12.排序

（a4）快速排序：变种

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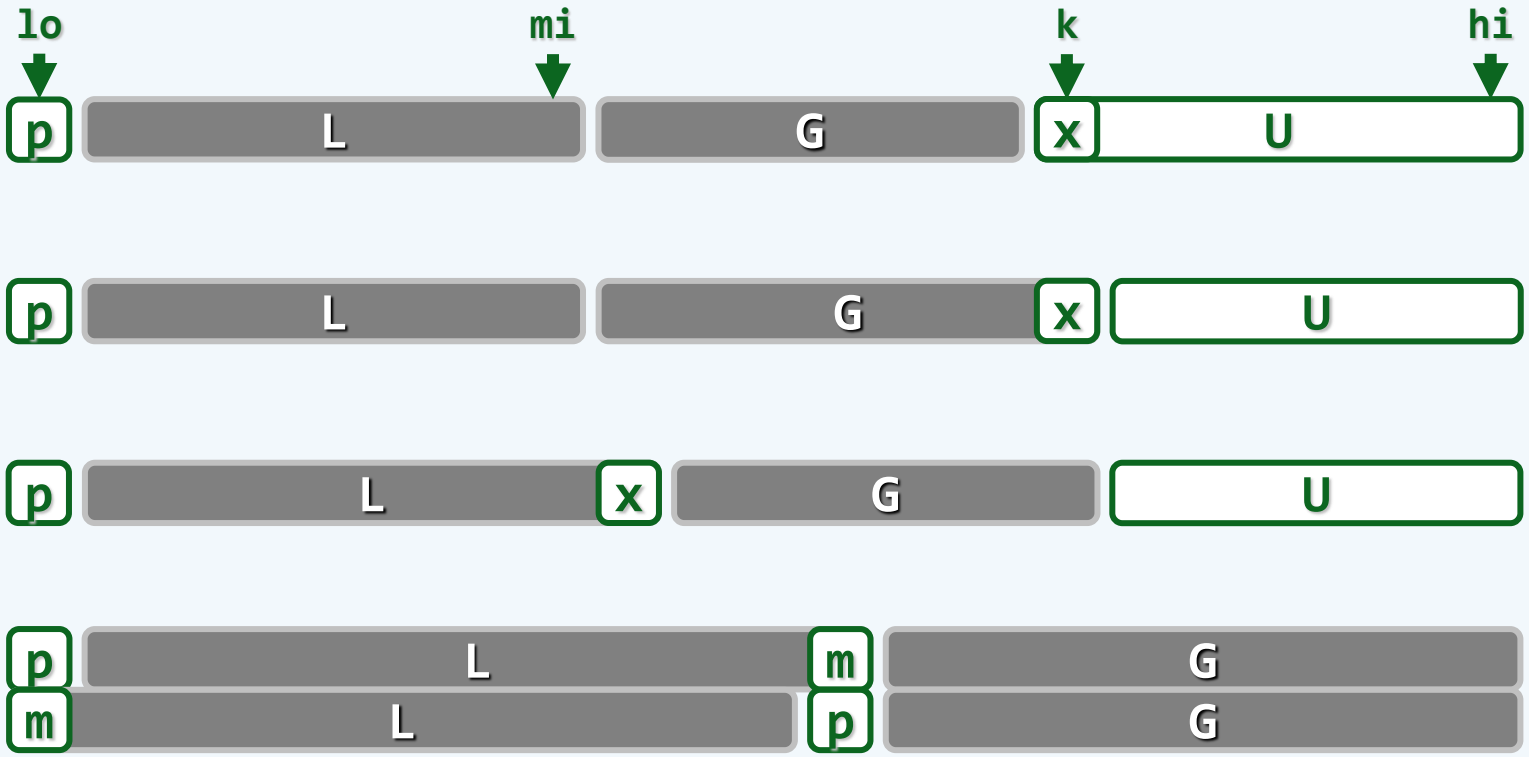
不变性

❖ 四部分： S = [lo] + L(lo, mi] + G(mi, k) + U[k, hi]

