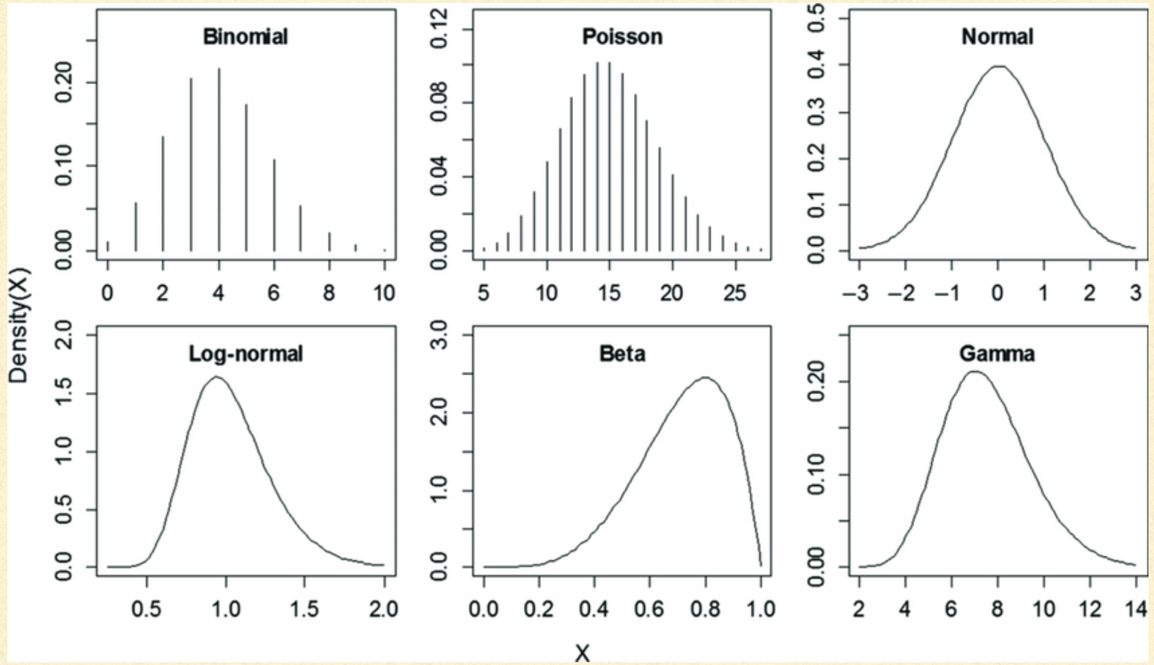
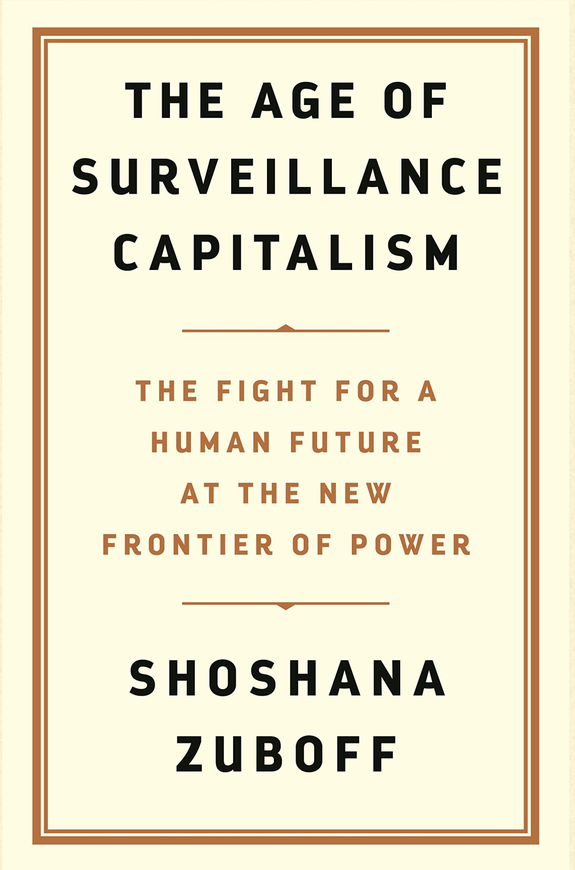


