

In almost all problems, I have given the answers to four significant digits. If your answer is slightly different from one of mine, consider that to be roundoff error and mark the closely matching one. If your answer differs from the closest one of mine by more than one percent (meaning the ratio of yours to mine is less than 0.99 or greater than 1.01), then mark "J) None of the preceding". The first fifteen problems are the ones randomly chosen from the homework exercises. If you do all of them correctly, you can breathe more easily (since you will have reached a passing level of D-) as you head into the ten non-homework questions.

1. The June 2008 Gallup Poll on first ladies of 1050 U.S. adults split the sample into four age groups: ages 18-29, 30-49, 50-64, and 65+. In the youngest age group, 60% said that Hillary Clinton fit their idea of a first lady. The sample contained 260 18- to-29-year-olds. Find the 90% confidence interval for the true percentage of all 18- to-29-year-olds who would choose Hillary Clinton. Since this is a multiple-choice test, give as your single answer the length of the confidence interval.

A) 7.644% B) 8.114% C) 8.584% D) 9.05% E) 9.524% F) 9.994% G) 10.464% H) 10.934% I) 11.404% J) None of the preceding

2. The seller of a loaded die claims that it will favor the outcome 6. We don't believe that claim, and roll the die 200 times to test an appropriate hypothesis. Our P-value turns out to be 0.03. Which of the statements below are true, and which ones are false?

a) There's a 3% chance that the die is fair.

b) There's a 97% chance that the die is fair.

c) There's a 3% chance that a loaded die could randomly produce the results we observed, so it's reasonable to conclude that the die is fair.

d) There's a 3% chance that a fair die could randomly produce the results we observed, so it's reasonable to conclude that the die is loaded.

A) TTTF B) FTTT C) FTTF D) TFFT E) FTFT F) TFTF G) FFFT H) TFFF I) FFTF J) None of the preceding

3. Someone hands you a box of a dozen chocolate covered candies, telling you that half are vanilla creams and the other half peanut butter. You pick candies at random and discover that the first four you eat are all peanut butter. If there really were 6 vanilla and 6 peanut butter candies in the box, what is the probability you would have picked four peanut butter candies in a row?  
A) 0.01658 B) 0.01854 C) 0.0205 D) 0.2246 E) 0.02442 F) 0.02638 G) 0.02834 H) 0.03030 I) 0.03226 J) None of the preceding

4. A company is sued for job discrimination because only 19% of the newly hired candidates were minorities when 27% of all applicants were minorities. The lawsuit is based on the hiring of 100 employees, and the number of applicants is so large that it can be assumed to be infinite. Is this evidence that the company's hiring practices are discriminatory? To answer this question, calculate the one-sided P-value using the normal approximation (rather than the binomial distribution).  
A) 0.0278 B) 0.02894 C) 0.03008 D) 0.03122 E) 0.03236 F) 0.0335 G) 0.03464 H) 0.03578 I) 0.03692 J) None of the preceding

5. A company is sued for job discrimination because only 19% of the newly hired candidates were minorities when 27% of all applicants were minorities. The lawsuit is based on the hiring of 100 employees, and the number of applicants is so large that it can be assumed to be infinite. Is this evidence that the company's hiring practices are discriminatory? To answer this question, calculate the one-sided P-value using the binomial distribution.  
A) 0.04043 B) 0.04199 C) 0.04355 D) 0.04511 E) 0.04667 F) 0.04823 G) 0.04979 H) 0.05135 I) 0.05291 J) None of the preceding

6. A study published in the *Archives of General Psychiatry* in March 2001 examined the impact of depression on a patient's ability to survive cardiac disease. Researchers identified 450 people with cardiac disease, evaluated them for depression, and followed the group for 4 years. Of the 361 patients with no depression, 67 died. Of the 89 patients with minor or major depression, 26 died. Among people who suffer from cardiac disease, are depressed patients more likely to die than non-depressed ones? Create a 99% confidence interval for the difference in survival rates. Since this is a multiple-choice test, give as your single answer the length of the confidence interval.  
A) 0.2163 B) 0.227 C) 0.2377 D) 0.2484 E) 0.2591 F) 0.2698 G) 0.2805 H) 0.2912 I) 0.3019 J) None of the preceding

7. It's estimated that 50,000 pregnant women worldwide die each year of eclampsia, a condition involving elevated blood pressure and seizures. A research team from 175 hospitals in 33 countries investigated the effectiveness of magnesium sulfate in preventing the occurrence of eclampsia in at-risk patients. Results are summarized below. (*Lancet*, June 1, 2002). Write a 95% confidence interval for the decrease in the percentage of eclampsia cases associated with this treatment. Since this is a multiple-choice test, give as your single answer the length of the confidence interval.

