2.1.1 Ordered Sampling with Replacement

Here we have a set with n elements (e.g.: $A = \{1, 2, 3, \cdots . n\}$), and we want to draw k samples from the set such that ordering matters and repetition is allowed. For example, if $A = \{1, 2, 3\}$ and $k = 2$, there are 9 different possibilities:

1. (1,1);
2. (1,2);
3. (1,3);
4. (2,1);
5. (2,2);
6. (2,3);
7. (3,1);
8. (3,2);
9. (3,3).

In general, we can argue that there are k positions in the chosen list: (Position 1, Position 2, ..., Position k). There are n options for each position. Thus, when ordering matters and repetition is allowed, the total number of ways to choose k objects from a set with n elements is

$$n \times n \times \ldots \times n = n^k$$

Note that this is a special case of the multiplication principle where there are k "experiments" and each experiment has n possible outcomes.