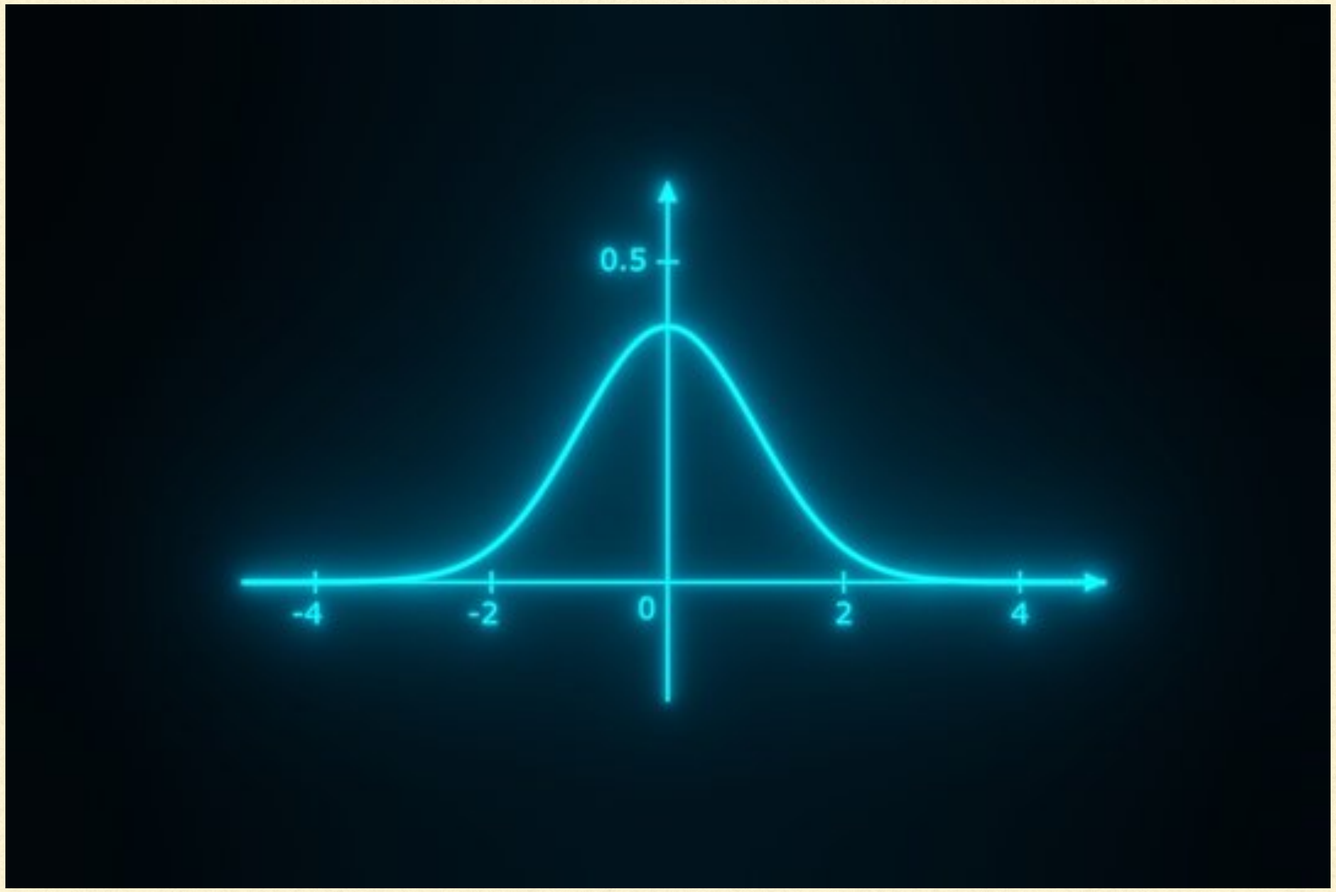
YOU CAN'T RUN FROM TESTINY! (THIS IS A PUN THERE ARE NO TESTS)

Sections 1 & 2 (Instructor: Jose Aveldanes)

ZUBOFF (CONTINUED NEXT 20 MINS)

