

## MS Module 6: Hypothesis testing of proportions (overview 2<sup>nd</sup> edition)

(The attached PDF file has better formatting.)

(Readings from the second 2<sup>nd</sup> edition of the Devore text.)

Two complex statistical procedures that are not used in actuarial work (Levene's test and Tukey's procedure) have been removed from the syllabus, simplifying modules 10-14 on analysis of variance (ANOVA). To keep the 24 module sequence,

- ! Module 4 Hypotheses and Test Procedures is now split into
  - " Module 4a Type 1 and Type 2 errors:
  - " Module 4b Tests about a population mean
  
- ! Module 5 Hypothesis testing of proportions is now split into
  - " Module 5a Tests About a Population Proportion
  - " Module 5b Hypothesis testing –  $p$  values

Reading: §9.3: Tests About a Population Proportion

- ! Large sample tests use the central limit theorem and an approximate normal distribution.
- ! Small sample tests use the binomial distribution.

Know the test statistic value of  $z$  for large sample tests. Review §3.5 if you are not familiar with the binomial distribution. Example 9.11 shows the seven step procedure.

If the null hypothesis is not true, the  $Z$  statistic is still normally distributed but its mean and variance are not 0 and 1. The  $\beta$  values (probabilities of Type II errors) depend on the type of null hypothesis (one-tailed or two-tailed) and the value of  $p_0$  and  $p'$  (the proportions in the null hypothesis and the assumed alternative).

For two-sided null hypotheses, we use the absolute value of  $p' - p_0$ . For a one-side (single tailed) null hypothesis, check whether  $p'$  is larger or smaller than  $p_0$  before plugging values into the formula. If  $p'$  is in the null hypothesis, computing  $\beta$  makes no sense.

The equations right above Example 9.12 seem complex, but they all use the same adjustment to previous equations. The formulas use the additional parameters  $\sqrt{p'q'}$  and  $\sqrt{p_0q_0}$ . Know Example 9.12 (large sample) and Example 9.13 (small sample), on which final exam problems may be modeled.

Review end of chapter exercises 36, 37, 38, 39, 40, and 41.