GENERAL

ap statistics chapter 11 answers

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Introduction

AP Statistics is a rigorous course that challenges students to think critically about data, design experiments, and interpret results. Chapter 11, which focuses on *confidence intervals and hypothesis tests for a population mean*, is one of the most frequently revisited topics during exam prep. Students often search online for **AP Statistics Chapter 11 answers**or “chapter 11 AP Stats solutions” to verify their work and deepen their understanding. This article provides a comprehensive guide to Chapter 11, covering key concepts, common pitfalls, practice questions, and study strategies. By the end of this read, you’ll have a solid foundation to tackle any problem that appears on the AP exam.

Overview of AP Statistics Chapter 11

Chapter 11 builds on the foundation laid in earlier chapters and introduces the mechanics of estimating population parameters and testing hypotheses about means. The main objectives are:

- Compute confidence intervals for a population mean when the population standard deviation is known or unknown.
- Conduct hypothesis tests for a population mean using z-tests and t-tests.
- Interpret p-values and confidence levels in context.
- Understand the relationship between sample size, variability, and precision.

These skills are essential for the free-response and multiple-choice sections of the AP exam. Mastery of Chapter 11 also equips students with tools applicable in real-world data analysis, research, and decision-making.

Key Statistical Concepts Covered

1. Sampling Distributions – How the distribution of sample means behaves as sample size changes.
2. Standard Error (SE) – The measure of variability of the sampling distribution.
3. Confidence Intervals (CIs) – Ranges that likely contain the true population mean.
4. Hypothesis Testing – Formulating null and alternative hypotheses, choosing test statistics, and determining significance.
5. p-Values – Probability of observing data as extreme as the sample if the null hypothesis is true.
6. Type I & Type II Errors – Understanding the trade-offs between false positives and false negatives.

Common Questions and Answers from Chapter 11

Below we present a selection of typical questions students encounter, followed by detailed explanations that serve as model answers. These examples illustrate the application of formulas, critical thinking, and interpretation skills required on the AP exam.

1. Constructing a Confidence Interval for a Population Mean

Question:A sample of 25 students has a mean test score of 78 with a sample standard deviation of 6.5. Construct a 95% confidence interval for the population mean score.

Answer:

1. Because the population standard deviation is unknown and the sample size is n < 30, use a t-distribution.
2. Degrees of freedom (df) = n – 1 = 24.
3. Find the t critical value for a two-tailed 95% CI: t* "H 2.064 (from t-tables).
4. Standard error (SE) = s / " n = 6.5 / " 25 = 6.5 / 5 = 1.3.
5. Margin of error (ME) = t* × SE = 2.064 × 1.3 "H 2.683.
6. Confidence interval = 78 ± 2.683 !’ (75.317, 80.683).
7. Interpretation: We are 95% confident that the true mean score of all students lies between 75.3 and 80.7.

2. Conducting a One-Sample t-Test

Question:A researcher claims that the average daily caffeine intake of adults is 200 mg. A random sample of 40 adults has a mean intake of 210 mg with a standard deviation of 30 mg. Test the claim at a 5% significance level.

Answer:

1. Null hypothesis: H €: ;Â Ò # Ör †6Æ –Ò —2 G ue).
2. Alternative hypothesis: H •: ;Â & # Ör ‡Gpo-sided).
3. Compute the t-statistic:\\nt = (x0B b ¼ €) / (s / " n) = (210 – 200) / (30 / " 40) "H 10 / 4.743 "H 2.107.
4. Degrees of freedom: df = 39.
5. Find the critical t-value for ; Ò ã R ‡Gpo-tailed): t* "H 2.022.
6. Decision: |t| = 2.107 > 2.022 !’ reject H €.
7. Conclusion: There is sufficient evidence at the 5% level to reject the claim that the average daily caffeine intake is 200 mg.

3. Calculating a p-Value for a t-Test

Question: Using the same data from Question 2, calculate the p-value.

Answer:

1. With t = 2.107 and df = 39, consult a t-table or use software. The two-tailed p-value "H 0.041.
2. Interpretation: The probability of observing a mean difference as extreme as 10 mg, assuming the true mean is 200 mg, is about 4.1%.
3. Because 0.041

4. Effect of Sample Size on Confidence Interval Width

Question: Compare the 95% confidence intervals for the mean of a population when using sample sizes of 25 and 100, assuming the same sample standard deviation of 12.

