PSQF 4143: Section 15

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Hypothesis Tests for Correlations

- Many researchers may be interested in testing if the correlation differs from 0.
- The hypotheses would be:
  - $H_0 : \rho = 0$
  - $H_1 : \rho \neq 0$
  - Can also do one-sided hypotheses here.

Test Statistic

$$TS = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \sim t_{df}$$

- $df = n - 2$
- n denotes the number of pairs of observations

Example

- A researcher wants to determine whether $r = 0.66$ is significantly greater than 0.
- The sample size was 50 (50 observations on X and Y scores)
- Let's use $\alpha = .01$

Testing a constant other than 0

- The sampling distribution is distributed as a t_{df} when testing against 0.
- However, what if we wanted to test the following hypotheses?
  - $H_0 : \rho = 0.50$
  - $H_1 : \rho > 0.50$
- Since the correlation can only go as large as +1 (or as small as -1), testing constants other than 0 can lead to skewed sampling distributions.
- Fortunately, a procedure developed by R.A. Fisher can be used in these situations.

Fisher's r to z Transformation

- We will use the table D.7 of the course packet (page 230) to convert correlations (r) to the z' metric.
  - Note, that for negative correlations, just make the z' value negative.
- The sampling distribution will now be normally distributed.

$$TS = \frac{z' - z'_0}{\frac{1}{\sqrt{n-3}}} \sim Z$$
$$\hat{\sigma}_{z'} = \frac{1}{\sqrt{n-3}}$$

Example

- A researcher wants to determine whether $r = 0.66$ is significantly greater than 0.50.
- The sample size was 50 (50 observations on X and Y scores)
- Let's use $\alpha = .05$

Assumptions

1. r computed from a random sample
2. The population is bivariate normal
3. $n > 10$
4. ρ is not too close to 1 or -1

Confidence interval for a correlation

- A two-sided confidence interval for z'_{pop} is given by:

$$z' \pm z_{crit} \frac{1}{\sqrt{n-3}}$$

- The confidence limits calculated above are in the z' metric. After calculation, we will back-transform them into the r metric using table D.7 from the coursepacket.

Example

- Find a 95% confidence interval for ρ, given that a sample of $n = 50$ and $r = .66$.