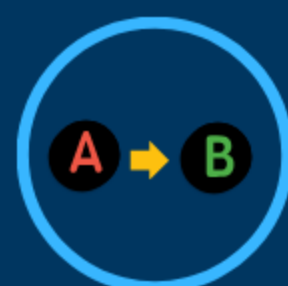# Common Stats Pitfalls

Understanding widespread misconceptions in statistics is essential for anyone working with quantitative data. By recognizing these pitfalls, researchers can more critically evaluate statistical claims, design more robust studies, analyze data more effectively, and report findings with greater accuracy and confidence.

False Causality

A logical error in which a causal relationship is assumed between two events simply because they seem to occur together.

This fallacy often stems from an oversimplification of complex relationships, overlooking alternative explanations or contributing factors, and mistaking correlation for causation without adequate evidence.

What is the relationship between shark attacks and ice cream sales?
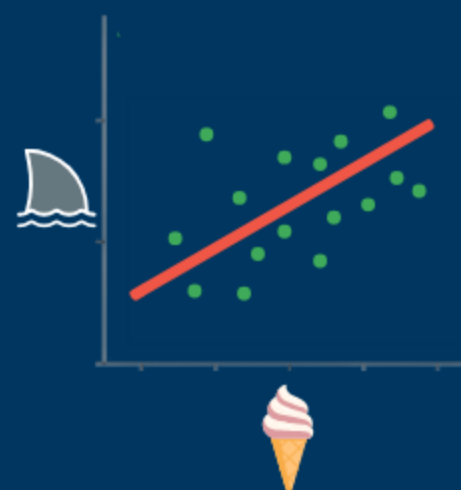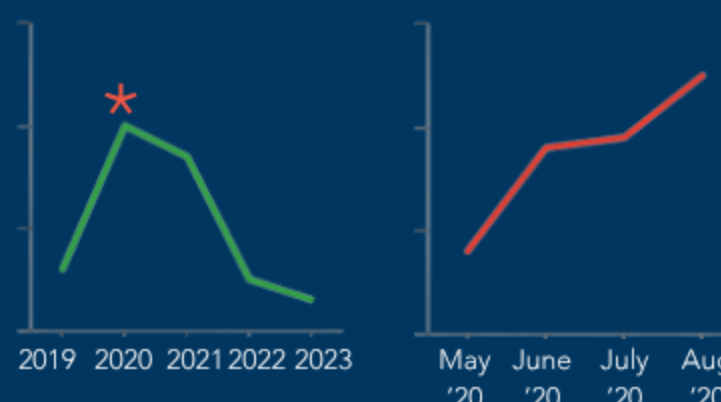

Explanation:
People can still enjoy their ice cream without worrying about being attacked by sharks! While the two may be correlated, they are not necessarily causally linked. Both increase during the summer due to independent seasonal factors.

Cherry-picking

The selective reporting of data points that support a desired claim, while omitting or disregarding those that may challenge or contradict it. This practice distorts the overall analysis, resulting in biased and misleading results.

Increase in home office furniture sales

2019 2020 2021 2022 2023   May '20 June '20 July '20 Aug '20

Explanation:
By magnifying selected data points, one risks promoting false narratives. For instance, highlighting the pandemic spike in 2020 in home office furniture sales without showing the post-lockdown decline can mislead others into thinking the trend was permanent.

HARKing

The term stands for *Hypothesizing After the Results are Known,* a practice where researchers formulate or modify their hypotheses based on the data analysis and present them as if they were established beforehand.

Does the use of flashcards improve test scores?

Flashcards users feel more confident!

Explanation:
A researcher tests whether flashcards improve test scores but finds no significant effect. Instead of reporting this, they run more analyses and find a significant link between flashcard use and student confidence, an outcome not originally hypothesized. They then reframe the study to suggest it was about confidence from the start.

Multiple Testing

The multiple hypotheses testing problem refers to the increased risk of a Type I error—rejecting a true null hypothesis—when conducting multiple statistical tests simultaneously.

Each test carries a risk of a false positive, and as the number of tests grows, so does the cumulative chance of finding at least one significant result purely by chance.

What effect do fertilizers have in plant growth?

VS A VS B C VS D VS
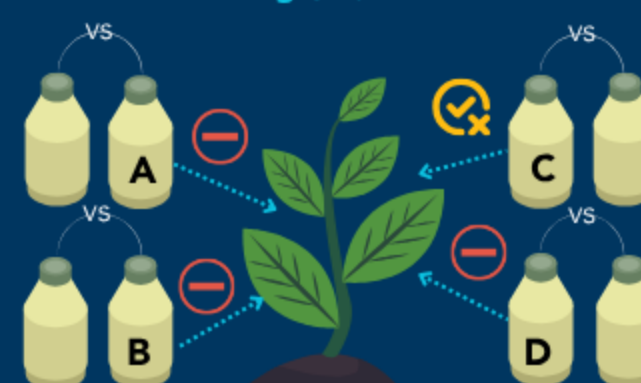
Explanation:
By comparing each of the four fertilizer groups to the control simultaneously, the likelihood of finding a "significant" result by random chance increases. Without significance threshold adjustments by the number of comparisons, one might wrongly assume that a fertilizer C works when it actually doesn't.

Ever heard of p-hacking? It's a broad term that refers to manipulating data or statistical analyses–often using a combination of questionable techniques, including some of the above –to achieve statistically significant results.
LEARN MORE

Did you know that UCSB has a DataLab that provides advice on statistical methods to faculty and graduate students?

datascience.ucsb.edu/consulting