In almost all numeric 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". All hypothesis tests have their directionality specified. Unless otherwise specified, all confidence intervals are 95%. In problems involving the binomial distribution, if conditions are met for the normal approximation to the binomial, the approximation should be used; otherwise, use exact binomial calculations. Based on our two referenda, the first 25 questions are strictly computational, while the last five, extra-credit, problems, require some memory of having read the book, having worked the homework problems and/or having paid attention in class. Of the 25 computational problems, the first 15 should be recognizable as homework problems you have done, while the next 10 are new problems.

1. When a truckload of apples arrives at a packing plant, a simple random sample of 180 is selected and examined for bruises, discoloration, and other defects. The whole truckload will be rejected if more than 5% of the sample is unsatisfactory. Suppose that in fact 7% of the apples on the truck do not meet the desired standard. What's the probability that the shipment will be accepted anyway?

A) 0.1141 B) 0.1249 C) 0.1357 D) 0.1465 E) 0.1573 F) 0.1681 G) 0.1789 H) 0.1897 I) 0.2005 J) None of the preceding

2. Although most of us buy milk by the quart or gallon, farmers measure daily productions in pounds. Ayrshire cows average 47 pounds of milk a day, with a standard deviation of 6 pounds. For Jersey cows, the mean daily production is 43 pounds, with a standard deviation of 5 pounds. Assume that Normal models describe milk production for these breeds. A farmer has 25 Jerseys, and a neighboring farmer has 12 Ayrshires. What's the probability that the Ayrshire herd average is at least 5 pounds higher than the average for the Jersey herd?

A) 0.1666 B) 0.2139 C) 0.2612 D) 0.3085 E) 0.3558 F) 0.4031 G) 0.4504 H) 0.4977 I) 0.5450 J) None of the preceding

3. In 1995 a San Melas reproductive clinic reported 45 births to 210 women under the age of 40 who had previously been unable to conceive. Find a 90% confidence interval for the success rate at this clinic. Since this is a multiple-choice test, give as your single answer the length of the confidence interval.

A) 0.05750 B) 0.06463 C) 0.07176 D) 0.07889 E) 0.08602 F) 0.09315 G) 0.10028 H) 0.10741 I) 0.11454 J) None of the preceding

4. We hope to estimate the percentage of adults aged 25 to 30 who never graduated from high school. What sample size, in the worst-case scenario, that $p = q$, would allow us to increase our confidence level to 98% while reducing the margin of error to only 1.5%?

A) 5312 B) 5663 C) 6014 D) 6365 E) 6716 F) 7067 G) 7418 H) 7769 I) 8120 J) None of the preceding

5. In the 1980s it was generally believed that autism affected about 5% of the nation's children. Some people believe that the increase in the number of chemicals in the environment has led to an increase in the incidence of autism. A recent study examined 200 children and found that 16 of them showed signs of some form of autism. Is this strong evidence that the level of autism has increased? Report the P-value for a test of the null hypothesis H_0: $p=0.05$ versus the alternative hypothesis H_A: $p>0.05$.

A) 0.01403 B) 0.01795 C) 0.02178 D) 0.02579 E) 0.02971 F) 0.03363 G) 0.03755 H) 0.04147 I) 0.04539 J) None of the preceding

6. An artist experimenting with clay to create pottery with a special texture has been experiencing difficulty with these special pieces. About 30% break in the kiln during firing. Hoping to solve this problem, she buys some more expensive clay from another supplier. She plans to make and fire 9 pieces, and will decide to use the new clay if at most one of them breaks. If the new clay really could reduce breakage to only 15%, what's the probability that her test will not detect the improvement?

A) 0.3463 B) 0.3734 C) 0.4005 D) 0.4276 E) 0.4547 F) 0.4818 G) 0.5089 H) 0.5360 I) 0.5631 J) None of the preceding

7. In October 2000 the US Department of Commerce reported the results of a large-scale survey on high school graduation. Researchers contacted more than 25,000 Americans aged 24 years to see if they had finished high school; 84.9% of the 12,460 males and 88.1% of the 12,678 females indicated that they had high school diplomas. Create a 99% confidence interval for the difference in graduation rates between males and females and report its length (since this is a multiple-choice test).

