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Index Permutation*

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Abstract: n numbers have $n!$ permutations. We give each permutation a unique sequece number, an index. Thus we can generate all $n!$ permutations. It is also applicable to acquire m combinations, $m \leq n$.

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Contents

1. Introduction

A question is raised: a statistic function needs to randomly generate five different numbers from 1 to 32 at a same time. We try to generate random numbers and then use some logic structures to do the discretiion. But there are arguments about the chances a. So if we give each permutation a unique sequence number and generate an *index number* s in $[1, n!]$, s will bring us a group of different numbers at one time. In the following section, we give the algorithm about how to parse s.

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2. Parsing the index

Algorithm parseindexes(n,m,s)
Input: $n \in N,\ n \geq 2, m \in N,\ m \leq n, s \in N,\ s \in [1, \frac{n!}{m!}]$.
Output: **r**, an array of intergers, one permutation of m numbers from n numbers, **r**'s index is from 0 to $m-1$.
Let $i = 0, dsi = 1, j = 0$.
for $i = 0; i < m; i++$ **do**
  $dsi = (s)\ mod\ (n-i)$
  if $dsi = 0$ **then**
    $dsi = n - i$
  end if
  $\mathbf{r}_i = dsi$
  if $s \leq n - i$ **then**
    break from the **for** loop
  end if
  s = (s-1)/(n-i)+1;
end for
return r.

It is trivial to find m combinations from n numbers.

3. Discussion

We omit the discussion to compare this method to other implementation like recursive call *etc.* We hope this algorithm can provide some hints for statistic study or encrptography study.

References