Ch 8 – Hypothesis Testing – Single Sample

Intro

What's so special about testing a hypothesis with a single sample? It is that you are testing a claimed parameter value against a sample of data. In Ch 9 where tests are based on two samples, it is usually the comparison of the two populations underlying the two samples that is of interest, and not a claim about one or the other population. In fact, we are usually testing whether the two samples can be considered to come from the same population, which is another way of saying that the two populations underlying the two samples are identical. So you see in Ch 8 we say, lets see if the proportion of red beads is really 0.10, and we will test this hypothesis based on a single sample (of say n=25). But in ch 9 the kind of question we ask is whether the proportion of red beads from bowl #1 is the same as the proportion of red beads from bowl #2. We are not saying anything about the proportion of red beads except that, whatever it is, we want to know if it is the same in the two bowls. See the Ch 8 - Ch 9 distinction?

What is in Ch 8?

8.1 General Hypothesis Testing Framework for One Sample Tests
- Null Hypothesis, H_0
- Alternative Hypothesis, H_a
- Test Statistic
- Rejection Regions – one and two tailed
- Type I and Type II Errors (Type I = rejection error, Type II = acceptance error)

8.2 Test of a Population Mean –
- Case I – Normal, sigma known
- Case II – Not necessarily Normal, sigma not known
- Case III – Normal, sigma not known

(Sorry: in Ch 7 I used Case 1,2,3 but my 3. is II above and my 2. is III above. This should not be a problem – the numbering is just to emphasize the things that distinguish the situations, and this is the same in both notes and text. The basic distinction is that if the population is not normal, you need the CLT (and large samples) to get reliable results.)

In the discussion of Cases I,II,III, there is also a discussion of "power" and its relationship to the necessary "sample size". As I mentioned in connection with CIs in Ch 7, each CI formula is associated with a condition for sample size determination.

8.3 Tests of a Population Proportion
- Large Sample Test (Uses the CLT and theory we discussed in Ch 7)
- Small Sample Test (Uses the Binomial Distribution, but is not widely used since small samples have so little info about a population proportion.)

continued next page ...

8.4 P-values

In sections 8.1 – 8.3, the idea is that the test results in a decision "accept" or "reject" the hypothesis. There are some logical problems with trying to consider this theory as a decision-making procedure. One attempt to improve the approach is to soften the role of a hypothesis test as a decision-making procedure, and instead to say it is a way of measuring the credibility (or believe-ability) of a hypothesis. The P-value is an index of this credibility. Small P-value -> hypothesis not credible. See the definition of P-value on p 347.

Here is some everyday language that tries to capture the logic of hypothesis testing:

"If something happens that is unusual under ordinary circumstances, then this is evidence that the circumstances are not ordinary." See if you can relate this to the P-value approach to hypothesis testing.

8.5 Practical Issues in Interpreting Hypothesis Tests

statistical significance vs practical importance
P-values vs likelihood ratios
parametric vs nonparametric modeling

Addendum: Relationship between CIs and HTs

In the situations we discuss in this course, a test of hypothesis that results in "accept" or "reject" can be done by computing the associated CI and noting whether the hypothesized value is "in" or "out" of the CI. The two approaches are equivalent. But note that the P-value approach to HT does give slightly different info than the CI.