

Review

Test of Significance AP Statistics

Name: _____

Directions: Work on these sheets. Tables and formulas appear on a separate sheet.

Part 1: Multiple Choice. Circle the letter corresponding to the best answer.

1. A significance test gives a P -value of 0.04. From this we can
- (a) Reject H_0 at the 1% significance level
 - (b) Reject H_0 at the 5% significance level
 - (c) Say that the probability that H_0 is false is 0.04
 - (d) Say that the probability that H_0 is true is 0.04
 - (e) None of the above. The answer is _____.
2. A significance test was performed to test the null hypothesis $H_0: \mu = 2$ versus the alternative $H_a: \mu \neq 2$. The test statistic is $z = 1.40$. The P -value for this test is approximately
- (a) 0.16
 - (b) 0.08
 - (c) 0.003
 - (d) 0.92
 - (e) 0.70
 - (f) None of the above. The answer is _____.
3. To determine the reliability of experts used in interpreting the results of polygraph examinations in criminal investigations, 280 cases were studied. The results were:

Examiner's Decision	"Innocent"	True Status	
		Innocent	Guilty
"Innocent"		131	15
	"Guilty"	9	125

If the hypotheses were H_0 : suspect is innocent vs. H_a : suspect is guilty, then we could estimate the probability of making a Type II error as:

- (a) $15/280$
 - (b) $9/280$
 - (c) $15/140$
 - (d) $9/140$
 - (e) $15/146$
4. An opinion poll asks a random sample of adults whether they favor banning ownership of handguns by private citizens. A commentator believes that more than half of all adults favor such a ban. The null and alternative hypotheses you would use to test this claim are:
- (a) $H_0: \hat{p} = 0.5; H_a: \hat{p} > 0.5$
 - (b) $H_0: \hat{p} = 0.5; H_a: \hat{p} \neq 0.5$
 - (c) $H_0: p = 0.5; H_a: p \neq 0.5$
 - (d) $H_0: p = 0; H_a: p > 0$
 - (e) None of the above. The answer is _____.

5. Bags of a certain brand of tortilla chips claim to have a net weight of 14 ounces. Net weights actually vary slightly from bag to bag and are normally distributed with mean μ . A representative of a consumer advocate group wishes to see if there is any evidence that the mean net weight is less than advertised and so intends to test the hypotheses

$$H_0: \mu = 14, H_a: \mu < 14.$$

To do this, he selects sixteen bags of this brand at random and determines the net weight of each. He finds the sample mean to be $\bar{x} = 13.82$ and the sample standard deviation to be $s = 0.24$.

We conclude that we would

- (a) Reject H_0 at significance level 0.10 but not at 0.05.
- (b) Reject H_0 at significance level 0.05 but not at 0.025.
- (c) Reject H_0 at significance level 0.025 but not at 0.01.
- (d) Reject H_0 at significance level 0.01.
- (e) Fail to reject H_0 at the $\alpha = 0.10$ level.

Part 2: Free Response

Answer completely, but be concise. Write sequentially and show all steps.

Nitrites are often added to meat products as preservatives. In a study of the effect of these chemicals on bacteria, the rate of uptake of a radio-labeled amino acid was measured for a number of cultures of bacteria, some growing in a medium to which nitrites had been added. Here are the summary statistics from this study.

Group	n	\bar{x}	s
Nitrite	30	7880	1115
Control	30	8112	1250

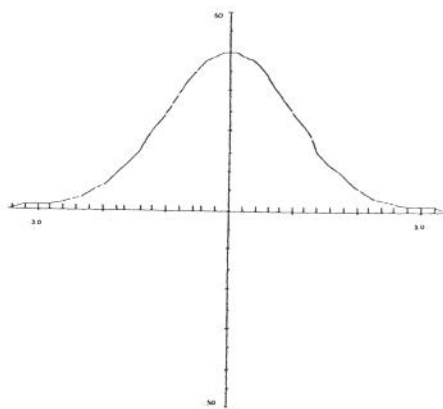
6. Carry out a test of the research hypothesis that nitrites decrease amino acid uptake and report your results.

In the past, the mean score of the seniors at South High on the American College Testing (ACT) college entrance examination has been 20. This year a special preparation course is offered, and all 53 seniors planning to take the ACT test enroll in the course. The mean of their 53 ACT scores is 22.1. The principal believes that the new course has improved the students' ACT scores. Assume that ACT scores vary normally with standard deviation 6.

7. State hypotheses in both words and symbols for testing the principal's claim.

8. Identify the appropriate statistical procedure and verify conditions for its use.

9. Calculate the test statistic and the P -value. Illustrate using the graph provided.



10. State your conclusions clearly in complete sentences.

Mars Inc., makers of M&M candies, claims that they produce plain M&Ms with the following distribution:

Brown: 30%	Red: 20%	Yellow: 20%
Orange: 10%	Green: 10%	Blue: 10%

A bag of plain M&Ms was selected randomly from the grocery store shelf, and the color counts were as follows:

Brown: 16	Red: 11	Yellow: 19
Orange: 5	Green: 7	Blue: 3

11. You want to conduct an appropriate test of the manufacturer's claim for the proportion of yellow M&Ms. Identify the population parameter of interest. Then state hypotheses.

12. State and verify the conditions for performing the significance test.


13. Calculate the test statistic and the P -value.

14. What do you conclude about the manufacturer's claim? Explain.

15. Based on this sample, construct and interpret a 90% confidence interval for the proportion of yellow M&M candies produced by Mars.

(3)

The developer of a new filter for filter-tipped cigarettes claims that it leaves less nicotine in the smoke than does the current filter. Because cigarette brands differ in a number of ways, he tests each filter on one cigarette of each of nine brands and records the difference between the nicotine content for the current filter and the new filter. The mean difference is $\bar{x} = 1.32$ milligrams (mg), and the standard deviation of the differences is $s = 2.35$ mg.

16. Describe the population of interest and the parameter for which inference is being performed.
 17. State H_0 and H_a for this study in both symbols and words.
 18. What conditions are required to carry out the significance test? Discuss the validity of each.
 19. Determine the test statistic and the P -value. Show your work.
 20. What do you conclude?
 21. A 90% confidence interval for the mean amount of additional nicotine removed by the new filter is $(-0.14, 2.78)$. Determine t^* for this interval. Then interpret the interval.
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The pesticide diazinon is in common use to treat infestations of the German cockroach, *Blattella germanica*. A study investigated the persistence of this pesticide on various types of surfaces. Researchers applied a 0.5% emulsion of diazinon to glass and plasterboard. After 14 days, they placed 18 cockroaches on each surface and recorded the number that died within 48 hours. On glass, 9 cockroaches died, while on plasterboard, 13 died.

22. Construct and interpret a 95% confidence interval for the difference in the two population proportions.

23. Chemical analysis of the residues of diazinon suggests that it may persist longer on plasterboard than on glass because it binds to the paper covering on the plasterboard. The researchers therefore expected the mortality rate to be greater on plasterboard than on glass. Conduct a significance test to assess the evidence that this is true.

