3.1. The Product and Sum Rules for Counting



Theorem 3.1 (The Product Rule for Counting)

Suppose that a procedure can be broken down into a sequence of two tasks. If there are m ways to do the first task, and for each of these ways of doing the first task there are n ways to do the second task, then there are m total ways to do the procedure.



Theorem 3.2 (The Sum Rule for Counting)

If a procedure can be done either in one of m ways or in one of n ways, where none of the set of m ways is the same as any of the set of n ways, then there are m+n ways to do the procedure.

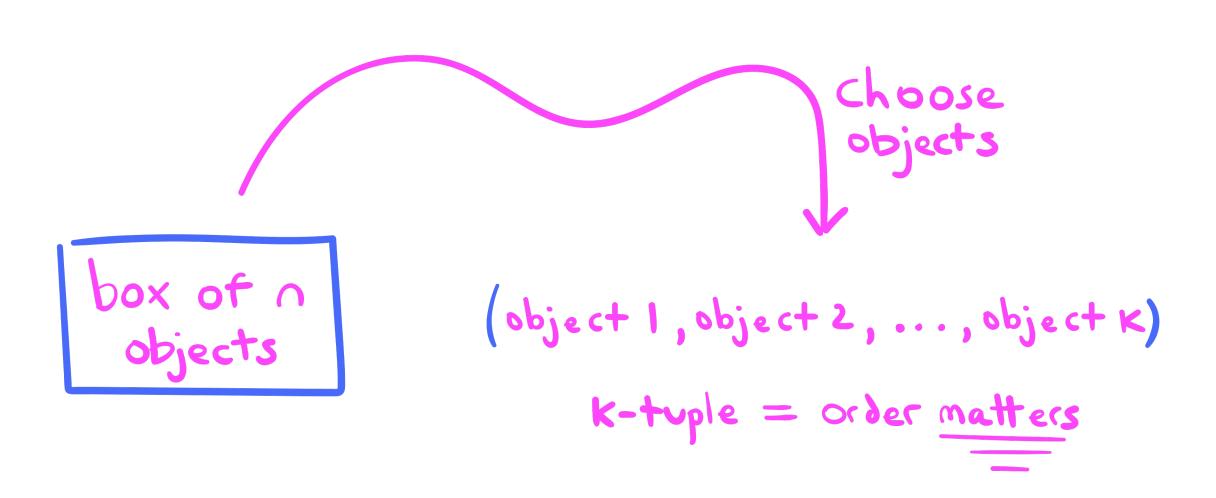


Problem Prompt

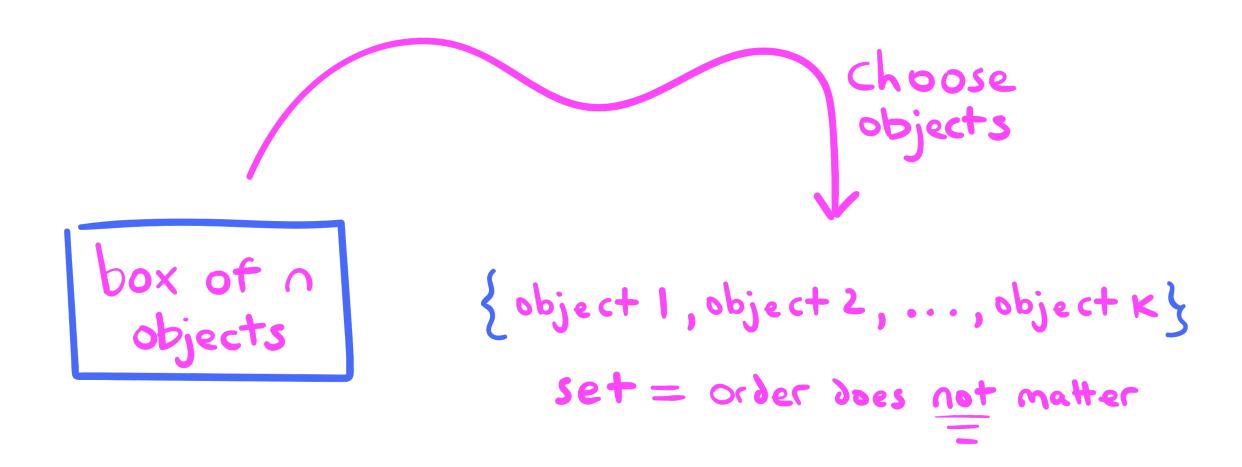
Do problem 1 on the worksheet.

3.2. Permutations and combinations

permutations



combinations





Definition 3.1

An ordered collection of k distinct objects is called a *permutation* of those objects. The number of permutations of k objects selected from a collection of n objects will be designated by the symbol P_k^n .

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Definition 3.2

An unordered collection of k distinct objects is called a *combination* of those objects. The number of combinations of k objects selected from a collection of n objects will be designated by the symbol C_k^n or $\binom{n}{k}$.

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Theorem 3.3 (Formula for Counting Permutations)

For $0 \le k \le n$, we have

$$P_k^n = rac{n!}{(n-k)!}.$$

Note: Remember the convention that 0! = 1.



Problem Prompt

Do problem 2 on the worksheet.

Theorem 3.4 (Formula for Counting Combinations)

For $0 \le k \le n$, we have

$$inom{n}{k} = C_k^n = rac{n!}{(n-k)!k!}.$$

Note: Remember the convention that 0! = 1.



Problem Prompt

Do problem 3 on the worksheet.