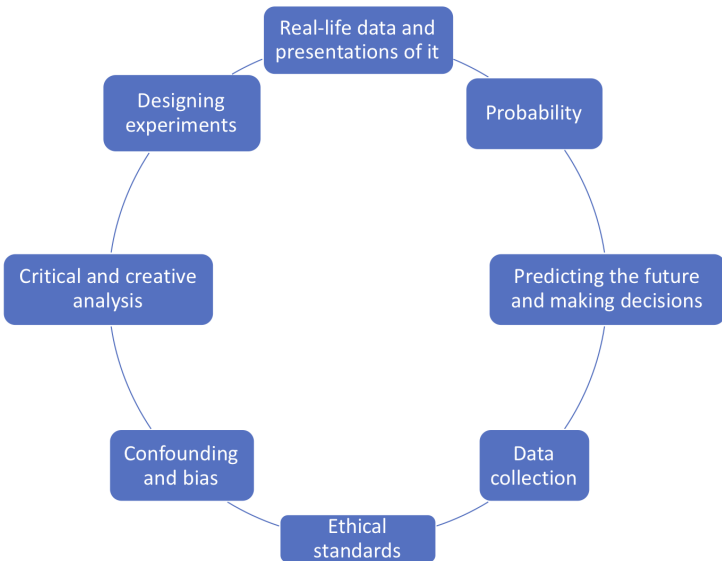
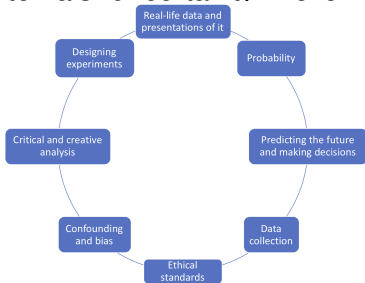


Interwoven Connections



Problem solving at the heart of mathematics:
visualization, generalization, making decisions

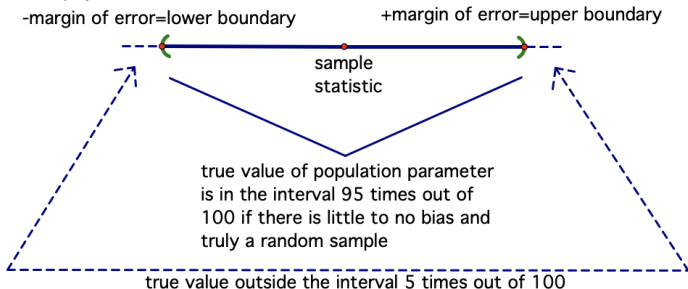
- collecting data: reproducibility, consensus, and random sampling if possible
- presenting data: entire data set versus numerical or visual snapshots of it
- expected value: weighted probabilities for decisions
- mean and median: central tendencies
- box plots: comparisons
- regressions: correlations
- confidence intervals: uncertainty in even the best polls



all can be subject to bias and distortion, and are definitely subject to probability and random variations

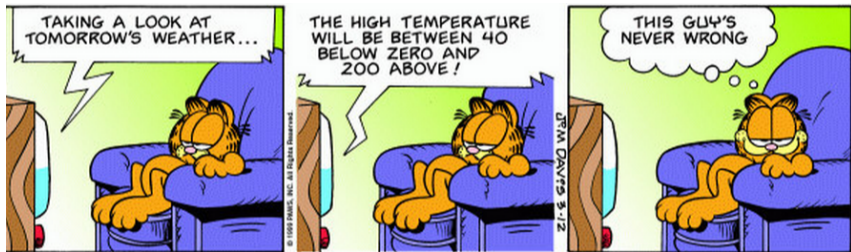
Confidence Levels

- If there is little to no bias and truly a random sample, then **$x\%$ confidence interval** is a numerical interval generated by a procedure that x times out of 100 will produce an interval that contains the true value for the entire population.
- Many polls use the 95% confidence level:



- Likelihood of the sample outcome—no way to know which intervals contain the true percentage and which don't

Margin of Error



Garfield by Jim Davis <https://garfield.com/comic/1999/03/12>

- **margin of error** gives a range the actual percentage is likely to be within if the sample size is large enough. Higher confidence level has a wider interval.
- For a 95% confidence interval, a sample of size n will have margin of error approximately $\frac{1}{\sqrt{n}}$ (**conservative estimate**).
- We check for overlaps in the intervals in order to evaluate the statistical validity of headlines and statements in polls

