Test 3 Checklist

1. sampling:
   (a) population vs sample
   (b) sample space Ω is the set of possible outcomes
   (c) observational study vs designed experiment
   (d) with / without replacement
   (e) simple random sample, stratified sample, voluntary response sample
   (f) sampling issues/dangers
2. inference - generalizing from a sample to a population

	sample/empirical/estimated statistic	population/theoretical/true parameter
proportion	$\hat{p}$	p
mean	$\overline{x}$	μ
standard deviation	s	σ
correlation	r	ρ ("rho")

3. Basic inference by equating sample and population ratios or averages.
4. Confidence interval - a window around the point estimate that is likely to contain the true population parameter
   (a) confidence level $1-\alpha$, e.g. if $\alpha = .05$ then 95% confident
   (b) margin of error
   (c) CI can be written as point estimate $\pm$ MOE
   (d) one sample proportion: $\hat{p} = \frac{x}{n}$ is the point estimate for p; use 1-propZint for CI
   (e) one sample mean $\overline{x}$ is the point estimate for μ; use tInterval for CI
5. Hypothesis Test outline:
   (a) null hypothesis H_0
   The presumption that you want to discredit/reject.
   (b) alternative hypothesis H_1
   what the "prosecutor" thinks the evidence may point to
   (c) sample statistics and effect sizes
   calculated from the observed data
   (d) p-value
   plausibility of H_0; measures how consistent the sample evidence is with the null hypothesis (the probability that such an extreme observation would occur by chance if H_0 were true)
   (e) conclusion
   The lower the p-value, the more "significant" the results are against H_0 in favor of H_1.
   - If p-value $\leq \alpha$ then the data are inconsistent with H_0;
     the difference is statistically significant, so reject H_0
   - If p-value $> \alpha$, then the data are reasonably consistent with H_0;
     the difference is not statistically significant, so fail to reject H_0.
6. significance level α (think "reasonable doubt" threshold), $\alpha = .05$ is common
7. left-tailed ($<$), right-tailed ($>$), two-tailed ($\neq$)

8. one-sample hypothesis test:
   - one sample mean
     $H_0 : \mu = \mu_0$, use t-test
   - one sample proportion
     $H_0 : p = p_0$, use 1-propZtest
9. You may do a hypotheis test of $H_0 : rho = 0$ using linRegttest
10. two sample inference on the calculator
    (a) two sample proportion HT
    $H_0 : p_1 = p_2$, use 2-propZtest
    (b) two sample proportion CI
    $p_1 - p_2$, use 2-propZint
    (c) two sample mean HT
    $H_0 : \mu_1 = \mu_2$, use 2-sampTtest
    (d) two sample mean CI
    $\mu_1 - \mu_2$, use 2-sampTint
    (e) two sample standard deviation HT
    $H_0 : \sigma_1 = \sigma_2$, use 2-sampFtest
11. Understand the hypothesis test framework, notation, and terminology.
    (a) What does statistically "significant" really mean? Interpret the p-value and effect size together.
    (b) Have intuition about how changes in the problem setup and/or data will affect the p-value or confidence interval.
    (c) Type I error: reject a true H_0 (convict the innocent)
    (d) Type II error: fail to reject a false H_0 (acquit the guilty)
12. Confidence interval (CI) and hypothesis testing (HT) decision guide:
    (a) Decide what statistic you are studying, and which distribution applies:
    - proportions p (normal - Z)
    - means μ (T distribution)
    - correlation rho (T distribution)
    - standard deviations σ (F distribution)

    (b) Decide if you have 1 or 2 samples, or a scatter plot.
    (c) If you are interested in the differences between matched pairs, subtract and treat the differences as one sample.
    (d) Confidence interval (estimate, MOE) or hypothesis test (p-value significance) ?
    (e) If you are doing a HT, is it left, right, or two-tailed? State H_0 and H_1. Find the p-value. Reject H_0 (the effect is statistically significant) if the p-value $< \alpha$.
    (f) If you are doing a CI, be able to identify the point estimate and margin of error.