	Total Subjects	Reported side effects	Developed eclampsia	Deaths
Magnesium sulfate	4999	1201	40	11
Placebo	4993	228	96	20

A) 0.6543% B) 0.686% C) 0.7177% D) 0.7494% E) 0.7811% F) 0.8128% G) 0.8445% H) 0.8762% I) 0.9079% J) None of the preceding

8. A Slippery Rock University study released in 2007 found that many high school students cheat on tests. The researchers surveyed a random sample of 3500 high school students nationwide; 77% of them said they had cheated at least once. Create a 95% confidence interval for the level of cheating among high school students. Since this is a multiple-choice test, give as your single answer the length of the confidence interval.

A) 1.9% B) 2.048% C) 2.196% D) 2.344% E) 2.492% F) 2.64% G) 2.788% H) 2.936% I) 3.084% J) None of the preceding

9. In 1999 the Centers for Disease Control and Prevention estimated that about 34.8% of high school students smoked cigarettes. They established a national health goal of reducing that figure to 16% by the year 2010. To that end, they hoped to achieve a reduction to 30% by the end of 2001. Early in 2002 they released a research study in which only 29.0% of a random sample of 10,204 high school students said they were current smokers. Is this evidence that progress toward the goal is on track? To answer this question, calculate the P-value for the appropriate one-sided test. A) 0.01128 B) 0.01175 C) 0.01222 D) 0.01269 E) 0.01316 F) 0.01363 G) 0.0141 H) 0.01457 I) 0.01504 J) None of the preceding

10. Analysis of the salaries of a random sample of 288 Nevada teachers produced the confidence interval shown below. Which conclusions below it are correct?

t-interval for  $\mu$ : with 90.00% confidence,  $38944 < \mu(\text{TchPay}) < 42893$

- 1) If we took many random samples of Nevada teachers, about 9 out of 10 of them would produce this confidence interval.
  - 2) If we took many random samples of Nevada teachers, about 9 out of 10 of them would produce a confidence interval that contained the mean salary of all Nevada teachers.
  - 3) About 9 out of 10 Nevada teachers earn between \$38,944 and \$42,893.
  - 4) About 9 out of 10 of the teachers surveyed earn between \$38,944 and \$42,893.
  - 5) We are 90% confident that the average teacher salary in the United States is between \$38,944 and \$42,893.
- A) 1 B) 2 C) 3 D) 4 E) 5 F) 1,2 G) 2,3 H) 3,4 I) 4,5 J) None of the preceding

11. Data collected by child development scientists produced this confidence interval for the average age (in weeks) at which babies begin to crawl.

t-interval for  $\mu$ : with 95.00% confidence,  $29.202 < \mu(\text{age}) < 31.844$

If this interval is based on a sample of size 20, what will be the length of the 90% confidence interval computed from the same data?

A) 1.855 B) 1.937 C) 2.019 D) 2.101 E) 2.183 F) 2.265 G) 2.347 H) 2.429 I) 2.511 J) None of the preceding

12. Lavrans Bjorgulfson was trying to decide whether to use a new racing wax for cross-country skis. He decided that the wax would be worth the price if he could average less than 55 seconds on a course he knew well, so he planned to test the wax by racing on the course 6 times. His 6 race times were: 56.3, 50.5, 52.4, 46.5, 52.2 and 43.2 seconds.

Should he buy the wax? To answer this question, calculate the P-value for the appropriate one-sided test.

A) 0.02327 B) 0.02428 C) 0.02529 D) 0.02630 E) 0.02731 F) 0.02832 G) 0.02933 H) 0.03034 I) 0.03135 J) None of the preceding

13. Some archaeologists theorize that ancient Egyptians interbred with several different immigrant populations over thousands of years. To see if there is any indication of changes in body structure that might have resulted, they measured maximum skull breadth of skulls of male Egyptians dated from 4000 B.C.E. and skulls of male Egyptians dated from 200 B.C.E. (A. Thomson and R. Randell-Maciver, *Ancient Races of the Thebaid*, Oxford: Oxford University Press, 1905.) Random samples of their results (in millimeters) are given below.

4000 B.C.E.	132	125	129	119	136	138	137
200 B.C.E.	143	141	135	133	140	139	142

What are the degrees of freedom for the unequal-variance (non-pooled) t-test?

A) 5.093 B) 6.428 C) 7.763 D) 9.098 E) 10.433 F) 11.768 G) 13.103 H) 14.438 I) 15.773 J) None of the preceding

14. Using the data from Problem 13, find the 95% confidence interval for the difference in mean skull breadth using the equal-variance (pooled) method. Since this is a multiple-choice test, give as your single answer the length of the confidence interval.

A) 10.86 B) 11.59 C) 12.32 D) 13.05 E) 13.78 F) 14.51 G) 15.24 H) 15.97 I) 16.7 J) None of the preceding

15. Using the data from Problem 13, perform Tukey's test for the difference in skull breadth and report the value of the test statistic.

A) 4 B) 5 C) 6 D) 7 E) 8 F) 9 G) 10 H) 11 I) 12 J) None of the preceding

16. The one-sample t statistic for testing  $H_0: \mu=500$  versus  $H_A: \mu>500$  from a sample of  $n=5$  observations has the value  $t=2.22$ . Find the P-value.