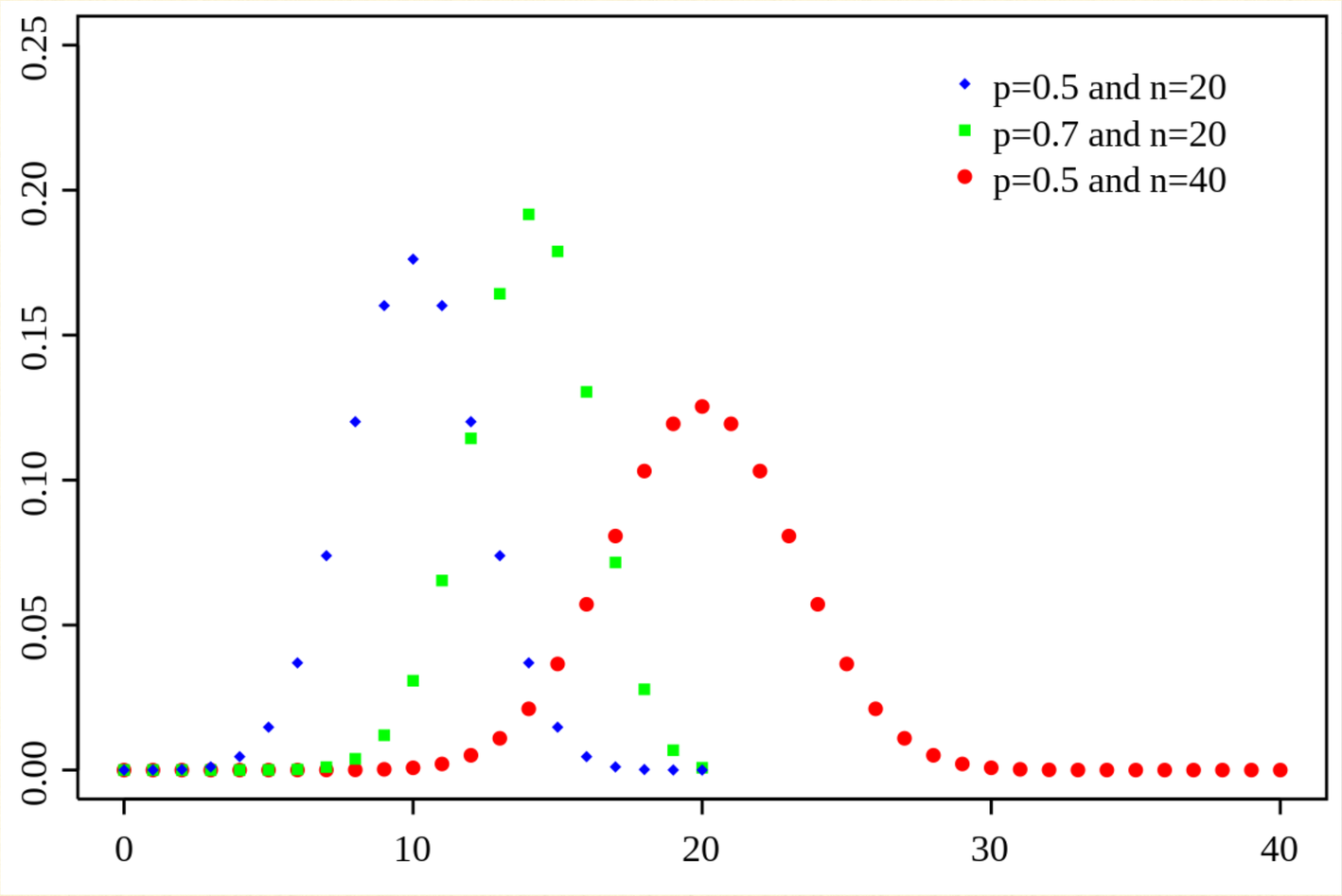
QUESTION: ARE OUR EXPECTATIONS ABOUT WHAT IS ETHICAL ONLINE VERSUS OFFLINE DIFFERENT?





