

Section 1.2:

Random sampling

Warm up: Counting

You find three paths in the forest. Each of those branches into two paths of their own. How many possible routes might you take?

What if there are three paths, each branches into four paths, and each of those branches into five paths? How many total routes?

You roll two (six-sided) dice. How many outcomes are there?

_____ possibilities for 1st die

_____ possibilities for 2nd die

How many two-letter combinations are there?

_____ possibilities for 1st letter

_____ possibilities for 2nd letter

How many two-letter combinations are there where the letters are distinct?

_____ possibilities for 1st letter

_____ possibilities for 2nd letter

How many two-digit numbers are there with distinct digits? (First digits may be 0.)

How many two-digit numbers are there so the second digit is larger than the first?

How many ways are there of ordering the numbers 1, 2, 3?

How many ways are there of ordering the numbers 1, 2, 3, ..., n ?

How many three digit numbers are there with distinct digits? (First digit may be 0.)

How many three digit numbers are there where the digits are increasing?

Sampling: Choosing an object at random from a given set

Ex) Deal 5 cards randomly from 52 card deck (sampling). **What is the probability of a full house?**

- Note: Deck has four suits, hearts (H), diamonds (D), clubs (C), and spades (S). There are 13 cards of each suit (some have special names, but let's just call them 1,2,3, ..., 13)
- Full house: 3 of one number, and two of another number, e.g. (5H, 5D, 5S, 9H, 9D)

$$\Omega = \{ \underline{\hspace{15em}} \}$$

Two standard choices for defining outcomes:

Option 1: Order matters, so $(5H, 5D, 5S, 9H, 9D)$ is different from $(9H, 9D, 5H, 5D, 5S)$

Option 2: Order does not matter (use set notation):

$$\{5H, 5D, 5S, 9H, 9D\} = \{9H, 9D, 5H, 5D, 5S\}$$

We should be able to answer our question using either option (and get the same answer!)

Note: All outcomes are equally likely (since there is one of each card in deck)

Fact: If $\# \Omega < \infty$ and each outcome is equally likely, then
 $P(A) = \underline{\hspace{2cm}}$

What is the probability of a full house?

Option 1: Order matters

Counting Ω

Option 1: Order matters

$$\# \Omega = \underline{\hspace{2cm}}$$

$$\text{Notation: } (n)_k = n(n-1)(n-2) \cdots (n-k+1)$$

Counting Ω

Option 2: Order doesn't matter

More counting

$$A = \{\textit{full house}\}, \#A = ?$$

Option 1: Order matters

