PERMUTATIONS

Complete the following problems to reinforce your understanding of the concept covered in this module.

Problem 1:

There are 7 snowboarders competing in a competition. Assuming that there are no ties, in how many ways could the gold, silver, and bronze medals be awarded to the group?

Problem 2:

Six students show up to take an Engineering exit exam, there are 6 individual desks. Determine how many ways these students can be placed at these desks.

Problem 3:

Students are given a student ID with a six digit numeral from the numbers 0 to 5 for each digit, but each numeral can only be used once. How many different unique student IDs can be given out?

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Solution 1:

The first thing that must be done is to quickly recognize that this is a problem dealing with permutations. Recall that when you need to count the number of ways you can arrange items where order is important, then a permutation can be used to count.

The general equation for a permutation is:

$$ {}_{n}P_{r} = \frac{n!}{(n-r)!} $$

So defining n and r, we find that:

n=7, which is the number of snowboarders
r=3, which represents the number of medals

Plugging these values in to the equation:

$$ {}_{7}P_{3} = \frac{7!}{(7-3)!} = \frac{7!}{4!} $$
$$ = \frac{7(6)\cdots(2)(1)}{(4)(3)(2)(1)} = 210 $$

There are 210 ways that the gold, silver, and bronze medals can be awarded to the 7 snowboarders.

Solution 2:

Again, recognize quickly that this is a problem dealing with permutations. When you need to count the number of ways you can arrange items where order is important, then a permutation can be used to count.

So defining n and r, we find that:

n=6, which is the number of students
r=6, which represents the number of desks

Plugging these values in to the equation:

$$ {}_6P_6 = \frac{6!}{(6-6)!} = \frac{6!}{0!} $$
$$ = \frac{6(5)\cdots(2)(1)}{1} = 720 $$

It's important to remember that 0! is not 0, but 1, therefore, there are 720 different ways that the 6 students could be placed at the 6 desks.

Solution 3:

When you need to count the number of ways you can arrange items where order is important, then a permutation can be used to count.

Defining n and r, we find that:

n=6, which is the number of digits on a student ID
r=6, which represents the number digits each number could be

Plugging these values in to the equation:

$$ {}_6P_6 = \frac{6!}{(6-6)!} = \frac{6!}{0!} $$
$$ = \frac{6(5)\cdots(2)(1)}{1} = 720 $$

There are 720 unique IDs that can be given out.