LET'S TALK DISTRIBUTIONS

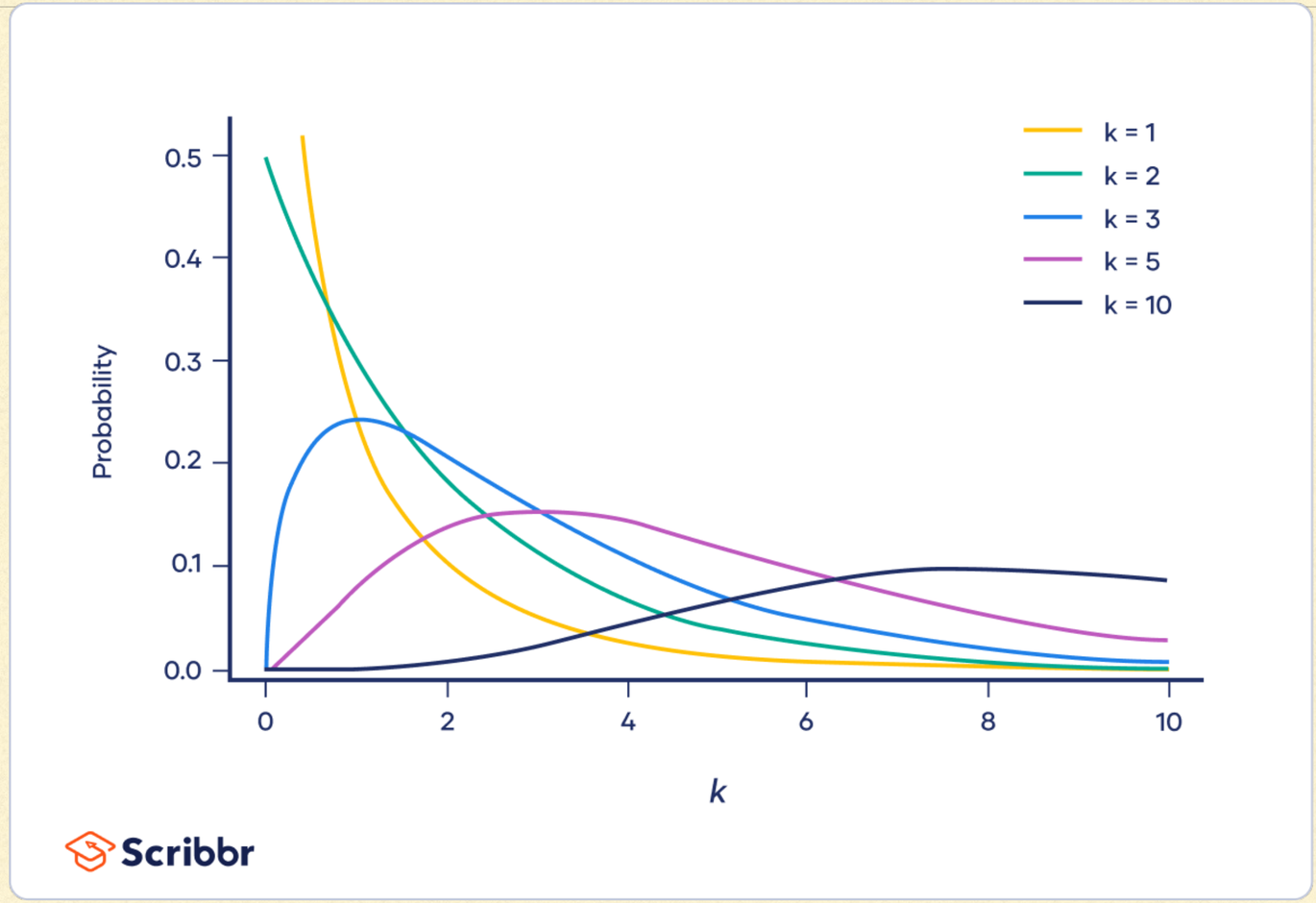
Data Science with R and Python (Aveldanes)



A **binomial distribution** can be thought of as simply the probability of a SUCCESS or FAILURE outcome in an experiment or survey that is repeated multiple times.

