We are heading toward Statistical Inference

Example of what we're going to do (eventually):

We suspect the average IQ of all ENC students is 120:

$$\mu = 120$$

We take a random sample of 30 ENC students and find the average of that sample to be 124:

$$\bar{X} = 124$$

Does $\bar{X} = 124$ support $\mu = 120$ or not?

Essentially we are going to ask:

What is the probability we get $\bar{X} = 124$ if $\mu = 120$?

Definitions/Terminology

Added to the Vocab List

Probability: A measurement of the likelihood of the occurrence of some chance event.

Outcome: A possible result of an experiment.

Sample Space: The set of all possible outcomes.

Event: A subset of the sample space, or a set of outcomes.

Simple Event: An event that has only one element. (Cannot be broken down any further.)

Examples of experiments

a. Toss a coin one time and observe the side that shows.

b. Roll a die once and observe the up side.

c. Roll two dice and observe the pair of numbers that show.

d. Buy a lottery ticket where 5 marbles are selected from 30 marbles.

Some rules of probability

1) P(impossible event) = 0

2) P(guaranteed event) = 1

3) For any event A, $0 \leq P(A) \leq 1$

4) The sum of the probs of all simple events must equal 1

In fact,

5) For any event, the sum of the probs of each simple event must equal the prob of the event

Suppose our class is distributed this way:

	From Mass	Not From Mass	
Fresh	3	5	8
Soph	4	10	14
Jun	8	8	16
Sen	5	7	12
	20	30	50

Assuming individuals are selected at random, the probabilities for different categories will equal the proportions of those categories.

Historical proportion = Future probability

So: P(from Mass)

P(Senior)

P(Fresh or Soph)

- Suppose an unfair coin has heads twice as likely as tails. Find P(H) & P(T).

- Suppose a die has 1,2,3,4,5 all equally likely, but 6 as likely as all the others combined. Find each prob.

- Suppose I have a sample space with simple events A, B, C & D. Suppose A is twice as likely as B, and B is twice as likely as C, and C is twice as likely as D. Find the prob of each.

Now suppose we have equally likely simple events (or equally likely outcomes).

- A fair die has six sides. What is the prob of each?

- What if a sample space has N equally likely outcomes?

P(each simple event) = ?

- What if we choose an event of size S from a sample space with N equally likely outcomes? What will the prob of that event be?

Blood Types and Rh factor in the United States

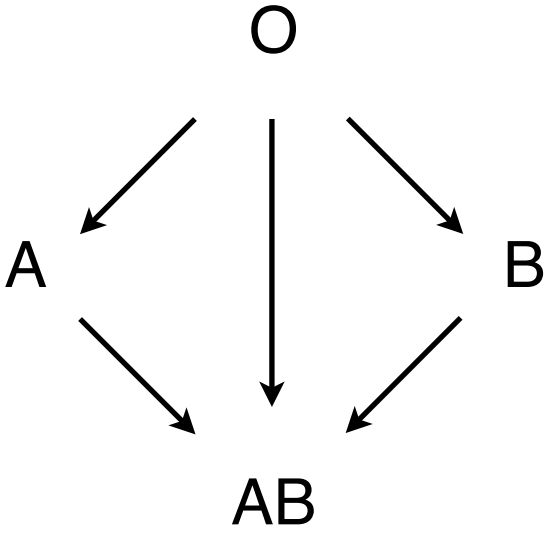
(Contingency table)

	A	B	AB	O
Rh+	36	8	3	37
Rh-	6	2	1	7

These are the percentages of each type of blood in the U.S.

Rh+ means your blood contains a certain substance
Rh- means your blood is missing that substance

If you are Rh-, you cannot tolerate/receive blood that is Rh+.



Some state lotteries are the type where you select three digits, each from 0-9.

Q1: How many different strings of this type are there?

Q2: Are any of those strings more or less likely than the others?

Q3: So how much probability do we assign to each individual number?

