Statistics 3.4: Additional Topics in Probability and Counting

**Objective 1: Permutations**

Recall from 3.1 that the fundamental counting principle is used the find the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. In this section, you will study several other techniques for counting the number of ways an event can occur. An important application of the fundamental counting principle is determining the number of ways that *n* objects can be arranged in order or in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_ of objects. The number of different\_\_\_\_\_\_\_\_\_\_\_\_\_ of *n* distinct objects is \_\_\_.

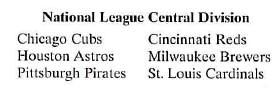
The expression \_\_\_\_ is read “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” and is defined as:

As a special case 0! = \_\_\_\_. Here are several other values of *n*!.

1!= 2!= 3! = 4! =

Read Ex 1, pg 172

TIY 1: The teams in the National League Central Division are listed below. How many different final standings are possible?



Suppose you want to choose \_\_\_\_\_\_ of the objects in a group and put them in order. Such an ordering is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of *n* distinct objects taken *r* at a time is:

Read Ex 2, pg 173

TIY 2: A psychologist shows a list of eight activities to her subject. How many ways can the subject pick a first, second, and third activity?

Read Ex 3, pg 173

TIY 3: The board of directors for a company has 12 members. One member is the president, another is the vice-president, another is the secretary, and another is the treasurer. How many ways can these positions be assigned?

**Calculator shortcut for permutations:**

You may want to order a group of *n* objects in which some of the objects are the same. For example, how many ways could arrange the letters of the word “KEEP” so that each arrangement is distinct? This is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ permutation and is found by using a variation of the permutation formula. The number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of *n* objects, where are of one type and are of another type, and so on is:

Read Ex 4, pg 174

TIY 4: The contractor wants to plant six oak trees, nine maple trees, and five poplar trees along the street. In how many distinguishable ways can they be planted?

TIY 4.5:

Find the number of distinguishable permutations in each problem.

1. How many ways can you arrange the letters of the word MISSISSIPPI?
2. How many ways can you arrange the letters of the word STREET?

**Objective 2: Combinations**

You want to buy 3 CDs from a selection of 5 CDs. How many ways could that be done?

In each selection above, order does not matter…any group of 3 CDs is the same. The number of ways to choose \_\_\_ objects from \_\_\_\_ objects without regard to order is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and can be found using the following formula:

Read Ex 5, pg 175

TIY 5: The manager of an accounting department wants to form a three-person advisory committee from the 20 employees in the department. In how many ways can the manager form this committee?

TIY 5.5: There are 12 people running a race. How many ways could they come in 1st, 2nd, or 3rd place?

**Calculator shortcut for combinations:**

RECAP:

|  |  |  |
| --- | --- | --- |
| **Principle** | **Description** | **Formula** |
| Fundamental Counting Principle | To find the number of ways that 2 or more events can occur in sequence. |  |
| Permutation | The number of different arrangements of *n* distinct objects. |  |
| Permutation | The number of arrangements of *n* objects taken *r* at a time. |  |
| Permutation | The number if distinguishable arrangements when objects repeat. |  |
| Combinations | The number of groups that can be made when *r* objects are selected from *n* objects. |  |

**Objective 3: Applications of Counting Principles (Practice Problems)**

Ex 6: A student advisory board consists of 17 members. Three members serve as the board’s chair, secretary, and webmaster. Each member is equally likely to serve either of the positions. What is the probability of selecting at random the three members that hold each position?

TIY 6: A student advisory board consists of 20 members. Two members serve as the chair and secretary. Each member is equally likely to serve any of the positions. What is the probability of selecting the two members who hold each position?

Ex 7: You have 9 letters consisting of three Bs, one U, one M, one L, and three Es. What is the probability that you randomly arrange the letters in order and they spell *BUMBLEBEE*?

TIY 7: You have 6 letters consisting of one L, two Ts, two Es, and one R. If the letters are randomly arranged in order, what is the probability that the arrangement spells *LETTER*?