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Some Methods for Generating Permutation

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Abstract.
Here This paper describes some algorithms for generating permutation account by the form theoretical. So this paper presents the various algorithms by description in detail.
In this paper, these methods which is previous proposed were compared in the programs which is written in computer programs for all the methods to know more the methods efficient.
Keywords: permutation, algorithms permutation, comparisons permutation, generating

1. Introduction

A permutation is called an arrangement. It is moving the things or symbols into a distinguishable sequences. In math we employ the word to relate to changes in sets of things, and most usually to their orderIn more than a fields of arithmetic the word combination is old by dissimilar other than intimately connected meanings. They all tell to the idea of mapping the rudiments of a put to additional rudiments of the equal set, i.e., exchange (or "permuting") rudiments of a put (Third, 2005). The proposal of permutations is on the basis of a number of topics inside math for example amount hypothesis, algebra, geometry, likelihood, information, discrete math, graph theory, in addition to lots of added specialties. A permutations contain a few impractical apply. Permutation be able to exist used to describe switching networks in processor networking and equivalent processing. Permutation too used in a variety of cryptographic algorithms (Duato, 2003). Also permutation methods used in applied statistics.

Lagrange (1770) was the first which studied the permutations on the theory of algebraic equations .So there are many methods for listing permutations we can see in references (Tompkins, 1956; Lehmer,1960; Smith, 1970; Sedgewick, 1977), Tompkins (1956)presented an article in his reports on the use of a number of domains in generating permutation to explain the problems. Lehmer (1960) found a studying (combination tricks) to a computer. And Smith (1970) was action such as is generation of permutation sequences. Robert Sedgewick surveyed the various permutation generation methods published until 1977. Also Sedgewick discusses the different classes of methods and details the analysis and implementation of the most prominent.

2. Description Some Methods For Generating Permutation

Normally, it is difficult to generate all permutations for any elements. Hence there are many researchers have been generated to list all permutation. During compute it could exist necessary toward create permutations of a given series of

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principles. There are above thirty algorithms for generating permutations have be available in the long-ago years then there had applied on computer. The algorithms excellent modified to make this count on Unsystematic method, or systematic method or the recent method by using starter sets that generating all permutation, for chosen permutations. We will describe these types of methods and we will apply these methods in computer by writing special programs to work a comparison together.

2.1Unsystematic Method

There are many methods which are depending on unsystematic of the way, in any case some methods use cyclic rotations to obtain the *n*! permutations. Another methods use random style for generating permutations. These two types no deferent to give unsystematic permutations of a known series of *n* principles, it makes no difference whether single income be relevant cyclic chosen permutation of *n* to the series, or select a unsystematic part from the place of different permutations of the series.

This technique original available in 1938 by Fisher R. A. and Frank Y.. But this method suffers from the difficulty to generate all permutation so this method be able to be remedied via using a unlike bijective communication, following using *ki* from *n* to choose a part among *i* remaining basics of the series (for lessening standards of *i*), relatively than removing the part and compact the series via variable behind additional basics one rest, one swaps the part through the ending residual part.

There were a lot of methods proposed which is based on the same principle as this method such as & Johnson, S. M. & Trotter, H. F. Wells, M.B. & Heap, B.R (Sedgewick, 1977).

The resulting method for generating unsystematic permutation can be described as follows steps:-

Step1/ Fix one element in born and put the remember number in series then change the all remember number.

Step2/ Take the cycle for the entire permutation product from step 1.

The next example which have *n* = 4 elements is 1 2 3 4 that product 24 permutations which explain in the following steps:-

Step1/ Fix one element in born and put the remember number in series then change the all remember number. So take inverse these elements without the element that is fixing as the following:

1234 2134 3124 1324 2314 3214

Step2/ Take the cycle for all the permutation product from step 1 as

1234 2134 3124 1324 2314 3214

2341 1342 1243 3241 3142 2143

3412 3421 2431 2413 1423 1432

4123 4213 4312 4132 4231 4321

2.2 Systematic Method

These methods are based on exchange, so *n*! permutations of *n* number be obtained via a sequence of (*n*!-1) relations. Here be several methods to systematically create every one permutations of a known series. Traditional method be one of these types of method. These methods distinguished by

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easy and supple, which is based on result the after that change in lexicographic ordering. It be able to switch frequent principles, in favor of which container it generates the different permutations every formerly. To apply it, one starts by organization the series in growing arrange, and after that repeats advancing to the after that permutation providing lone be originate.

