

Section 6.4

Permutations

A permutation of n items is an ordered list of those items. The number of possible permutations of n items is given by n factorial, which is

$$n! = n \times (n - 1) \times (n - 2) \times \cdots \times 2 \times 1$$

for n a positive integer, and $0! = 1$.

Permutations of n items taken r at a time

A permutation of n items taken r at a time is an ordered list of r items chosen from a set of n items. The number of permutations of n items taken r at a time is given by

$$P(n, r) = \frac{n!}{(n - r)!} = n \times (n - 1) \times (n - 2) \times \cdots \times (n - r + 1).$$

Combinations of n items taken r at a time

The number of combinations of n items taken r at a time is given by

$$C(n, r) = \frac{P(n, r)}{r!} = \frac{n!}{r!(n - r)!} = \frac{n \times (n - 1) \times (n - 2) \times \cdots \times (n - r + 1)}{r!}.$$

Problem 1. How many ordered sequences are possible that contain four items chosen from six?

Solution [here](#).

Problem 2. How many unordered sets are possible that contain three objects chosen from seven?

Solution [here](#).

Problem 3. How many five-letter sequences are possible that use the letters b, o, g, e, y once each?

Solution [here](#).

Problem 4. How many three-letter (unordered) sets are possible that use the letters q, u, a, k, e, s at most once each?

Solution [here](#).

Problem 5. A bag contains 3 red marbles, 2 green ones, 1 lavender one, 2 yellows, and 2 orange marbles.

- a) How many possible sets of four marbles are there?
- b) How many sets of three marbles include all the red ones?
- c) How many sets of four marbles include none of the red ones?
- d) How many sets of four marbles include one of each color other than lavender?
- e) How many sets of five marbles include at least two red ones?
- f) How many sets of five marbles include either the lavender one or exactly one yellow but not both colors?

Solution [here](#).

Problem 6. Ben and Ann are among 7 contestants from which 4 semifinalists are to be selected. Of the different possible selections, how many contain Ben but not Ann?

Solution [here](#).

Problem 7. If 10 persons met at a reunion and each person shakes hands exactly once with each of the others, what is the total number of handshakes?

Solution [here](#).