PreCalculus Notes – Section 9.1 **BASIC PROBABILITY**

* Counting the possibilities.

**Ex 1: 3 coins are tossed. How many possible outcomes are there?**

* Each coin has 2 possible outcomes; heads or tails.

Solution 1: 1st coin: T or H

2nd coin: T H T H

3rd coin: T H T H T H T H

Count the “branches” = 8 total possibilities.

Solution 2: make “slots” to represent the three coins. Fill-in the number of possible outcomes for each coin. Multiply.

**Ex 2: A man has 6 pairs of pants, 10 shirts, and 5 ties. How many different outfits can he wear?**

He has three items of clothes. Make 3 “slots” – one for each type of clothing. \_\_\_\_\*\_\_\_\_\_\*\_\_\_\_\_

Solution:

**Ex 3: The standard NC license plates have 3 letters followed by 4 digits. How many license plate options are there?**

Solution:

In reality, NC does not have that many options. WHY?

In the license plate example, letters and numbers can be repeated. In some situations, objects cannot be repeated.

**Ex 4: Count the number of ways that the letters in DRAGONFLY can be arranged.**

We cannot use the letters more than once, so there will be one less option for each letter position.

Solution:

This is the same thing as \_\_\_\_ (read: “factorial”). There is a factorial button on your calculator. Go to MATH 🡪 PRB

**Ex 5: Count the number of ways that the letters in BUTTERFLY can be arranged.**

\*Here, the T’s are repeated. When you rearrange those T’s, the “word” formed would not actually be different… BUT1T2ERFLY = BUT2T1ERFLY.

So to account for these repeated words (we don’t want to count them twice), we need to divide out those repeated possibilities.

Solution:

**Ex 6: Count the number of different ways that the letters in BUMBLEBEE can be arranged.**

Solution:

**Ex 7: Four people are chosen from a group of 10 to buy tickets to a concert. The first person chosen gets first choice of seating, second person gets to choose next, and so on. In how many ways can this be done?**

Solution:

In this case, order is important. You would want to be first in line! This is called a PERMUTATION.

**PERMUTATIONS – ORDER IS IMPORTANT, NO REPEATS.**

**Ex 8: Using the letters A, C, T, how many “words” (not necessarily real) can be made?**

Solution:

**Notation: P(n, r) or nPr.** This is read: “n objects taken r at a time”

P = Permutation n = number of objects to choose from r = number of “slots” to fill.

So, the information from Example 7 would be written as 10P4. Example 8 would be written as 3P3.

**Formula for Permutation: **

So, Example 7 could be done using the formula:

**This formula is programmed in the calculator. Go to MATH 🡪 PRB. Select nPr. To repeat example 8, you would type in: 10 nPr 4 then hit enter.**

**Ex 9: A teacher draws names out of a hat to determine the seating chart. If there are 25 students and 25 desks, how many different seating charts can be made?**

Solution:

**COMBINATIONS: Order is irrelevant.**

If you are picking 4 people out of 10 to serve on a committee, does the order in which they are chosen really matter? Nothing happens if they are chosen first versus chosen fourth. You would still be on the committee. This is a combination.

**Notation: C(n, r) or nCr.**

**Formula for Combination: ** \*\* This is dividing out the repeated possibilities.

**This formula is programmed in the calculator. Go to MATH 🡪 PRB. Select nCr.**

Redo example 8 as a combination:

**Ex 10: For Queen of Hearts, the ballot of 30 girls must be narrowed to 10 for the court. In how many ways can this happen? (order does not matter – you just need to be one of the 10).**

**Ex 11: Papa Joe’s offers 10 different toppings on their new specialty pizza. To use a coupon, you must choose 3. In how many ways can this be done?**

Solution:

What if ANY number of toppings could be ordered? 10C0 + 10C1 + 10C2 + 10C3 + …

OR use the counting principle: 10 slots (for the 10 topping options) – each topping has TWO possibilities – either it is on the pizza or not… 2\*2\*2\*2\*2\*2\*2\*2\*2\*2 = 1024 pizza options.

**You decide: Permutation or Combination?**

1. 30 people running for 4 spots on the Principal’s Advisory Board
2. 30 people running for Student Body Pres/VP/Sect/Treas?
3. A cook choosing 5 potatoes from a bag of 12
4. “Pick 3” lotto. 3 numbers are chosen from 54 numbered balls (no repeats).
5. 7 digit telephone number (no repeats).

PreCalculus – HW 9.1 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. There are four candidates for homecoming queen and three for king. How many king-queen pairs are possible?
2. Excluding J, Q, X, and Z, how many 3-letter crossword entries can be formed that contain no repeated letters?
3. How many different arrangements are there for the letters in the word MISSISSIPPI?
4. How many different license plates can be made containing 2 digits followed by 2 letters and then 3 more digits if there are to be no repeated letters or digits?
5. How many different sequences of heads and tails are there if a coin is tossed 10 times?
6. How many different 5-card hands are there from a deck of 52 cards?
7. How many different 5-card hands include the ace and king of spades?
8. The head of the personnel department interviews 8 people for 3 identical job openings. How many different groups of 3 can be employed?
9. Mrs. Fischer gives 20 study questions from which 8 will be chosen to be on the test. How many unique tests can she develop?
10. How many different answer keys are there for a 10 question True/False test? What about a 10 question multiple choice test (A, B, C, D)?
11. Luigi sells one size pizza but claims that his selection of toppings allow for “more than 4000 different choices.” What is the smallest amount of toppings Luigi could offer?