The algorithm go backside toward during 14th century India. There are many algorithms for listing permutations had been frequently rediscovered ever since such as algorithms proposed by Fischer and Krause and R.J. Ord-Smith is generating permutations systematic.

The following steps generate the subsequently permutation systematically following a known permutation. It changes the known permutation inside spaces.

Step1/ Choose all the elements in systematic series increasing comparison by all elements which is previous.

Step2/ Comparison increase with first element and repeat the working with the step1.

Step3/ Repeat all the previous steps with comparison with all elements to get in all permutations.

The next example which have n = 4 elements is 1 2 3 4 that product 24 permutations which explain in the following steps

Step1/ Choose all the elements in systematic series increasing comparison by all elements which are previous.

1234 1243 1324 1342 1423 1432

Step2/ Comparison increase with first element and repeat the working with the steps 1.

2134 2143 2314 2341 2413 2431

Step3/ Repeat all the previous steps with comparison with all elements to get in all permutations.

1234 1243 1324 1342 1423 1432
2134 2143 2314 2341 2413 2431
3124 3142 3214 3241 3412 3421
4123 4132 4213 4231 4312 4321

2.3 Systematic andUnsystematic Method

This method proposed by Zake in 2013, which is used the starter by fixing tow elements and then it use the previous two methods. So these methods based on tow elements are comprehensive method that is plural the systematic method and unsystematic method. The following steps for this method

Step1/ Fix tow elements from the integer’s number, than fixing tow elementsthat are different from the previous two. So delete equivalence permutations.

Step2/ Generate all permutations cyclically from the starters sets only which produce from step 1.

Step3/ Find the inverses (reverse) of all permutations produce from step 2.

This method is abstracted from the integers 1 2 3 4 5 for 5 elements to generate all permutations in the following steps:

Step1/ Fix tow part from the numbers 1 2 3 4 5, such as “1 , 4”, we include the equivalent permutations and result in the following

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(12354)≅ (15324)
(12534)≅ (13524)
(13254)≅ (15234)

And then than fixing tow elementsthat are different from the previous two delete the equivalence permutation, we produce the following:

(1 2354)	(12534)	(13254)
(12453) ≅ (15423)	(13452) ≅ (15432)	(13425)≅ (12435)
(12543) ≅ (14523)	(13542) ≅ (14532)	(13245)≅ (14235)
(14253) ≅ (15243)	(14352) ≅ (15342)	(14235)≅ (13245)

Step2/ Generate all permutations from these permutations {1 2 3 4 5, 1 2 4 3 5, 1 3 2 4 5, 12354,12534,13254,12453,12543,14253,13452,13542,14532}. Every permutations be generated regularly pro each permutation as the following:

(12345)	(12354)	(12534)	(13254)
(23451)	(23541)	(25341)	(32541)
(34512)	(35412)	(53412)	(25413)
(45123)	(54123)	(34125)	(54132)
(51234)	(41235)	(41253)	(41325)

(12435)	(12453)	(12543)	(14253)
(24351)	(24531)	(25431)	(42531)
(43512)	(45312)	(54312)	(25314)
(35124)	(53124)	(43125)	(53142)
(51243)	(31245)	(31254)	(31425)

(13245)	(13452)	(13542)	(14532)
(32451)	(34521)	(35421)	(45321)
(24513)	(45213)	(54213)	(53214)
(45132)	(52134)	(42135)	(32145)
(51324)	(21345)	(21354)	(21453)

Step3/ Create the inverses permutations (reverse) of the above step,

Permutations	inverse	Permutations	inverse
(12345)	(54321)	(12354)	(45321)
(23451)	(15432)	(23541)	(14532)
(34512)	(21543)	(35412)	(21453)
(45123)	(32154)	(54123)	(32145)
(51234)	(43215)	(41235)	(53214)

