**Combinatorics HW Generating Function and Integer Partition**

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1. **Integer composition: Integer 5 is partitioned into orderly partitions which are made up by numbers 1,2,3,4. Such as (1+1+3, or 1+3+1 or 2+3, 4+1,....) How many different ways are there?**

Since order is considered, since no location can contain 0, then r-1 partitions could be used for n-1 available locations, giving c(n-1, r-1). Therefore, since we need at least 2 numbers to create 5, then r would be in range [2, 5]. Accordingly, we should count the number of each possible orderly r-partition for n, where n is 5, giving

Therefore, there are 15 different ways to orderly partition Integer 5.

1. **Integer partition: How many ways to partition n into several numbers that the order between numbers is ignored. Please write the corresponding generating function.**

Since order is not considered, various numbers of each digit could be used to construct integer n, which gives the following generative function:

1. **Provide proof that the partition number for integer n using different odd numbers (ordering is ignored), equals to the partition number of n being partitioned into the self-conjugated Ferrers Diagrams.**

**(1st row exchanged with 1st column, 2nd row exchanged with 2nd column, …, as image is rotated by the dotted line as axis shown in slices; is still Ferrers diagram. 2 Ferrers diagrams are known as a pair of conjugated Ferrers diagrams. The diagram is called self-conjugated if its conjugated diagram is the same with the original diagram.)**