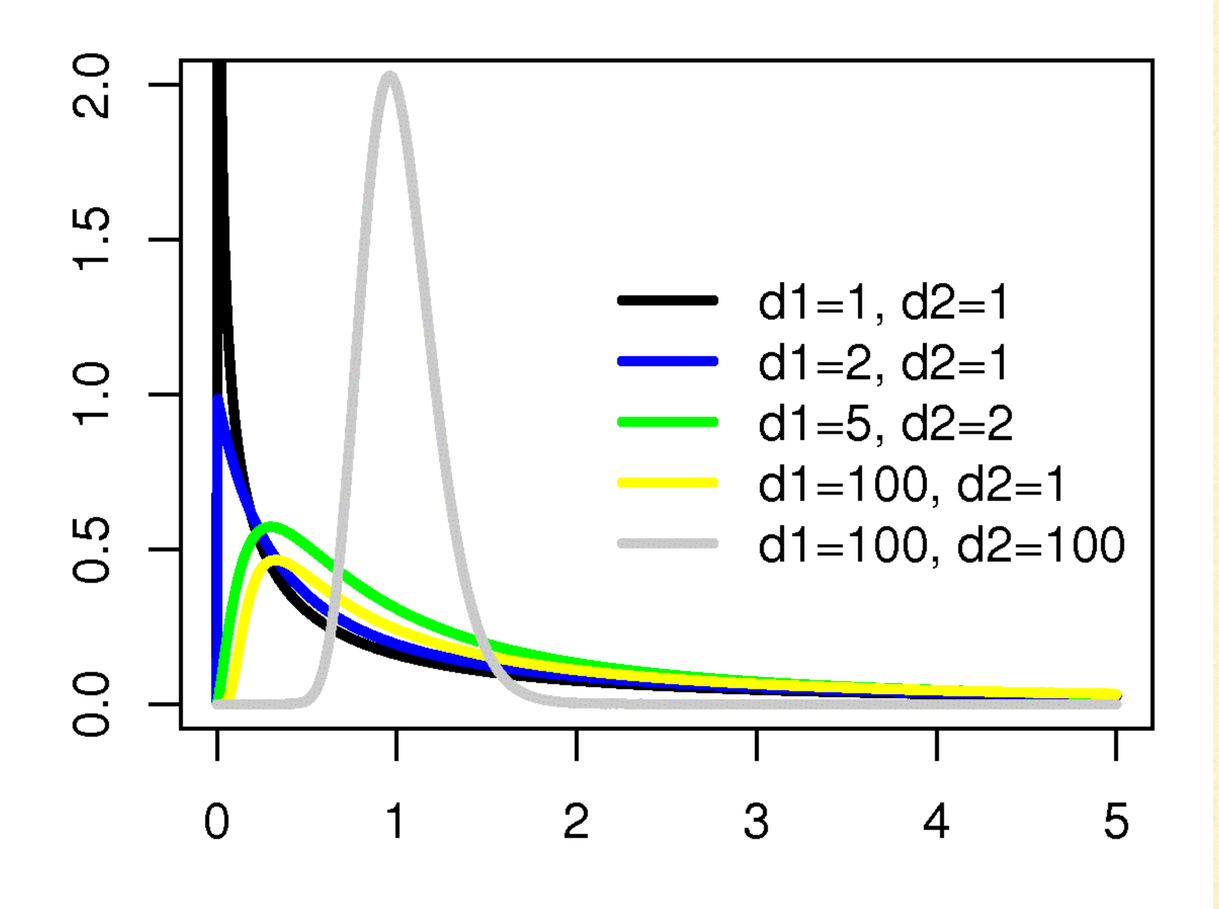
BINOMIAL DISTRIBUTION (LINK): P(EVENT) = (NUMBER OF WAYS EVENT CAN OCCUR) * P(ONE OCCURRENCE).

Sections I & II (Instructor: Jose Aveldanes)



