AP Test Review – Significance Tests

I. Basics

A. A significance test is a formal procedure for using observed data to decide between 2 competing claims (usually about a parameter).

B. Hypotheses

a) Null Hypothesis, H_0: claim of no difference of the parameter (H_o = parameter)

b) Alternative Hypothesis, H_a: claim we find evidence for (one sided or two sided)

C. P-Value

a) the probability of getting a value as extreme or more extreme in the direction of H_a given H_o is true

b) the smaller the p-value, the more evidence for the H_a

D. Significance Level, α

a) We test our p-value against α to determine if we have sufficient evidence to reject H_o

b) the higher the α, the easier it is to reject H_o

E. Errors with hypothesis testing

a) Type I Error

i) Rejecting the H_o when it is true

ii) P (Type I error) = α

iii) Can be reduced by lowering α, increasing n,

b) Type II Error

i) Fail to reject H_o when H_a is true

ii) P (Type II error) = β = 1 – Power

iii) can be reduced by increasing α, increasing n, increasing effect size

F. Power

a) Probability of correctly accepting the H_a

b) Power = 1 – P(Type II error)

c) can increase power by increasing n, increasing α, increasing effect size

II. Use Inference Summary handout for all formulas, conditions, and 4 step process

III. Special Cases

A. Paired data

a) 1 subject receiving both treatments or 2 similar subject receiving treatments

b) use paired t procedures by calculating the difference in values

c) then perform 1 sample t test for μ

B. Pooled z procedures

a) used if the H_o is H_o: $p_1-p_2 = 0$ (or $p_1=p_2$) *this is how it is noted on formula sheet

b) $\hat{p}_C = \frac{X_1+X_2}{n_1+n_2}$ (pooled or combined proportion)

c) in this case, $\hat{p}_C$ is equal to p on the formula sheet

Tips and Common Mistakes:

- Wording of hypotheses is vital to your test, practice writing them
- The most difficult decision to make is which type of test to use, practice as many as you can
- 2 sided CI's can also be used as significance tests (is your sample statistic in the range of plausible values?)
- You can **NEVER** say the H_o is true when concluding a significance test, you either reject it or fail to reject it. It may be better to always phrase your conclusions in term of H_a
- A χ^2 test for independence comes from one sample. A χ^2 test for homogeneity comes from 2 samples.
- If using your calculator, always report the degrees of freedom, test statistic and p-value
- Always use the 4 step process when performing a significance test
- Except in the above case, pooling should not be done unless you are told to do so