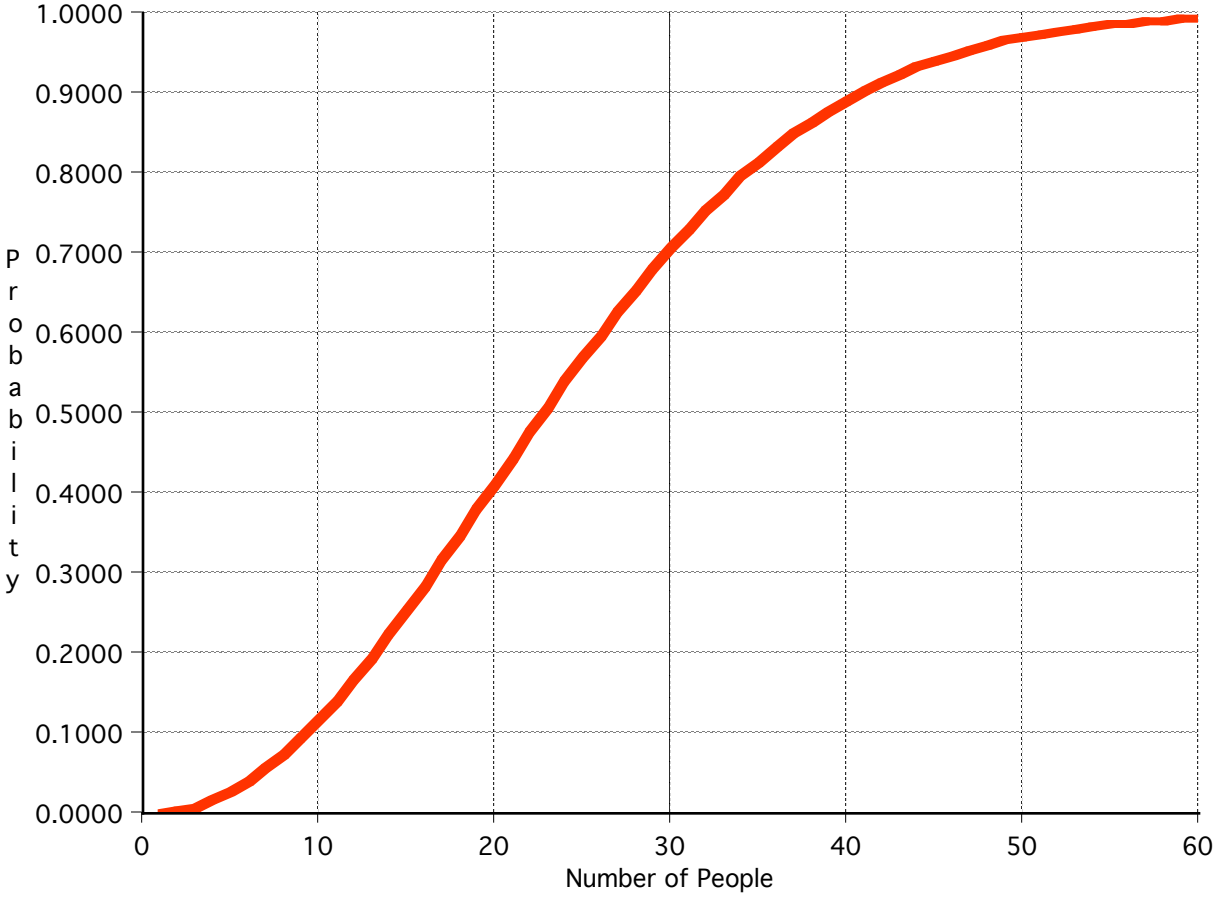
Q4: What is the probability that on 6/12 the number is 612?

Q5: What is the probability that on 6/13 the number is 612?

Q6: What is the probability that on 6/12 & 6/13 the two numbers match?

Birthday Problem

P(there are matches when there are n people)



n	Prob
5	0.0271
10	0.1170
15	0.2529
20	0.4114
25	0.5687
40	0.8912
50	0.9704