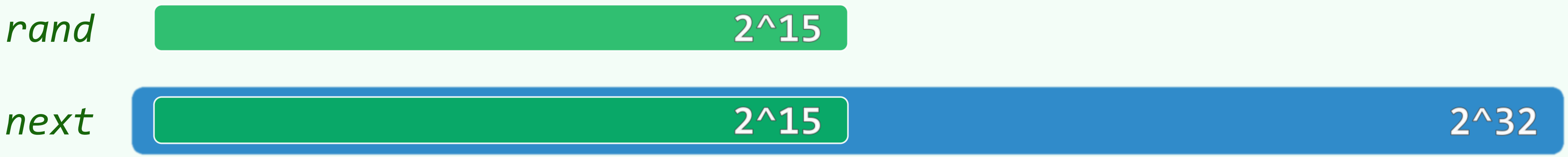
❖ （伪）随机数发生器的实现，因具体平台、不同历史版本而异

创建的散列表**可移植性**差——故需慎用此法！

(伪) 随机数法：The C Programming Language (2nd edn), p46

❖ `unsigned long int next = 1; //sizeof(long int) = 8`

```
void srand(unsigned int seed) {  next = seed;  } //sizeof(int) = 4 or 8
int rand(void) { //1103515245  =  3^5 * 5 * 7 * 129749
   next = next * 1103515245 + 12345;
   return (unsigned int)(next/65536) % 32768;
}
```

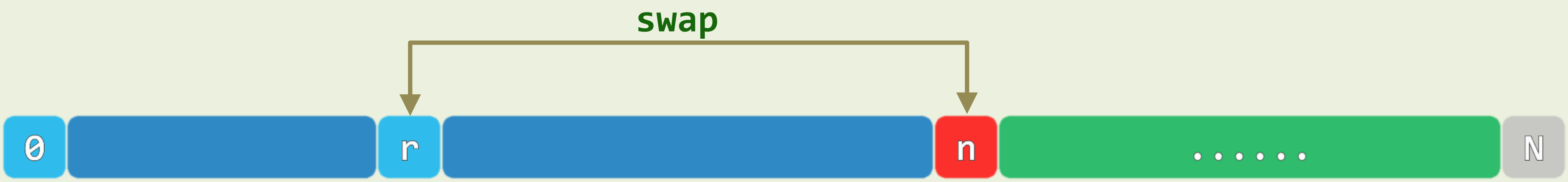


❖ `int rand() { int uninitialized; return uninitialized; }`

```
char* rand( t_size n ) { return ( char* ) malloc( n ); }
```

就地随机置乱：任给一个数组A[0, n)，理想地将其中元素的次序随机打乱

```
//[R. Fisher & F. Yates, 1938], [R. Durstenfeld, 1964], [D. E. Knuth, 1969]
void shuffle( int A[], int n ) {
   for ( ; 1 < n; --n ) //自后向前，依次将各元素
      swap( A[ rand() % n ], A[ n - 1 ] ); //与随机选取的某一前驱（含自身）交换
} //20! < 2^64 < 21!
```



❖ 的确可以等概率地生成所有n!种排列？ $20! < 2^{64} < 21!$