A) 1.652% B) 1.841% C) 2.030% D) 2.219% E) 2.408% F) 2.597% G) 2.786% H) 2.975% I) 3.164% J) None of the preceding

8. 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 350 people with cardiac disease, evaluated them for depression, and followed the group for 4 years. Of the 261 patients with no depression, 47 died. Of the 89 patients with minor or major depression, 26 died. [Numbers have been changed to make this a new problem; see the article for the original numbers.] Among people who suffer from cardiac disease, are depressed patients more likely to die than non-depressed ones? Report the P-value for a test of the null hypothesis H_0: $p_1=p_2$ versus the alternative hypothesis H_A: $p_1 \neq p_2$.

A) 0.01220 B) 0.01531 C) 0.01842 D) 0.02153 E) 0.02464 F) 0.02775 G) 0.03086 H) 0.03397 I) 0.03708 J) None of the preceding

9. The ISA Babcock Company supplies poultry farmers with hens, advertising that a mature B300 Layer produces eggs with a mean weight of 60.7 grams. Suppose that egg weights follow a Normal model with standard deviation 3.1 grams. What's the probability that a dozen randomly selected eggs average more than 62.5 grams?

A) 0.01329 B) 0.01624 C) 0.01919 D) 0.02214 E) 0.02509 F) 0.02804 G) 0.03099 H) 0.03394 I) 0.03698 J) None of the preceding

10. Among 242 Cleveland area children born prematurely at low birth weights between 1977 and 1979, only 74% graduated from high school. Among a comparison group of 233 children of normal birth weight, 83% were high school graduates. ("Outcomes in the Young Adulthood for Very-Low-Birth-Weight Infants," *New England Journal of Medicine*, 346, no.3 [2002]) Create an 80% confidence interval for the difference in graduation rates between children of normal and very low birth weights and report its length (since this is a multiple-choice test).

A) 0.06187 B) 0.06615 C) 0.07043 D) 0.07471 E) 0.07899 F) 0.08327 G) 0.08755 H) 0.09183 I) 0.09611 J) None of the preceding

11. Hoping to lure more shoppers downtown, a city builds a new public parking garage in the central business district. The city plans to pay for the structure through parking fees. During a two-month period (44 weekdays), daily fees collected averaged $136 with a standard deviation of $18. Write a 95% confidence interval for the mean weekday income this parking garage will generate and report its length (since this is a multiple-choice test).

A) $10.04 B) $10.49 C) $10.94 D) $11.39 E) $11.84 F) $12.29 G) $12.74 H) $13.19 I) $13.64 J) None of the preceding

12. In 1998, as an advertising campaign, the Nabisco Company announced a "1000 Chips Challenge," claiming that every 18-ounce bag of their Chips Ahoy cookies contained at least 1000 chocolate chips. Dedicated Statistics students at the Air Force Academy (no kidding) purchased some randomly selected bags of cookies, and counted the chocolate chips. Some of their data are given below. (*Chance*, 12, no 1[1999])

1219   1214   1087   1200   1419   1121   1325   1345

Create a 95% confidence interval for the average number of chips in Chips Ahoy cookies and report its length (since this is a multiple-choice test).

A) 134.3 B) 143.6 C) 143.6 D) 152.9 E) 162.2 F) 171.5 G) 180.8 H) 190.1 I) 199.4 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 30 skulls of male Egyptians dated from 4000 B.C.E. and 30 others 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.	131	125	131	119	136	138	139
200 B.C.E.	141	141	135	133	131	140	139	140

Perform a two-sided rank sum test for the difference and report the P-value.

A) 0.01519 B) 0.02072 C) 0.02625 D) 0.03178 E) 0.03731 F) 0.04284 G) 0.04835 H) 0.05388 I) 0.05941 J) None of the preceding

14. American League baseball teams play their games with the designated hitter rule, meaning that pitchers do not bat. The league believes that replacing the pitcher, traditionally a weak hitter, with another player in the batting order produces more runs and generates more interest among fans. Below are the average numbers of runs scored in American League and National League stadiums for the first half of the 2001 season (data slightly altered to make this a new problem).

