2.1 REVISION ENUMERATION

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When you are trying to count something you will end up using arithmetic operations like addition, substraction and multiplication. If you have written down an expression which you believe is correct for a given counting problem, it is very important that every use of addition and substraction corresponds to a use of the Rule of Sum and each multiplication is due to the Rule of Product. In addition, we often translate a given problem to a problem we already know how to solve. This translation is called the Rule of Bijection.

Four basic situations occur quite frequently:

You have a bag of balls numbered 1 to n and you pick out m of these balls at random.

Once you are convinced that your problem is equivalent to picking balls from a bag, you need to ask yourself the following two questions.

1. Does the order the balls were picked matter? (ordered/unordered selection)
2. Are balls returned to the bag after being picked? (allowing/without repeats)

These two questions gives us four possibilities. They are as follows:

1. ordered selection, allowing repeats: n^m
2. ordered selecction, without repeats: $P(n, m)$
3. unordered selection, allowing repeats: $C(n + m - 1, n - 1)$
4. unordered selection, without repeats: $C(n, m)$

So for instance, the probability of getting 7 correct numbers in Lotto is $P = \frac{1}{C(34,7)}$. In for instance Lotto, $m = 7$ balls are chosen from $n = 34$. The order doesn't matter, and once a ball has been picked, it is not put back in the bag.

These four cases are often combined using the Rule of Sum and the Rule of Product.