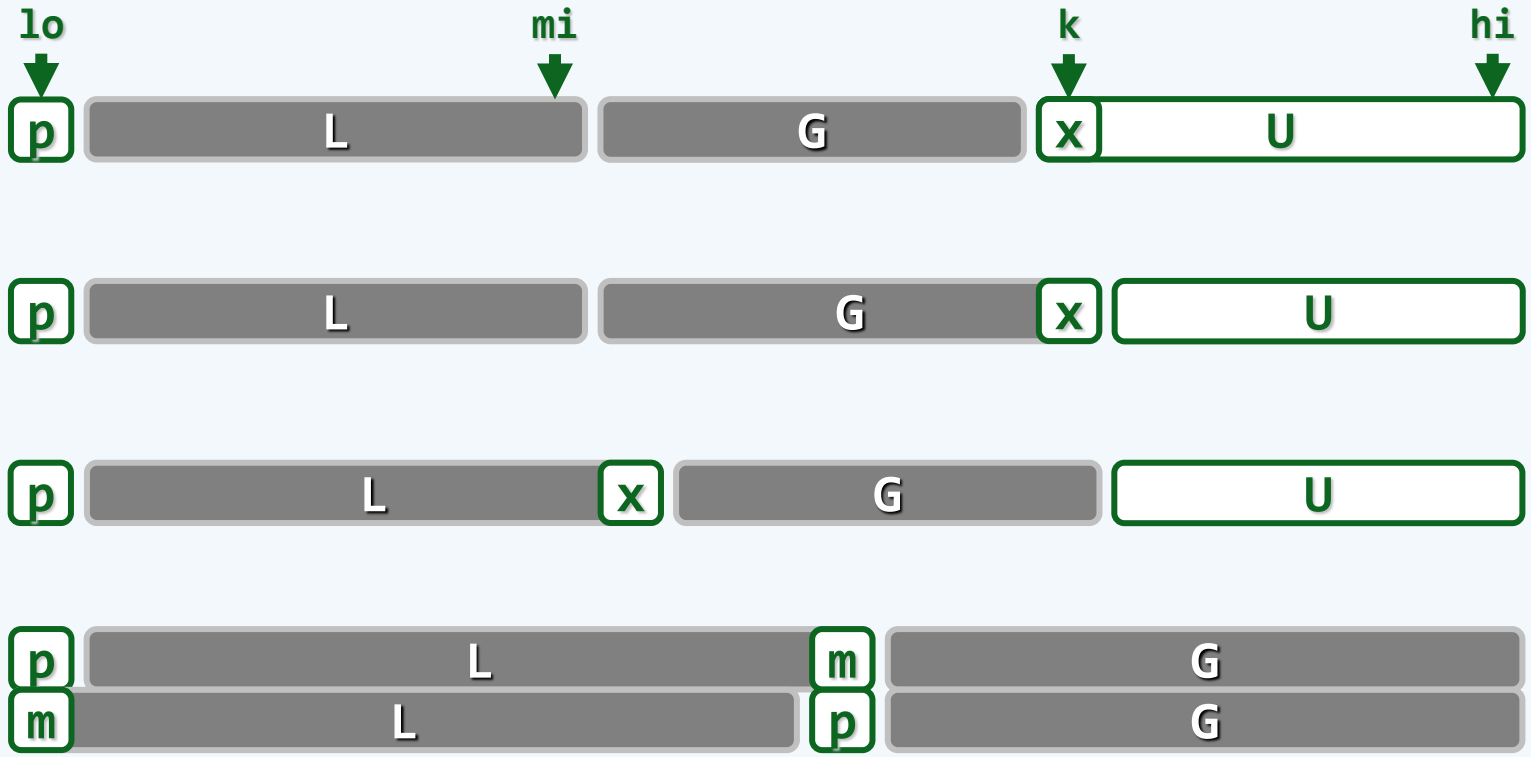
L < pivot ≤ G



单调性

❖ [k]不小于轴点 ? 直接G拓展 : G滚动后移，L拓展

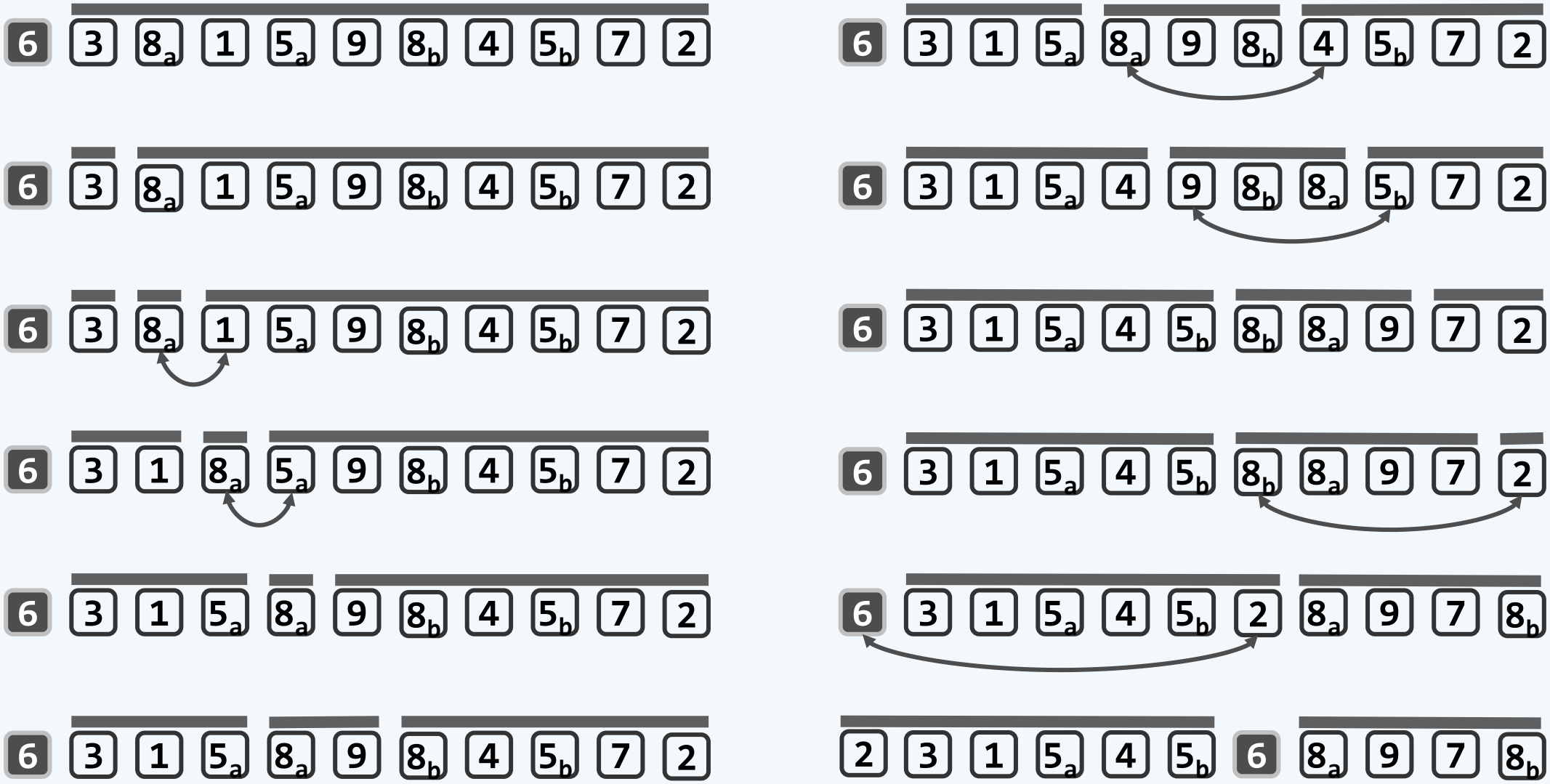
pivot <= S[k] ? k++ : swap(S[++mi], S[k++])



实现

```
template <typename T> Rank Vector<T>::partition( Rank lo, Rank hi ) { //[lo, hi]
   swap( _elem[ lo ], _elem[ lo + rand() % ( hi - lo + 1 ) ] ); //随机交换
   T pivot = _elem[ lo ]; int mi = lo;
   for ( int k = lo + 1; k <= hi; k++ ) //自左向右考查每个[k]
      if ( _elem[ k ] < pivot ) //若[k]小于轴点，则将其
         swap( _elem[ ++mi ], _elem[ k ]); //与[mi]交换，L向右扩展
   swap( _elem[ lo ], _elem[ mi ] ); //候选轴点归位（从而名副其实）
   return mi; //返回轴点的秩
}
```

实例


6 3 8a 1 5a 9 8b 4 5b 7 2
6 3 8a 1 5a 9 8b 4 5b 7 2
6 3 8a 1 5a 9 8b 4 5b 7 2
6 3 1 8a 5a 9 8b 4 5b 7 2
6 3 1 5a 8a 9 8b 4 5b 7 2
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6 3 1 5a 4 9 8b 8a 5b 7 2
6 3 1 5a 4 5b 8b 8a 9 7 2
6 3 1 5a 4 5b 8b 8a 9 7 2
6 3 1 5a 4 5b 2 8a 9 7 8b
2 3 1 5a 4 5b 6 8a 9 7 8b