

# Re: Help with Permutations

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- *From:* [mareg@xxxxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:mareg@xxxxxxxxxxxxxxxxxxxxxxxxxxxx) ()
  - *Date:* Sun, 8 Jan 2006 11:38:37 +0000 (UTC)
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In article <43c06b71\$0\$163\$edfadb0f@xxxxxxxxxxxxxxxxxxxxxxxx>, "Jonas" <asdf@xxxxxxxxxxxxxxxx> writes:

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>
><mareg@xxxxxxxxxxxxxxxxxxxxxxxx> wrote in message
>news:dpolh3\$im4\$1@xxxxxxxxxxxxxxxxxxxxxxxxxxxx
>> In article <1136584344.300707.31850@xxxxxxxxxxxxxxxxxxxxxxxx>,
>> "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:
>>>
```

## Re: Help with Permutations

```
>>>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):
>>
>>  $k_1 k_2 k_r$ 
>> --- ---
>>  $\sum_{i_1=0}^{k_1} \sum_{i_2=0}^{k_2} \dots \sum_{i_r=0}^{k_r} \frac{(i_1 + i_2 + \dots + i_r)!}{i_1! i_2! \dots i_r!} - 1$ 
>>
>> (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,  $k_1=1, k_2=3, k_3=k_4=2$ 
>> gives 1265, as quasi reported.
>>
>> Derek Holt.
>
>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.
```

Sorry for the ambiguity; the  $-1$  is outside of the sum.

## Re: Help with Permutations

In fact 5023 is the correct answer when  $k_1=1$ ,  $k_2=3$ ,  $k_3=k_4=2$ , but, as quasi correctly observed, for the string "accddde", it should be  $k_1=1$ ,  $k_2=3$ ,  $k_3=2$ ,  $k_4=1$ .

Derek Holt.

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- **References:**

- ◆ **Help with Permutations**

- ◇ From: barliow

- ◆ **Re: Help with Permutations**

- ◇ From:

- ◆ **Re: Help with Permutations**

- ◇ From: Jonas

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