A) 0.03199 B) 0.03421 C) 0.03643 D) 0.03865 E) 0.04087 F) 0.04309 G) 0.04531 H) 0.04753 I) 0.04975 J) None of the preceding



17. Do job applicants lie? When trying to hire managers and executives, companies sometimes verify the academic credentials described by the applicants. One company that performs these checks summarized its findings for a six-month period. Of the 34 applicants whose credentials were checked, 7 lied about having a degree. Consider these data to be a random sample of credentials from a large collection of similar applicants. Calculate a 95% confidence interval for the true proportion of applicants who lie about having a degree, and report its length.

A) 0.2373 B) 0.2488 C) 0.2603 D) 0.2718 E) 0.2833 F) 0.2948 G) 0.3063 H) 0.3178 I) 0.3293 J) None of the preceding

18. When the sample size is small, and the observed proportion is close to 0 or 1, the Agresti-Coull method of calculating confidence limits for a proportion may give more accurate results. For example, if we get 18 heads out of 20 coin flips, the regular 95% confidence interval becomes (0.7685, 1.0315), which has an impossible value as an upper limit. Calculate the 95% Agresti-Coull confidence interval for 18 heads out of 20 coin flips and report its length.

A) 0.2042 B) 0.223 C) 0.2418 D) 0.2606 E) 0.2794 F) 0.2982 G) 0.317 H) 0.3358 I) 0.3546 J) None of the preceding

19. Casey, a starting player for a major college basketball team, made only 47% of her free throws last season. During the summer she worked on developing a softer shot in the hope of improving her free-throw accuracy. In the first eight games of this season, Casey made 28 free throws in 40 attempts. Let  $p$  be her probability of making each free throw that she shoots this season. Calculate the P-value for the test of the hypothesis  $H_0: p=0.47$  versus  $H_A: p>0.47$ . Use the normal approximation rather than the binomial distribution.

- A) 0.001357 B) 0.00141 C) 0.001463 D) 0.001516 E) 0.001569 F) 0.001622 G) 0.001675 H) 0.001728 I) 0.001781  
J) None of the preceding

20. We hope to estimate the percentage of adults aged 65 to 70 who never graduated from high school. What sample size would allow us to estimate this percentage with a margin of error of 4% with 95% confidence? Calculate the sample size under the “worst case” (or cautious) approach.

- A) 460 B) 507 C) 554 D) 601 E) 648 F) 695 G) 742 H) 789 I) 836 J) None of the preceding

21. A TV news reporter says that a proposed constitutional amendment is likely to win approval in the upcoming election because a poll of 667 likely voters indicated that 54% would vote in favor. The reporter goes on to say that the margin of error for this poll was exactly 3%. What confidence level did the pollsters use?  
A) 88% B) 89% C) 90% D) 91% E) 92% F) 93% G) 94% H) 95% I) 96% J) None of the preceding

22. The U.S. Census Bureau reports that 26% of all U.S. businesses are owned by women. A Colorado consulting firm surveys a random sample of 410 businesses in the Denver area and finds that 119 of them have women owners. Should the firm conclude that its area is unusual? Report the P-value from a two-sided test of the appropriate null hypothesis. Use the normal approximation to perform the test.  
A) 0.1423 B) 0.1491 C) 0.1559 D) 0.1627 E) 0.1695 F) 0.1763 G) 0.1831 H) 0.1899 I) 0.1967 J) None of the preceding

23. Using the information in Problem 22, report the margin of error for an estimate of the percentage of women-owned businesses in the Denver area. Use the 95% level of confidence in computing the margin of error.  
A) 2.499% B) 2.878% C) 3.257% D) 3.636% E) 4.015% F) 4.394% G) 4.773% H) 5.152% I) 5.531% J) None of the preceding

24. The Missouri race for President was extremely close: “PPP surveyed 1,343 likely voters from October 31st to November 2nd” and found Barack Obama had a 0.8% lead over John McCain. Given the stated sample size, at the 95% confidence level, what was the margin of error?  
A) 2.304% B) 2.489% C) 2.674% D) 2.859% E) 3.044% F) 3.229% G) 3.414% H) 3.599% I) 3.784% J) None of the preceding

25. The National Perinatal Statistics Unit of the Sydney Children's Hospital reports that the mean birth weight of all babies born in Australia in 1999 was 7.41 pounds. A Missouri hospital reports that the average weight of 122 babies born there last year was 7.68 pounds, with a standard deviation of 1.31 pounds. If we believe the Missouri babies fairly represent American newborns, is there any evidence that U.S. babies and Australian babies do not weigh the same at birth? To answer this question, report the P-value from a two-sided t-test.  
A) 0.01952 B) 0.02053 C) 0.02154 D) 0.0225 E) 0.02356 F) 0.02457 G) 0.02558 H) 0.02659 I) 0.0276 J) None of the preceding