Combinatorics

Permutations and Combinations

## Summary

Listing Number Type

|  |  |
| --- | --- |
| Permutations on n things taken r at a time with repetition |  |
| Permutations of n things taken r at a time without repetition |  |

## Permutations and Combinations

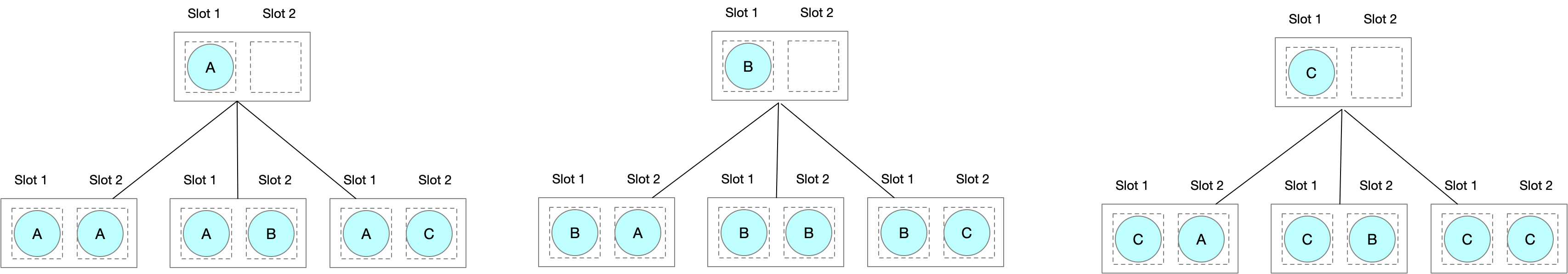
The fundamental difference between permutations and combinations is that with permutations order is significant whereas with combinations it is not. So with permutations A,B = B,A whereas with combinations A,B = B,A.

### Permutations

With permutations order is important. We consider two types of permutation; one which allows repetition and one which does not.

#### Permutations with repetition

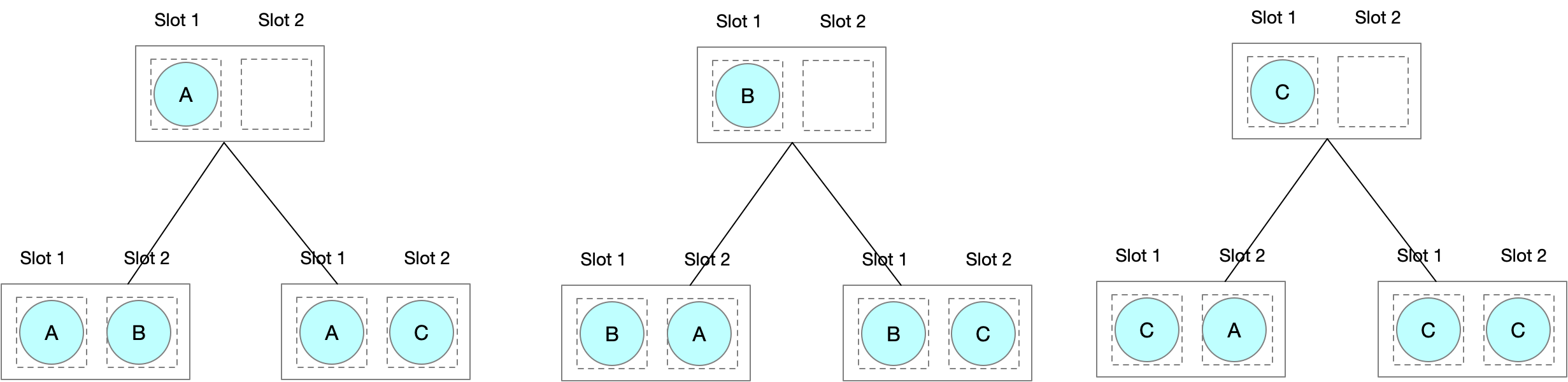
If repetitions are allowed, we have the following situation. We have 3 objects {A, B, C} taken two objects at a time. For each of the three possible values of the first slot we have 3 possible values for the second slot.



We have permutations. In full generality there are ways of arraning n objects taken r at a time with repetition.

#### Permutations without repetition

If repetition is not allowed we have the following situation



We have three choices for the first slot. But for each of those choices we only have two choices for the second slot as once value from the set have been used up. So we have ways of taking 3 objects 2 at a time without repetition. In full generality we have

Ways of taking n objects r at time withour repetition. R must be less than or equal to n. This can be expressed as . We show why in the following section

##### Proof

Substituting (2) into (1)

And re-arranging