GENERAL

ap statistics chapter 6a test answers

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Understanding AP Statistics Chapter 6A: Mastering Test Answers and Exam Success

AP Statistics is a rigorous course that challenges students to apply statistical reasoning to real-world data. Chapter 6A, which focuses on hypothesis testing for population means, is a cornerstone of the curriculum. It introduces the concepts of null and alternative hypotheses, test statistics, p-values, and the decision rule that determines whether to reject the null hypothesis. For many students, mastering this chapter is essential for scoring well on the AP exam. In this comprehensive guide, we will walk through the key concepts, provide detailed example problems with step-by-step solutions, and share practical tips for tackling Chapter 6A test questions with confidence.

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Core Concepts of Chapter 6A

Hypothesis Testing Overview

Hypothesis testing is a systematic approach to evaluating claims about population parameters. In Chapter 6A, the focus is on testing claims about the mean (;Â’ öb ÷ VÆ F–öâà The process involves:

- Formulating a null hypothesis (H0) that represents the status quo or no effect.
- Defining an alternative hypothesis (H1) that reflects the claim or effect the student suspects.
- Choosing a significance level (; ’Â 6öÖÖöæÇ’ ã R ÷" ã à
- Calculating a test statistic based on sample data.
- Determining a p-value to quantify the evidence against H0.
- Applying the decision rule: reject H0 if p-value 0.

Key Assumptions

Before performing a test, students must verify that the data meet the necessary assumptions:

- Random Sampling: The sample should be randomly selected from the target population.
- Independence: Observations should be independent of one another.
- Normality: For small sample sizes (n
- Known or Unknown Population Standard Deviation (<2“ If <2 —2 ¶æðwn, a z-test is appropriate; if <2 —2 Væ¶æðwn, a t-test is used.

Test Statistics

Depending on the circumstances, Chapter 6A covers two primary test statistics:

1. z-test – used when <2 —2 ¶æðwn or the sample size is large enough for the CLT to hold.
2. t-test – used when <2 —2 Væ¶æðwn and the sample standard deviation (s) estimates <2à

The general formulas are:

z-test: z = (x0B Ò ¼0) / (<2 ò !¦â•

t-test: t = (x0B Ò ¼0) / (s / " n)

where x0@ is the sample mean, ;Ã is the hypothesized population mean, <0 is the population standard deviation, s is the sample standard deviation, and n is the sample size.

Types of Tests Covered

One-Sample Tests

These tests assess whether a single sample mean differs from a known or hypothesized value. The hypotheses typically take the form:

- Two-sided: H0: ;Â Ò ¼0 vs H1: ;Â & ¼0
- Left-tailed: H0: ;Â Ò ¼0 vs H1: ;Â
- Right-tailed: H0: ;Â Ò ¼0 vs H1: ;Â â ¼0

Two-Sample Tests

When comparing the means of two independent populations, Chapter 6A introduces the following tests:

- Two-sample z-test when both populations have known <2à
- Two-sample t-test for independent samples with unknown <2à
- Paired t-test for related samples.

Exact Tests

Although less common in AP Statistics, the chapter briefly mentions exact tests such as the binomial test for proportions and Fisher"s exact test for categorical data. These are useful when sample sizes are small or when assumptions for normal approximation fail.

Example Problems and Detailed Answers

Example 1: One-Sample z-Test

Suppose a manufacturer claims that the average tensile strength of its steel rods is 150 MPa. A random sample of 40 rods yields a mean tensile strength of 145 MPa with a population standard deviation of 10 MPa. Test the manufacturer"s claim at ; Ò ã Rà

1. State the hypotheses:\\n\\nH0: ;Â Ò S
2. H1: ;Â & S

z = (145 - 150) / (10 / " 40) = (-5) / (1.5811) "H -3.16\\n**Find the p-value:** For a two-tailed test, p = 2 * P(Z "d -3.16). Using standard normal tables or a calculator, P(Z "d -3.16) "H 0.0008. Thus, p "H 0.0016.\\n**Decision:** Since p "H 0.0016 0. There is strong evidence that the true mean tensile strength is different from 150 MPa.\\n

Example 2: One-Sample t-Test with Unknown <0

A nutritionist wants to test if the average daily calorie intake of a certain population is 2000 calories. A random sample of 25 individuals reports a mean intake of 2100 calories with a sample standard deviation of 120 calories. Test the hypothesis at ; Ò ã à

1. Hypotheses:\\n\\nH0: ;Â Ò #
2. H1: ;Â & #

t = (2100 - 2000) / (120 / " 25) = 100 / 24 = 4.17\\n\\n**Degrees of freedom (df):** df = n - 1 = 24.\\n**Find p-value:** For df = 24, t = 4.17 yields p \\n**Decision:** p 0. The average intake is significantly higher than 2000 calories.\\n

Example 3: Two-Sample t-Test (Independent Samples)

Researchers compare the effect of two teaching methods on student test scores. Method A yields a sample mean of 78 with sA = 6, nA = 30. Method B yields a sample mean of 82 with sB = 5, nB = 35. Test whether Method B results in a higher mean score at ; Ò ã Rà

1. Hypotheses:\\n\\nH0: ;Ä Ò ¼B
2. H1: ;Ä fÇC° ;Ä

SE = sqrt[(sA² / nA) + (sB² / nB)]\\n = sqrt[(36 / 30) + (25 / 35)]\\n = sqrt[1.2 + 0.7143]\\n = sqrt[1.9143] "H 1.383\\n\\n**t-statistic:**\\nt = (78 - 82) / 1.383 = -4 / 1.383 "H -2.89\\n\\n**Degrees of freedom (df):** Using Welch's approximation:\\ndf "H [(sA² / nA + sB² / nB)²] / [(sA t / (nA²(nA - 1))) + (sB t / (nB²(nB - 1)))]\\n "H 57.5 !' 57 (rounded down)\\n\\n**Find p-value:** For df = 57, t = -2.89 (one-tailed) gives p "H 0.003.\\n**Decision:**p 0. Method B yields a significantly higher mean score.\\n

Example 4: Paired t-Test

A diet program claims to reduce blood pressure. Ten participants' systolic blood pressure is measured before and after the program. The differences (before minus after) are: 8, 12, 5, 9, 7, 10, 4, 11, 6, 9. Test whether the program significantly reduces blood pressure at ; Ò ã Rà

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