American					National			
11.1	10.8	10.8	10.3		12.0	11.6	10.4	10.3
10.3	10.1	10.0	9.5		10.2	9.5	9.5	9.5
9.4	9.3	9.2	9.2		9.5	9.1	8.8	8.4
	9.0	8.3			8.3	8.2	8.1	7.9

Do the data suggest that the American League's designated hitter rule may lead to more runs? Calculate a 95% confidence interval to estimate the difference between the mean number of runs scored in American and National League games and report its length (since this is a multiple-choice test).

A) 1.119 B) 1.528 C) 1.937 D) 2.346 E) 2.755 F) 3.164 G) 3.573 H) 3.982 I) 4.391 J) None of the preceding

15. Having done poorly on their math final exams in June, six students repeat the course in summer school, then take another exam in August. If we consider these students representative of all students who might attend this summer school in other years, do these results provide evidence that the program is worthwhile? Report the P-value for the test of the null hypothesis H_0: $\mu_1=\mu_2$ versus the alternative hypothesis H_A: $\mu_1<\mu_2$.

June	51	49	68	66	62	62
Aug.	55	65	74	64	68	72

A) 0.01252 B) 0.01681 C) 0.02110 D) 0.02539 E) 0.02968 F) 0.03397 G) 0.03826 H) 0.04255 I) 0.04684 J) None of the preceding

16. The weight of potato chips in a medium size bag is stated to be 10 ounces. The amount that the packing machine puts into these bags is believed to be a Normal model with mean 10.1 ounces and standard deviation 0.13 ounces. What fraction of bags sold are underweight?

A) 0.2209 B) 0.2502 C) 0.2795 D) 0.3088 E) 0.3381 F) 0.3674 G) 0.3967 H) 0.4260 I) 0.4553 J) None of the preceding

17. Some of the bags of potato chips described in problem 16 are sold in "bargain packs" of 3 bags. What's the probability that none of the three are underweight?

A) 0.1762 B) 0.2133 C) 0.2504 D) 0.2875 E) 0.3246 F) 0.3617 G) 0.3988 H) 0.4359 I) 0.4730 J) None of the preceding

18. Given the descriptions of the potato chip bags in Problems 16 and 17, what's the probability that the mean weight of the 3 bags in a bargain pack is below the stated amount?

A) 0.06361 B) 0.06708 C) 0.07055 D) 0.07402 E) 0.07749 F) 0.08096 G) 0.08443 H) 0.08790 I) 0.09137 J) None of the preceding

19. A newspaper reports that the governor's approval rating stands at 68%. The article adds that the poll is based on a random sample of 867 adults and has a margin of error of 1.8%. What level of confidence did the pollsters use?

A) 68.33% B) 71.37% C) 74.41% D) 77.45% E) 80.49% F) 83.53% G) 86.57% H) 89.61% I) 92.65% J) None of the preceding

20. An airline's public relations department says that the airline rarely loses passengers' luggage. It further claims that on those occasions when luggage is lost, 80% is recovered and delivered to its owner within 24 hours. A consumer group who surveyed a large number of air travelers found that only 195 of 260 people who lost luggage on that airline were reunited with the missing items by the next day. Does this cast doubt on the airline's claim? Perform the appropriate one-sided test and report the P-value.

A) 0.02192 B) 0.02659 C) 0.03126 D) 0.03593 E) 0.04060 F) 0.04527 G) 0.04994 H) 0.05461 I) 0.05928 J) None of the preceding

21. Researchers comparing the effectiveness of two pain medications randomly selected a group of patients who had been complaining of a certain kind of joint pain. They randomly divided these people into two groups, then administered the pain killers. Of the 134 people in the group who received medication A, 99 said this pain reliever was effective. Of the 145 people in the other group, 83 said that pain reliever B was effective. Find a 97.5% confidence interval for the difference in the proportion of people who may find these medications effective and report its length (since this is a multiple-choice test).

