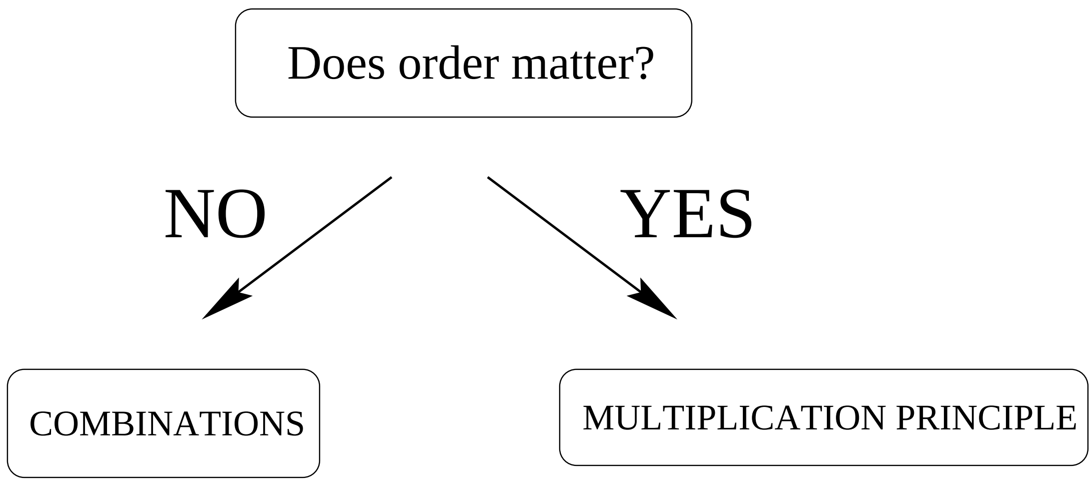

MULTIPLICATION PRINCIPLE

Make a blank space for each task (decision) to be done (made). Find the number of ways each task can be done. Watch for any restrictions that decrease then number of available choices for a task. If N_1 is the number of ways task 1 can be completed, N_2 is the number of ways that task 2 can be completed and N_i the number of ways task i can be completed, then the number of ways to complete the r different tasks is

$N = N_1 \cdot N_2 \ldots \cdot N_r$

COMBINATIONS

$$C(n,r) = \frac{n!}{(n-r)!r!} = \binom{n}{r}$$

This is the number of ways of GROUPING r objects from a set of n different objects. Keywords are committee, hand of cards, subset, sample and group. Sometimes our set of n objects is made of groups of similar objects and we need to choose a certain number from each group. If there are two kinds of objects in our set of n objects, type 1 and type 2, then we have $n = n_1 + n_2$. Choose r_1 from type 1 objects and r_2 from type 2 objects where $r = r_1 + r_2$, the total number chosen. Then the number of combinations is

$$\binom{n_1}{r_1} \cdot \binom{n_2}{r_2} = C(n_1, r_1) \cdot C(n_2, r_2)$$

If there is more than one combination that will satisfy the question, then find the number of ways to make each combination that satisfies the question and add them together.

PERMUTATIONS

$$P(n,r) = \frac{n!}{(n-r)!}$$

This is the number of ways of ARRANGING r objects from a set of n different objects. Keywords are arrangement, schedule, seated and ordering.

If the N objects are not all different; that is, we have N objects where n_1 of the objects are identical and n_2 objects of another type are identical and so on for r different kinds of identical objects then the number of DISTINGUISHABLE PERMUTATIONS (i.e. arrangements that look different) of the $N = n_1 + n_2 \ldots + n_r$ objects is

$$\frac{N!}{n_1! \cdot n_2! \ldots n_r!}$$