GENERAL

ap statistics chapter 8 review

Published: September 19, 2026 | Index ID: #-

Introduction

For students preparing for the AP Statistics exam, Chapter 8—**Hypothesis Testing**—is a cornerstone. It introduces the framework that underlies almost every statistical inference you'll encounter, from evaluating medical trials to analyzing social science data. This review distills the chapter into clear, actionable insights, helping you master the concepts, avoid common pitfalls, and ace the exam.

What Chapter 8 Covers

Chapter 8 is organized around the central question: *Can we use sample data to draw conclusions about a population?* The chapter is divided into four major themes:

- Setting up hypotheses—defining the null (H0) and alternative (H1) statements.
- Choosing the right test—deciding between z tests, t tests, chi square tests, or non parametric alternatives.
- Calculating test statistics and p values—applying formulas and interpreting results.
- Decision rules and error types—understanding Type /I, Type /II errors, and the power of a test.

Key Concepts Explained

Null and Alternative Hypotheses

The null hypothesis (H0) represents a statement of no effect or no difference. The alternative hypothesis (H1) reflects what you suspect might be true. For example:

1. H0: ;Â Ò R ‡F†R ÷ VÆ F–öâ ÖV â W V Ç2 R•
2. H1: ;Â & R ‡F†R ÷ VÆ F–öâ ÖV â F–f`ers from 5)

Choosing the correct form (one tailed vs. two tailed) is critical because it determines the critical region of the test statistic distribution.

Significance Level (; •

; is the threshold probability for rejecting H0. Common choices are 0.05, 0.01, or 0.10. A smaller ; reduces the chance of a Type I error but increases the risk of a Type II error. On the AP exam, 0.05 is the default unless a problem specifies otherwise.

Test Statistics

Depending on the data and assumptions, you'll use one of the following:

- z test—when <2 —2 ¶ædwn and sample size is large.
- t test—when <2 —2 Væ¶ædwn and sample size is small.
- Chi square test—for categorical data (goodness of fit or independence).
- F test—for comparing variances.
- Non parametric tests—Wilcoxon, Mann Whitney, etc., when assumptions are violated.

P Value

The p value is the probability of observing a test statistic as extreme as—or more extreme than—what you

obtained, assuming H0 is true. A small p value (0. On the AP exam, you'll often be asked to interpret or compute a p value.

Error Types and Power

Understanding the trade offs between errors helps you interpret results:

- Type /I error—false positive; rejecting H0 when it's true. Probability = ; à
- Type /II error—false negative; failing to reject H0 when H1 is true. Probability = ;"à
- Power—1 /– /;#° the probability of correctly rejecting H0 when H1 is true.

Step by Step Guide to Hypothesis Testing

1. State the research question. Identify what you want to test.
2. Formulate H0 and H1. Make sure they are mutually exclusive and exhaustive.
3. Choose ; à Default to 0.05 unless otherwise stated.
4. Select the appropriate test. Consider data type, sample size, and distribution assumptions.
5. Compute the test statistic. Plug values into the correct formula.
6. Find the p value. Use a calculator, statistical software, or tables.
7. Make a decision. If p /"d /; Â &V¦V7B ƒ ° otherwise, fail to reject.
8. Interpret the result. Relate the statistical conclusion back to the real world context.

Common Test Types and When to Use Them

One Sample z Test

Use when <0 is known and n "e 30. Formula: z = (Ø5Üe0@ – ;Â 'òƒÃ/" n). Example: testing whether a new drug changes blood when the population standard deviation is known.

One Sample t Test

Use when <2 —2 Væ¶æðwn and n /

Two Sample t Test (Independent Samples)

Assesses whether two population means differ. Assumes independent samples and equal variances (or uses Welch's correction). Formula involves pooled standard deviation.

Paired t Test

Used for before and after or matched pairs data. Compute differences d = Xi /– /Yi, then test whether mean difference = 0.

Chi Square Goodness of Fit

Tests if observed frequencies match expected frequencies. Formula: <{ = :5²„ò – E ')²/E ']. Degrees of freedom = k – 1, where k is the number of categories.

Chi Square Test of Independence

Examines association between two categorical variables. Compute expected counts Eij = (row total × column total)/ grand total. Degrees of freedom = (r /– /1)(c /– /1).

F Test for Equality of Variances

Compares two variances using the ratio s •²/s ,². Degrees of freedom = n • /– /1 and n , /– /1.

Practical Tips for the AP Exam

- Read the question carefully. Identify the type of test, sample size, and whether variances are assumed equal.
- Check assumptions. Many problems explicitly state whether normality or equal variances hold.
- Use the calculator efficiently. Know which buttons compute z, t, <{"Â æB `alues.
- Know the critical values. For common ; ÆPvels (0.05, 0.01), memorize z and t critical values for one tailed and two tailed tests.
- Practice interpreting results. AP questions often ask you to state conclusions in plain English.
- Time management. Allocate 2–3 minutes per problem; the first few are usually straightforward.

Example Problems with Full Solutions

Example 1: One Sample t Test

Suppose a teacher claims the average study time for her class is 2.5 hours per week. A random sample of 25 students reports a mean of 3.1 /hours with a standard deviation of 0.9 /hours. Test the teacher's claim at ; óÒ ó ã Rà

1. H0: ;Â óÒ ó"ãS° H1: ;Â ò& ó"ãP
2. t /= /(3.1 /– /2.5)/(0.9/" 25) /= /0.6/0.18 /= /3.33
3. Degrees of freedom = 24. Critical t for two tailed ; óÒ ó ã R —2 "ã cBà
4. Since 3.33 /> /2.064, reject H0.
5. Conclusion: There is evidence that the average study time differs from 2.5 hours.

Example 2: Chi Square Goodness of Fit

A poll reports that 40% of voters prefer Party A, 35% prefer Party B, and 25% are undecided. In a sample of 200 voters, 80 prefer Party A, 70 prefer Party B, and 50 are undecided. Test at ; óÒ ó ã Rà

1. Expected counts: 200 /× /0.40 /= /80, 200 /× /0.35 /= /70, 200 /× /0.25 /= /50.
2. Observed counts match expected counts exactly.
3. <{" óÒ ó£[(O /– /E)²/E] /= /0.
4. Degrees of freedom = 3 /– /1 /= /2. Critical <{" `or ; óÒ ó ã R —2 Rã"“ à
5. Since 0 /0.
6. Conclusion: The sample distribution matches the expected distribution.

Example 3: Two Sample t Test (Unequal Variances)

Two independent groups of students take different study methods. Group 1 (n = 15) has mean = 75, s = 4. Group 2 (n /= /12) has mean /= /70, s /= /5. Test whether the means differ at ; óÒ ó ã Rà

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