

Warm-up

1. Two coins are tossed...

- a. Write a sample space for the possible outcomes.
- b. Draw a probability tree to show all possible outcomes.
- c. Find the probability that two heads are obtained.

2. Which of these numbers cannot be a probability?

- a) -0.00001
- b) 0.5
- c) 1.001
- d) 0
- e) 1
- f) 20%

Wednesday 2/1/17 1.3 Permutations

Def: Arrangement of objects in a specific order

How many ways can you arrange the numbers 1, 2, 3, and 4?

1,2,3,4	2,1,3,4	3,2,1,4	4,2,3,1
1,2,4,3	2,1,4,3	3,2,4,1	4,2,1,3
1,3,2,4	2,3,1,4	3,1,2,4	4,3,2,1
1,3,4,2	2,3,4,1	3,1,4,2	4,3,1,2
1,4,2,3	2,4,1,3	3,4,2,1	4,1,2,3
1,4,3,2	2,4,3,1	3,4,1,2	4,1,3,2

24 ways

How many digits are we going to use?

How many numbers can we choose from
for the 1st digit?

2nd digit?

3rd digit?

4th digit?

Key Concept: Factorial

Notation: $n!$

The total number of permutations of n objects without repetition



Ex. 1 From 6 students you have to choose a president, vice-president, secretary and treasurer for the club. In how many ways can you do this?

Method 1:

Method 2:

Key Concept: Permutation

Notation: ${}_n P_r$

n is the **total** number of objects

r is the number of objects chosen (want)

$${}_n P_r = \frac{n!}{(n-r)!}$$

$${}_5 P_4 =$$

Ex. 2

$${}_6 P_4 =$$

$${}_{10} P_4 =$$

Ex.3 In how many different ways can five books be arranged on a shelf?

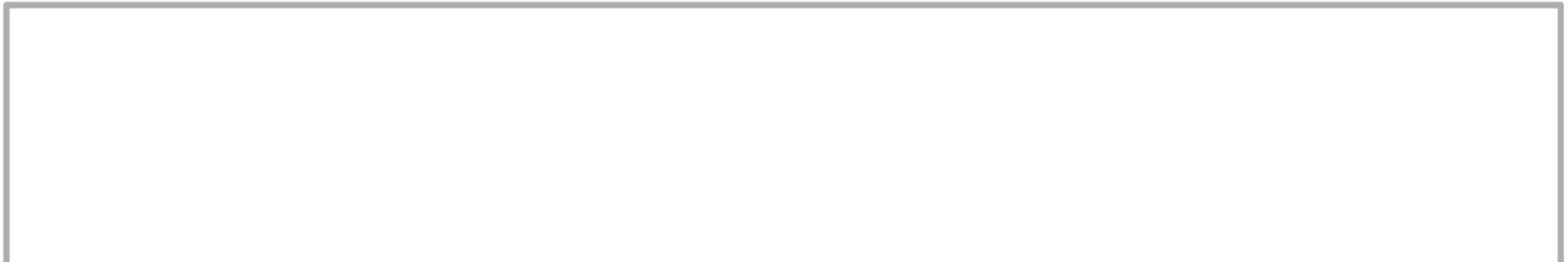
Ex. 4 How many two digit numbers can be made from the six digits 7, 2, 4, 5, 9, 3 if no digit can be used more than once?

5. What is the total number of possible 4-letter arrangements of the letters b, l, a, n, k if each letter is used only once in each arrangement?

What if all of the objects are not different?

Look at the arrangement of the numbers 1, 2, 2, and 3. What do you notice?

Repetitions are taken care of by dividing the permutation by the factorial of the number of objects that are identical.



Example 6:

How many **different** 5-letter words can be formed from the word **APPLE** ?

$$\frac{{}_5P_5}{2!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = \frac{120}{2} = 60 \text{ words}$$

You divide by 2! because the letter **P** repeats **twice**.

How many **different** six-digit numerals can be written using all of the following six digits
4,4,5,5,5,7

$$\frac{{}_6P_6}{2!3!} = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1 \cdot 3 \cdot 2 \cdot 1} = \frac{720}{12} = 60$$

Two fours repeat and **three** fives repeat, so divide by 2! and 3!

7. How many different permutations can be made using all the letters of the word Connecticut?

8. How many integers of three decimal places can be formed from the digits 5, 1, 8, 4 if repetition is allowed?

9. How many even integers of four places can be formed from the digits 1, 2, 3, 4, 5 if repetition is allowed?



1. Permutation - arrangement

Order Matters!

2. Repetitions -

$$\frac{nPr}{x! y!}$$

Divide
by
factorial repetitions

3. Methods -

$$\text{Method 1} = \frac{n!}{x! y!}$$

$$\text{Method 2} = nPr$$

ASSIGNMENT

Probability Assignment #2

#6-10