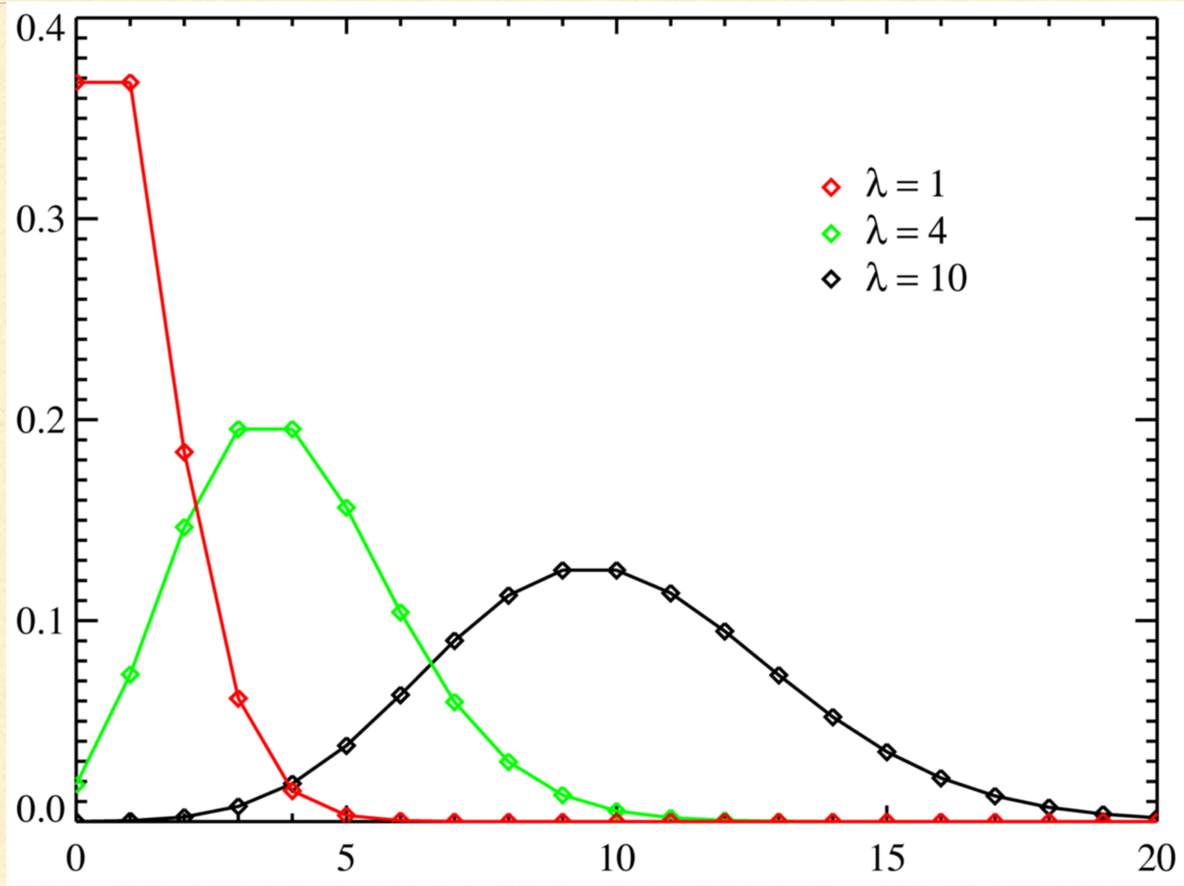
CHI-SQUARE (X^2) DISTRIBUTION (LINK)

Sections I & II (Instructor: Jose Aveldanes)



F-DISTRIBUTION (LINK)

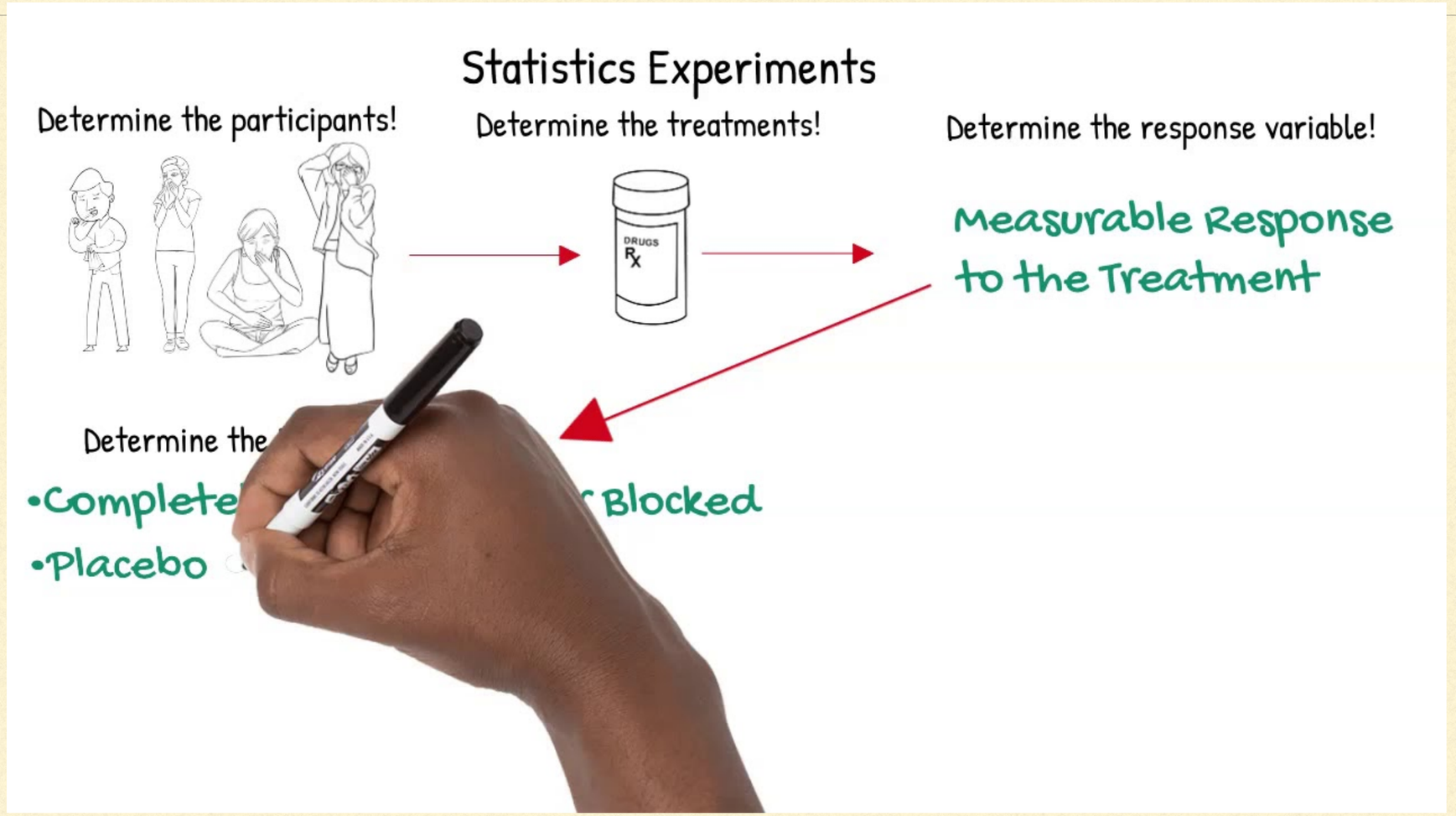
Sections I & II (Instructor: Jose Aveldanes)