Answer:

1. Standard error for n = 25: SE • = 12 / " 25 = 12 / 5 = 2.4.
2. Standard error for n = 100: SE , = 12 / " 100 = 12 / 10 = 1.2.
3. Margin of error for 95% CI (t* "H 2.064 for df=24, t* "H 1.984 for df=99):\\nME • = 2.064 × 2.4 "H 4.958.\\nME , = 1.984 × 1.2 "H 2.381.
4. Conclusion: The interval with n = 100 is narrower, providing a more precise estimate of the population mean.

5. One-Sided vs Two-Sided Tests

Question:A company claims that its new battery lasts longer than 400 hours. A sample of 30 batteries shows a mean lifespan of 410 hours with a standard deviation of 15 hours. Test the claim at a 1% significance level.

Answer:

1. H €: ;Â &B C †& GFW y does not last longer).\\nH •: ;Â â C †& GFW y lasts longer) – one-sided.

2. t = (410 – 400) / (15 / " 30) "H 10 / 2.739 "H 3.651.
3. df = 29, critical t for ; Ò ã †öæR×6–FVB’ $, "ãCc"à
4. Decision: 3.651 > 2.462 !’ reject H €.
5. Conclusion: At the 1% level, there is strong evidence that the battery lasts longer than 400 hours.

Practice Problems with Detailed Solutions

Below are five practice problems that mirror the difficulty and style of AP exam questions. Each problem includes a step-by-step solution to help reinforce your understanding.

Problem 1: Confidence Interval with Known <0

A manufacturing process produces bolts with a mean diameter of 5.00 mm and a known standard deviation of 0.05 mm. A sample of 40 bolts is measured, yielding a sample mean of 5.02 mm. Construct a 99% confidence interval for the true mean diameter.

Solution:

1. Because <2 —2 ¶æðwn, use a z-distribution.
2. Standard error: SE = <2 ò !¦â Ò ã R ò !£C $, ã s’à
3. Critical z for 99% two-tailed: z* "H 2.576.
4. Margin of error: ME = z* × SE "H 2.576 × 0.0079 "H 0.0203.
5. CI: 5.02 ± 0.0203 !’ (5.00, 5.04) mm.

Problem 2: Two-Sample t-Test (Unequal Variances)

Two teaching methods are compared. Method A has a sample of 20 students with a mean score of 85 and a standard deviation of 4. Method B has a sample of 15 students with a mean score of 80 and a standard deviation of 6. Test whether the mean scores differ at a 5% significance level.

Solution:

1. H €: ;Â Ò ¼ ,; H •: ;Â & ¼ ,.
2. Compute standard error using Welch’s approximation:\\nSE = " (s •²/n • + s ,²/n ,) = " (4²/20 + 6²/15) = " (0.8 + 2.4) = " 3.2 "H 1.789.
3. t = (85 – 80) / 1.789 "H 2.797.
4. Degrees of freedom (Welch-Satterthwaite): df "H ((s •²/n • + s ,²/n ,)²) / ((s • t/(n •²(n •–1))) + (s , t/(n ,²(n ,–1)))) "H 32.
5. Critical t for ; Ò ã R ‡Gpo-tailed) with df=32 "H 2.036.
6. Decision: 2.797 > 2.036 !’ reject H €.
7. Conclusion: There is significant evidence that the two teaching methods produce different mean scores.

Problem 3: Interpreting a p-Value

A clinical trial reports a p-value of 0.08 for the difference in recovery rates between a new drug and a placebo. What does this p-value indicate about the null hypothesis at the 5% significance level?

Answer:A p-value of 0.08 means there is an 8% chance of observing a difference as extreme as the one found if the null hypothesis (no difference) is true. Since 0.08 > 0.05, we fail to reject H €; the evidence is insufficient to claim a significant difference at the 5% level.

Problem 4: One-Sided Test for a Proportion (Using Normal Approximation)

A poll of 500 voters finds that 260 support a policy. Test whether the proportion of supporters in the population exceeds 50% at a 1% significance level.

Solution:

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