

Re: Help with Permutations

Source: <http://sci.tech-archive.net/Archive/sci.math/2006-01/msg00904.html>

- *From:* quasi <quasi@xxxxxxxx>
 - *Date:* Sun, 08 Jan 2006 04:29:24 -0500
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On Sun, 8 Jan 2006 02:31:26 +0100, "Jonas" <asdf@xxxxxxxxxxxxxxxx> wrote:

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>
><mareg@xxxxxxxxxxxxxxxxxxxxxxxx> wrote in message
>news:dpolh3\$im4\$1@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
>> In article <1136584344.300707.31850@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>,
>> "barliow" <jack.c.barlow@xxxxxxxx> writes:
>>>Hi all,
>>>
>>>I'm not mathematically fantastic so I hope this makes sense.
>>>
>>>I've written an algorithm to generate all permutations of words from a
>>>given alphabet.
>>>
>>>Alphabet:
>>>
>>>"abc"
>>>
>>>Gives permutations:
>>>
>>>a, b, c, ab, ac, ba, bc, ca, cb, abc, acb, bac, bca, cab, cba
>>>
>>>In order to keep track of the progress through the algorithm, I need to
>>>be able to calculate the total number of permutations in advance. I can
>>>do this using the following formula:
>>>
>>>Number of permutations of size k taken from n objects is:
>>>
>>> n!
>>>n_P_k = -----
>>> (n - k)!
>>>
>>>So I can calculate the total number of permutations off all lengths as:
>>>
>>>P = (3! / (3! - 1!)) + (3! / (3! - 2!)) + (3! / (3! - 3!)) = 15
>>>
>>>However, the algorithm is designed to eliminate repeated permutations
>>>that arise as a result of having repeated letters:
```

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>>>
>>>Alphabet:
>>>
>>>"acc"
>>>
>>>Gives permutations:
>>>
>>>a, c, ac, ca, cc, acc, cac, cca
>>>
>>>This means that the formula above no longer works. I'm wondering if
>>>someone can provide a formula to calculate the total of number of
>>>permutations of *all* lengths that will be outputted in the following
>>>scenarios:
>>>
>>>"abc" (should = 15)
>>>
>>>"accd" (should = 34)
>>>
>>>"acccdde" (uncertain as to what the result should be)
>>>
>>
>> I don't know a closed formula for this total number (which is not to say
>> that there isn't one!) but it is not difficult to calculate it.
>>
>> Suppose  $k_1, k_2, \dots, k_r$  are the numbers of each of the distinct letters
>> in your string. (For example, for "acccddee",  $k_1=1, k_2=3, k_3=k_4=2$ .)
>> Then the total number of what you describe above as "permutations" is
>> (view this in fixed width font):
>>
>> k1 k2 kr
>> --- ---
>> \\ (i1 + i2 + ... + ik)!
>> > . . . > ----- - 1
>> /// i1! i2! ... ik!
>> --- ---
>> i1=0 i2=0 ik=0
>>
>> (The -1 at the end is to avoid counting the empty string, which
>> corresponds
>> to  $i_1=i_2=\dots=i_r=0$  in the sum.)
>>
>> You should be able to write a program to evaluate this expression for
>> given
>>  $k_1, k_2, \dots, k_r$ . Doing it for the example above,  $k_1=1, k_2=3, k_3=k_4=2$ 
```

I think you meant $k_1=1, k_2=3, k_3=2, k_4=1$.

```
>> gives 1265, as quasi reported.
>>
>> Derek Holt.
>
```

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>I have calculated your sum and I get 4952 or 5023 depending on if the one
>is inside the sum or outside but not 1265.
>

The "1" is outside since it's intended to remove one case from the count.

However Derek Holt's formula does correctly give a result of 1265 for the example in question, so check your program.

quasi

P.S.

I implemented the formula in Maple and in my initial implementation, instead of 1265, I got the following ridiculous answer:

549831041606246399

Obviously, either Maple has a bug or there's a bug in my program. By default, I would assume the bug is mine, however the program is so simple as to be self evidently correct.

However I was able to work around the bug, revising the program slightly, and achieving the correct result.

I'll report the bug in a separate reply.

quasi

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• **Follow-Ups:**

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• **References:**

- ◆ **[Help with Permutations](#)**
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 - ◆ **[Re: Help with Permutations](#)**
◇ From:
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◇ From: Jonas
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