Poisson distribution is used to describe the distribution of rare events in a large population

POISSON DISTRIBUTION (LINK1, 2)

Sections I & II (Instructor: Jose Aveldanes)



CHAPTER 3: STATISTICAL EXPERIMENTS

Instructor Jose Aveldanes (Section I & II)

Key Terms

Treatment: something (drug, price, web headline) to which a subject is exposed

Treatment group: a group of subjects exposed to a specific treatment

Control group: a group of subjects exposed to no (or standard) treatment

Randomization: process of randomly assigning subjects to treatments

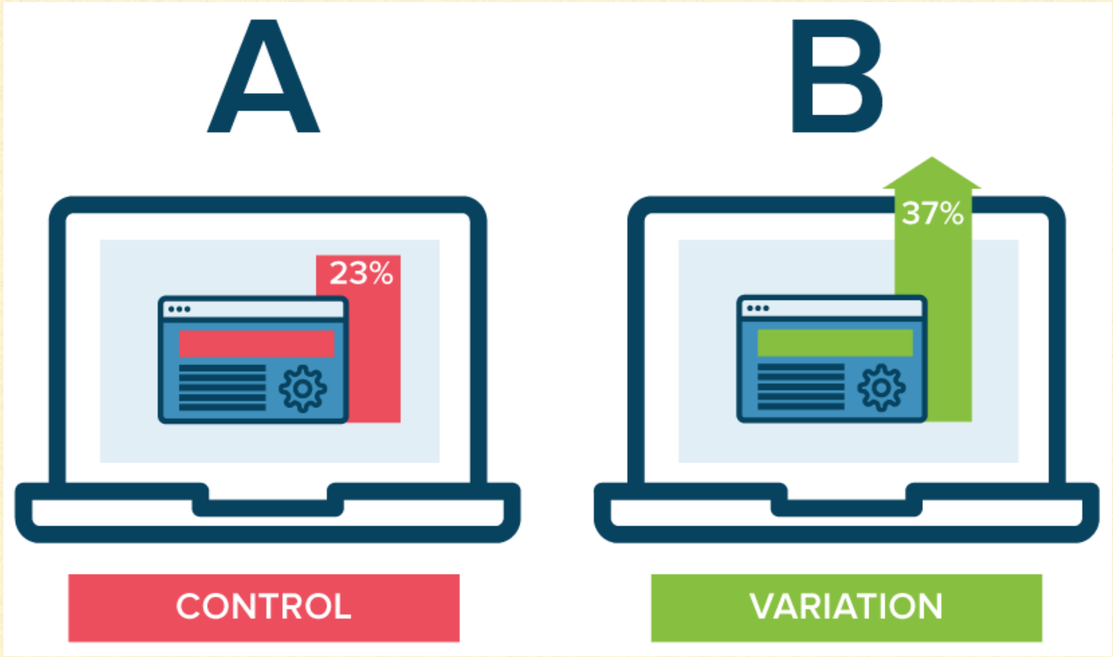
Subjects: the items (web visitors, patients, etc.) that are exposed to treatments

