Probability Permutations

A **permutation** is an ordering of distinct objects in a straight line. The order of the objects is important. If we select **r** *different* objects from a set of **n** objects and arrange them in a straight line, this is called a **permutation** of **n** objects taken **r** at a time. Permutation is used when the order the objects are chosen matters.

We write this as P(n,r)

P reminds you of the word permutation.
n tells you the number of objects you may select.
r specifies how many you are selecting.

For example, P(5,3) indicates you are counting permutations (straight-line arrangements) formed by selecting three different objects (r) from a set of five available objects (n). This would apply if we are choosing a president, vice-president and treasurer for a club (the order you choose them in changes the position they hold, so order matters).

To solve this, we use the formula $P(n,r) = \dfrac{n!}{(n-r)!}$

$$P(5,3) = \frac{5!}{(5-3)!} = \frac{5 \bullet 4 \bullet 3 \bullet 2 \bullet 1}{2 \bullet 1} = \frac{60}{1} = 60$$

In forming **combinations**, order is not important. If we choose **r** objects from a set of **n** objects, we say that we are forming a **combination** of **n** objects taken **r** at a time.

We write this as C(n,r)

For example, if we want to know how many four-person committees can be formed from a set of ten people we can solve this using the combination rule:

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

$$C(10,4) = \frac{10!}{4!(10-4)!} = \frac{10 \bullet 9 \bullet 8 \bullet 7 \bullet 6 \bullet 5 \bullet 4 \bullet 3 \bullet 2 \bullet 1}{4 \bullet 3 \bullet 2 \bullet 1 \bullet 6 \bullet 5 \bullet 4 \bullet 3 \bullet 2 \bullet 1} = 210$$