Math 3201

2.3A Introduction to Permutations

A ***permutation*** is an ordered arrangement of all or part of a set.

Order does matter. For example, the pattern ABC would be considered different from BCA since the order of the letters is different. There are two different cases we will look at with permutations.

We will consider:

- permutations of n different elements taken n at time
- permutations of n different elements taken r at a time

Permutations of n Different Elements Taken n at Time

We will first consider this case, in which we will include **all** of the elements in the various arrangements that we come up with. These types of problems can be solved using the **Fundamental Counting Principle** and factorial notation. We've already seen some of these when we covered factorial notation.

Example 1:
How many different possibilities can we come up with for a three digit PIN using the digits 1, 2 ,3?

$P = 3 \times 2 \times 1 = 6$

or

$P = 3! = 6$

Example 2:
Determine the number of ways we can arrange 6 books in a line on a shelf.

$P = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

or

$P = 6! = 720$

Example 3:
In how many different ways can 9 different people stand in a line?

$P = 9! = 362\,880$

Textbook Questions: page 82, 83; 7, 8, 12, 13, 14