Warm-up 4/4/17
Find the mean, median, and mode of this data set.

2, 7, 4, 8, 2, 6, 4, 9, 2

$\frac{2+7+4+8+2+6+4+9+2}{9} = \frac{44}{9} = 4\frac{8}{9}$

2, 7, 4, 8, 2, 6, 4, 9, 2

9.1: Basic Combinatorics

How many different three digit numbers can you make from the numbers 1, 2 and 3?

123
132
213
231
321
312

6

Multiplication Principle of Counting

If a procedure P has a sequence of stages $S_1, S_2, \ldots, S_n$ and if

S_1 can occur in r_1 ways,

S_2 can occur in r_2 ways,

$\vdots$

S_n can occur in r_n ways,

then the number of ways that procedure P can occur is the product $r_1 r_2 \cdots r_n$

The Tennessee license plate shown below consists of three letters of the alphabet followed by three numerical digits (0 through 9). Find the number of different license plates that could be formed

S_1

(a) if there is no restriction on the letters or digits that can be used; $(26)(26)(26)(10)(10)(10)$

$17,576,000$

(b) if no letter or digit can be repeated.

$(26)(25)(24)(10)(9)(8)$

$11,232,000$

Permutations

One important application of the Multiplication Principle of Counting is to count the number of ways that a set of n objects (called an n-set) can be arranged in order. Each such ordering is called a permutation of the set.

Permutations of an n-set

There are n! permutations of an n-set.

Count the number of different 9 letter "words" that can be formed using the letters in each word.

(a) DRAGONFLY (b) BUTTERFLY (c) BUMBLEBEE

$9! = 362,880$ $\frac{9!}{2!} = 181,440$ $\frac{9!}{3! \cdot 3!} = 10,080$

Permutation Counting Formula

The number of permutations of n objects taken r at a time is denoted ${}_nP_r$ and is given by

$$ {}_nP_r = \frac{n!}{(n-r)!} \quad \text{for } 0 \le r \le n. $$

If $r > n$, then ${}_nP_r = 0$.

Evaluate each expression.

(a) ${}_6P_4 = \frac{6!}{(6-4)!} = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = 360$

(b) ${}_{11}P_3 = 11 \cdot 10 \cdot 9 = 990$

Sixteen actors answer a casting call to try out for roles as the dwarfs in a production of Snow White and the Seven Dwarfs. In how many ways can the director cast the seven roles?

$_{16}P_7 = 57,657,600$

Combination Counting Formula

The number of combinations of n objects taken r at a time is denoted $_nC_r$ and is given by

$$_nC_r = \frac{n!}{r!(n-r)!} \quad \text{for } 0 \le r \le n.$$

If $r > n$, then $_nC_r = 0$.

In each of the following scenarios, tell whether permutations or combinations are being described.

(a) A president, vice-president, and secretary are chosen from a 25-member garden club.

P

(b) A cook chooses 5 potatoes from a bag of 12 to make a potato salad.

C

(c) A teacher makes a seating chart for 22 students in a classroom with 30 desks.

C

In the Miss America pageant, 51 contestants must be narrowed down to 10 finalists. In how many ways can the 10 finalists be selected?

$$_{51}C_{10} = \frac{51!}{10!(51-10)!} = \frac{51 \cdot 50 \cdot 49 \cdot 48 \cdot 47 \cdot 46 \cdot 45 \cdot 44 \cdot 43}{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2}$$

$$= 1.277771 \times 10^{10}$$

The Georgia Lotto requires winners to pick 6 integers between 1 and 46. The order which you select them does not matter. How many different lottery tickets are possible?

$$_{46}C_{6} = 9,366,819$$

Assignment: pp. 649 - 650
2 - 36 evens, 45, 46