A) 0.1220 B) 0.1649 C) 0.2078 D) 0.2507 E) 0.2936 F) 0.3365 G) 0.3794 H) 0.4223 I) 0.4652 J) None of the preceding

22. Find the value of Z* that was used in constructing the confidence interval in Problem 21.

A) 1.842 B) 1.899 C) 1.956 D) 2.013 E) 2.070 F) 2.127 G) 2.184 H) 2.241 I) 2.298 J) None of the preceding

23. Observers in Texas watched children at play. Of the 1024 children seen biking, roller-blading, or skateboarding, only 12% wore a helmet. Suppose we want to do this study again and hope to end up with a 97% confidence interval for percent of kids who don't wear helmets in these activities, with margin of error of ±2%. How many (biking, roller-blading, and/or skateboarding) children must we observe? Since the 12% is so far away from 50%, use the 12% in obtaining your estimate of sample size.

A) 1046 B) 1079 C) 1112 D) 1145 E) 1178 F) 1211 G) 1244 H) 1277 I) 1310 J) None of the preceding

24. A company with a large fleet of cars hopes to keep gasoline costs down, and sets a goal of attaining a fleet average of at least 26.2 miles per gallon. To see if the goal is being met, they check the gasoline usage for 40 company trips at random, finding a mean of 24.93 mpg and a standard deviation of 3.76 mpg. Is this strong evidence that they have failed to attain their goal? Perform a one-sided hypothesis test with H_A in the appropriate direction and report the P-value.

A) 0.01719 B) 0.01950 C) 0.02181 D) 0.02412 E) 0.02643 F) 0.02874 G) 0.03105 H) 0.03336 I) 0.03567 J) None of the preceding

25. Several programs attempt to address the shortage of qualified teachers by placing uncertified instructors in schools with acute needs—often in inner cities. A 1999-2000 study compared students taught by certified teachers with others taught by undercertified teachers within the same schools. Reading scores of the students of certified teachers averaged 35.62 points with standard deviation 9.31. The scores of students instructed by undercertified teachers had mean 32.48 with standard deviation 9.43 points, on the same test. There were 44 students in each group. Is there evidence of a difference in scores between the two types of teachers? Calculate the P-value using a two-sided alternative hypothesis. (Ignore the possible lack of independence induced by the clustering of students within teachers.)

A) 0.1026 B) 0.1083 C) 0.1140 D) 0.1197 E) 0.1254 F) 0.1311 G) 0.1368 H) 0.1425 I) 0.1482 J) None of the preceding

26. (The bonus humor question) Garfield made the statement, "This guy's never wrong." What was he referring to?

A) Rainfall B) Humidity C) Wind D) Temperature E) Hang Seng Index F) Dow Jones Index G) S&P 500 Index
H) Nikkei Index I) Shanghai Index J) None of the preceding

27. In one of the assigned homework problems for the chapter on comparing two means, the authors had a little fun with us by giving us a problem that could not be done using the methods of that chapter. Why couldn't it be done with the methods of the chapter?

A) Skewness
B) Non-normality
C) Dependence
D) Kurtosis
E) Homoskedasticity
F) Heteroskedasticity
G) Bayesian methods required
H) Cobordism
I) Kyphosis
J) Bimodality

28. What is the recommended critical value of the test statistic for the significance level α=0.05 in "A Quick, Compact, Two-Sample Test to Duckworth's Specifications"?

A) 5 B) 6 C) 7 D) 8 E) 9 F) 10 G)11 H) 12 I) 13 J) None of the preceding

29. An example presented in class, regarding a new type of mammography (digital), could not be analyzed by the conventional test of the null hypothesis H_0: $p_1=p_2$ versus the alternative hypothesis H_A: $p_1 \neq p_2$. Suppose out of 1000 women known to have breast cancer, the older type (film mammography) detected 900 cancers and the new type of mammography detected 940 cancers. Suppose that 850 cancers were detected by both tests. Find the correct P-value for testing H_0: $p_1=p_2$ versus H_A: $p_1 \neq p_2$.

A) 0.0001233 B) 0.0002233 C) 0.0003233 D) 0.0004233 E) 0.0005233 F) 0.0006233 G) 0.0007233 H) 0.0008233
I) 0.0009233 J) None of the preceding

30. The footnote question in the chapter on comparing two means, "Are you sorry you looked?" refers to what?

A) Bayes's df
B) Chernoff's df
C) David's df
D) Fisher's df
E) Hotelling's df
F) Lehman's df
G) Neyman's df
H) Pearson's df
I) Satterthwaite's df
J) Tukey's df