(12534)	(43521)	(13254)	(45231)
(25341)	(14352)	(32541)	(14523)
(53412)	(21435)	(25413)	(31452)
(34125)	(52143)	(54132)	(23145)
(41253)	(35214)	(41325)	(52314)
permutations	inverse	permutations	inverse
(12435)	(53421)	(12453)	(35421)
(24351)	(15342)	(24531)	(13542)
(43512)	(21534)	(45312)	(21354)
(35124)	(42153)	(53124)	(42135)
(51243)	(34215)	(31245)	(54213)
(12543)	(34521)	(14253)	(35241)
(25431)	(13452)	(42531)	(13524)
(54312)	(21345)	(25314)	(41352)
(43125)	(52134)	(53142)	(24135)
(31254)	(45213)	(31425)	(52413)
permutations	inverse	permutations	inverse
(13245)	(54231)	(13452)	(25431)
(32451)	(15423)	(34521)	(12543)
(24513)	(31542)	(45213)	(31254)
(45132)	(23154)	(52134)	(43125)
(51324)	(42315)	(21345)	(54312)
(13542)	(24531)	(14532)	(23541)
(35421)	(12453)	(45321)	(12354)
(54213)	(31245)	(53214)	(41235)
(42135)	(53124)	(32145)	(54123)
(21354)	(45312)	(21453)	(35412)

This algorithm will be a basis to generate permutation and its application in calculating the determinant for $n \times n$ matrices.).

3. Results Of Comparison The Methods

In this part resolve check three algorithms in favor of generating every one permutations that was presented in section three. These examine show by making comparisons between these three methods by writing three programs in computer programs for these methods. The results for these comparisons can see in the table1. In this table we can see the time spend for the systematic and unsystematic method for generating permutation less than the systematic method and that this method fewer than the unsystematic method. These indicate the method for fixing tow elements better than the systematic method that is better than the unsystematic method. The computations have been implemented by using computer programs.

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Table 1: *Time spend (in seconds) for tree methods for generating permutation*

n	**Time spend for Systematic and Unsystematic Method**	**Time spend for Systematic method**	**Time spend for Unsystematic method**
3	0.002584	0.005988	0.006309
4	0.015610	0.0299034	0.080023
5	0.301280	0.516000	0.856900
6	0.847310	1.209900	1.567300
7	1.307736	2.100400	3.589966
8	2.543875	3.052940	3.980000
9	5.197464	7.184436	8.749090

Figure 1: Scheme the time for three basic methods for generating permutation

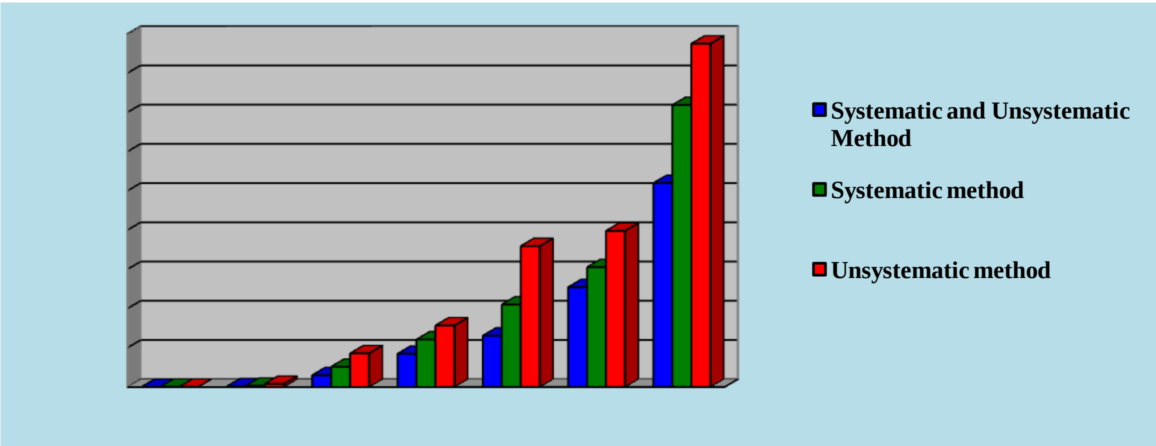

Figure 2: Comparisons of timing spend for three methods

4. Conclusion

In this study for these methods to generate the permutations and analysis I had presented the description for some these methods for give some information on it. By description these methods there are some points which was concluded these point are:

1- There are many studies on the permutations and methods of generating methods while these studies showed the evolution of a regular on the methods.
2- Methods of generating permutation is very more, but it was built on three basic methods are systematic, unsystematic and systematic and unsystematic.
3- Despite the abundance of previous studies, but there is a need to study the issue more because of n the existence of a gap to the lack of recent research in this topic.

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