Test statistic

The metric used to measure the effect of the treatment

A/B Testing

DEFINITION: AN EXPERIMENT WITH TWO GROUPS TO ESTABLISH WHICH OF TWO TREATMENTS, PRODUCTS, PROCEDURES, OR THE LIKE IS SUPERIOR.



A/B Testing

A/B testing is common in web design and marketing and results are readily measured

Examples: testing two soil treatments to determine which produces better seed germination, testing two therapies to determine which suppresses cancer more effectively, testing two web headlines to determine which produces more clicks, testing two web ads to determine which generates more conversions.

Proper A/B test has subjects that can be assigned to one treatment or another

Subject might be a person, a plant seed, a web visitor

Randomization helps us make sure any difference between two groups is the result of two things:

1. The effect of different treatments
2. Luck of the draw in which subjects are assigned to which treatments (i.e., the random assignment may have resulted in the naturally better-performing subjects being concentrated in A or B).

Without a control group, there is no assurance that “all other things are equal” and that any different is really due to treatment (or to chance).

When you have a control group, it is subject to the same conditions (except for the treatment of interest).

Note: blind studies are ones where the subjects are unaware of whether they are getting treatment A or treatment B.

a. Awareness of a particular treatment can affect response
b. Blinding is not possible when the nature of the treatment is transparent

Hypothesis Tests

Purpose is to help you learn if random chance might be responsible for the observed effect

- Null hypothesis: the hypothesis that chance is to blame
- Alternative hypothesis: counterpoint to the null (what you hope to prove).
- One-way test: hypothesis test that counts chance results only in one direction

Two-way test: hypothesis test that counts chance results in two directions

Note: humans underestimate the tendency of the human mind to underestimate the scope of natural random behavior.

Another note: humans have the tendency to misinterpret random events as having patterns of some significance

Statistical hypothesis testing was invented as a way to protect researchers from being fooled by random chance.

Proper design of A/B test, you collect data on treatments A and B in such a way that any observed difference between A and B must be due either to:

i. Random chance in assignment of subjects
ii. A true difference between A and B

1. A statistical hypothesis is a further analysis of an A/B test, or any randomized experiment, to assess whether random chance is a reasonable explanation for the observed difference between groups A and B.

Null Hypothesis

Hypothesis tests use the following logic: "Given the human tendency to react to unusual but random behavior and interpret it as something meaningful and real, in our experiments, we will require proof that the difference between groups is more extreme than what chance might reasonably produce."

One way to do this is via a resampling permutation procedure, in which we shuffle results from groups A and B and then repeatedly deal out the data in groups of similar sizes, and then observe how often we get a different as extreme as the observed difference.

The combined shuffled results from groups A and B, and the procedure of resampling from them, embodies the null hypothesis of groups A and B being equivalent and interchangeable and is termed the null model.

Alternative hypothesis

1. Hypothesis tests by their nature involve not just a null hypothesis but also an offsetting alternative hypothesis

Examples:

b. Null = "no difference between the means of group A and group B"; alternative = "A is different from B" (could be bigger or smaller)

c. Null = "$A \leq B$"; alternative = "$A > B$"

d. Null = "B is not X% greater than A"; alternative = "B is X% greater than A"

b. One-way versus Two-way Hypothesis Tests

1. One-directional test: you want to stick with A UNLESS B proves definitely better

2. If you want a hypothesis test to protect you from being fooled by chance in either direction, the alternative hypothesis is bidirectional (or two-tail) hypothesis (meaning A is different from B; could be bigger or smaller).

3. A one-tail hypothesis test often fits the nature of A/B decision making, in which a decision is required and one option is typically assigned "default" unless the other proves better.