Lesson #9PR - 3

<u>Performance Objective</u>: To Develop Counting Methods and Use Permutations

<u>Homework #9PR3</u> – NYA p.702 #1 – 17 (odd), 38

<u>Do Now</u>: Rolling a 6–sided die.

P(5) = **P(2 or 3) =** **P(odd #) =**

P(1 or even #) = **P(7) =** **P(greater than 2) =**

<u>State Test Prep</u>: What is P(Any ♦ followed by a Red Q)?

a) 0 **b) 13 / 2651** **c) 26 / 2704** **d) cannot be determined**

<u>Fundamental Counting Principle</u> – If there are *m* ways to make a first selection and *n* ways to make a second selection, then there are *m* • *n* ways to make both selections.

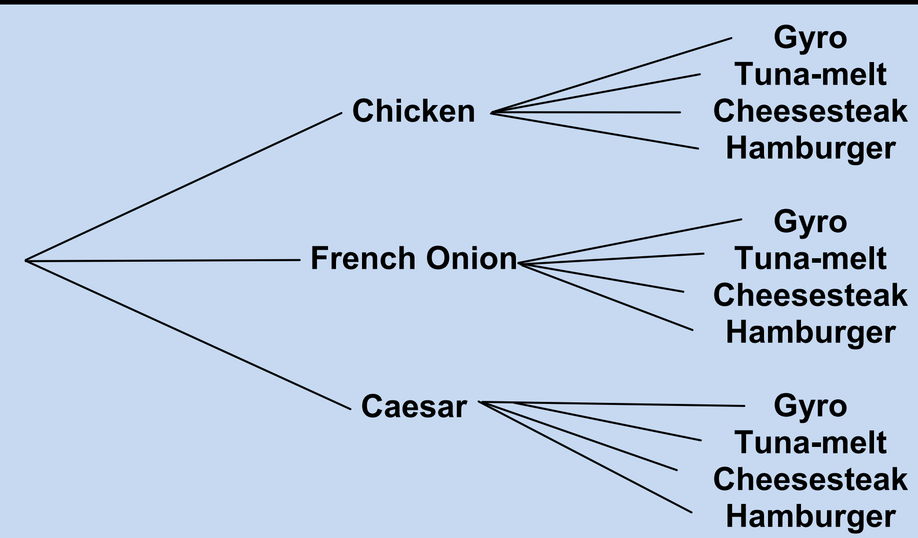
<u>Example 1</u>: Reggie has 4 pairs of pants, 5 shirts, and 2 pairs of shoes. How many different outfits (sets of clothing) does he have?

<u>Example 2</u>: Springfield's license plates are created with 7 characters. The first 3 are letters and the last 4 are numbers. How many different license plates can they issue before they have to redesign the license plate system?

Tree Diagrams are another way to count, but are better used to display a sample space in a clear and organized way. The major drawbacks are that they are time consuming and physically need a lot of space.

Example: Tree diagram showing all lunch specials combinations at a diner.

Soup or Salad
Chicken French Onion Caeser
Entree
Gyro Tuna-melt Cheesesteak Hamburger



<u>Good Use of Tree Diagrams</u>: How does the sample space change when the diner runs out of Caeser salad? How does a tree diagram help illustrate that?

<u>Arrangement</u> – Order of people, letters, numbers, etc.

<u>Permutation</u> – Arrangement in which order is important

When looking at options, often the order or arrangement is important. The Permutation ABC is different from the permutation CBA. When choosing an order, the *Counting Principle* helps you determine the number of choices or permutation.

Get in Line: Four students are holding cards with a letter on them (A, B, C, D).

1. Student A is alone. In how many ways can this student line up?
2. Student B joins A. In how many ways can these students line up?
3. Student C joins AB.
   a. In how many ways can student C line up if A and B are ordered as AB?
   b. If A and B are ordered as BA?
   c. In how many ways can the 3 students line up?
4. Student D joins them. Using the logic from part 3, in how many ways can all 4 students line up?
5. Predict the number of permutations if a 5^{th} student was included.

<u>Factorial</u> – notation used to write the product when the factors are consecutive whole numbers. Symbol used is an exclamation point, n!

4 factorial is written as 4!, meaning 4 • 3 • 2 • 1. This is equal to 24.

3! = 3 • 2 • 1 = 6

5! = 5 • 4 • 3 • 2 • 1 = 120

Special condition for factorials: 0! is defined to be 1, so 0! = 1.

Example 1A: Eight torchbearers were selected to carry the Olympic torch. How many ways can the torchbearers be selected? Use factorials.

Sometimes, not all the members of a group are selected. We have a method of finding an answer using factorials.

Example 1B: There are 3 V.I.P. locations; in how many ways can 3 torchbearers be selected?

We say n = 8, the total number of torchbearers.
We say r = 3, the total chosen from the torchbearers.

The permutation function $_nP_r$, or in this case $_8P_3$, means:

$$\frac{n!}{(n-r)!} = \frac{8!}{(8-3)!} = \frac{8!}{5!} = \frac{8 \bullet 7 \bullet 6 \bullet 5 \bullet 4 \bullet 3 \bullet 2 \bullet 1}{5 \bullet 4 \bullet 3 \bullet 2 \bullet 1} = 8 \bullet 7 \bullet 6 = 836$$

This is 8 choices for location one, 7 choices for location two, and 6 for location three. 336 total permutations.

Using the TI: In the MATH menu, select the PROB tab and choose nPr. Input your value for n, call the nPr function, then input your value for r.

Practice

1. $_5P_5$ 2. $_5P_4$ 3. $_5P_3$ 4. $_5P_2$ 5. $_5P_1$

6. An NBA (or WNBA) team normally has 12 active players (condition: all positions are different and are selected in order: C, F1, F2, G1, G2).
   a. How many 5-person starting lineups are there?
   b. If the tallest person is always the starting center, how many 5-person starting lineups are there?