

Statistics 213

Assignment 5

Note: answers may vary slightly due to rounding

1. A newspaper advertisement claims that 55% of the people who wear contact lenses experience no difficulty. In a random sample of 300 people who have purchased contact lens,
 - (a) What's the probability of at least 150 people having no problems? $\{.9641\}$
 - (b) What's the probability of having between 145 and 170 (inclusive) people having no problems? $\{.7302\}$
 - (c) What's the probability of having less than 160 having no problems? $\{.2611\}$
2. According to one study, $\frac{2}{3}$ of all Canadians have at least 2 televisions. In a random sample of 1000 Canadians,
 - (a) What's the probability of exactly 668 Canadians having at least 2 televisions? (use approximation) $\{.0239\}$
 - (b) What's the probability of between 640 and 670 (exclusively) Canadians having at least 2 televisions? $\{.5361\}$
 - (c) What's the probability of greater than 670 Canadians having at least 2 televisions? $\{.3974\}$
3. Estimate the probability of getting at least 52 girls in 100 births. Assume that boys and girls are equally likely. $[\text{.3821}]$
4. Estimate the probability of passing a true/false test of 50 question if 60% (or 30 correct answers) is the minimum passing grade and all responses are random guesses. $[\text{.1020}]$
5. A firm establishes a committee to investigate the amount each contract costs over and above the amount quoted in the original contract (overruns). The committee has determined that the standard deviation of overruns is \$17,500.
 - (a) The average overrun for a random sample of 50 contracts is \$12,000. Determine a 98% confidence interval estimate of the true mean overrun based on this sample. $\{\$6233.54, \$17,766.45\}$
 - (b) How large a sample should they use if they want to be 95% confident that the mean overrun is in error by no more than \$2000 $\{295\}$
 - (c) A random sample of 36 contracts is selected to estimate the average overrun. What is the probability that the sample mean will over-estimate the population mean overrun by at least \$5000 $\{.0436\}$
6. The earnings per share for a random sample of technology stocks listed on the NYSE were (in \$'s):
1.90 2.15 2.01 0.89 1.53 1.89 2.12 2.05 1.75 2.22 3.44
 - (a) Assuming that earnings per share are normally distributed, determine a 95% confidence interval estimate of the average earnings per share of the NYSE technology stocks. $\{ \bar{x} = 1.9955, s = 0.608 \}$ $\{\$1.58, \$2.41\}$
 - (b) A broker stated that the NYSE technical average earning was \$1.25 per share. Do the data confirm this or not. Use the results of (a) only
 - (c) How large a sample should be used if the estimate of the mean NYSE technology stock earnings is to be in error by no more than \$.10. You want to have a 97% level of confidence in your sample. $\{175\}$
 - (d) How can we decrease/increase the error? Assume that the variability does not change from the data given above.
7. A pilot study has revealed that the standard deviation of workers' monthly earnings in the chemical industry is \$180. How large a sample must be chosen to obtain an estimator of the mean salary that, with 90% confidence, will be correct to within $\pm \$20$? $\{220\}$

8. A random sample of 50 quarters has a mean weight of 5.622g and a standard deviation of 0.068g.
 - (a) Construct a 98% confidence interval estimate of the population mean of all quarters in circulation. [5.600g, 5.644]
 - (b) The U.S. Department of the Treasury claims that it mints quarters to yield a mean weight of 5.640g. Is this claim consistent with the confidence interval?
9. Assume that we want to estimate the mean IQ scores for the population of professors. How many professors must be randomly selected for IQ test if we want 95% confidence that the sample means is within 2 IQ points of the population mean? Assume the standard deviation is 15. [217]
10. It is found that a sample size of 843 is necessary to estimate the mean weight (in grams) of sugar in packets supplied by Domino. That sample size is based on a 95% degree of confidence and a population standard deviation that is estimated by the sample standard deviation of 0.074g. Find the margin of error. [.005]
11. Maximum heart rates during automated snow removal: $n=10$, $\bar{x}=124$, $s=18$. Find the 95% confidence interval estimate of the population mean for those who use the electric snow thrower. [111, 137]
12. The 95% confidence interval for the true mean distance by male students in one year is 11,290 to 12,466. This was based on a sample of 100 randomly selected male students. Find the sample standard deviation that was used. [$s=3000$]
13. You have been hired by the Ford Motor Company to do market research, and you must estimate the percentage of household in which a vehicle is owned. How many households must you survey if you want to be 94% confident that your sample percentage has a margin of error of three percentage points?
 - (a) Assume that a previous study suggested that vehicles are owned in 86% of households. [473]
 - (b) Assume that there is no available information that can be used to estimate the percentage of households in which a vehicle is owned. [982]
14. Because a proposed survey is time-consuming, an enterprising pollster posts it on the Internet and promises free software to everyone who responds by completing the survey. Results include 2250 responses, and 80% of them indicate that a fax machine is owned. Construct a 95% confidence interval for the percentage of all people who have a fax machine. Are the results valid? Why or why not? [78.3%, 81.7%] Results are not valid because the sample is self-selected (not a random sample)
15. A patio building company believes that it takes 27 days on average to complete a job. If the job is done in less time, the owner is afraid that the job may be rushed and will sacrifice quality. Further, a job that takes longer will escalate the costs. Records of fifty completed jobs are randomly selected. The mean length of job was found to be 25.3 days with a standard deviation of 2.1 days.
 - (a) Do records indicate that the mean length of a job is not 27 days as believed by Noah? Set up a test procedure.
 - (b) Suppose testing was carried out at the 1% level of significance (or $\alpha = .01$). What would your conclusion in (a) be { $z_{\text{calc}} = -5.724 < -2.575$, Rho }
 - (c) Determine the p-value of this test. { ~ 0 }
16. Industrial espionage is a growing problem. It has been estimated that corporate extortion cost companies more than \$3.35 million on average. Sixty-five cases of this nature were examined and found to average \$3.71 million with a standard deviation of \$1.21 million.

- (a) Do the data support the statement concerning the estimated cost of corporate extortion? Assume $\alpha = 0.01$ { $z_{\text{calc}} = 2.3986 > 2.3263$, Rho}
- (b) Determine the P-value of the test carried out in (a) {0.0082}
17. The owner of a small publishing firm thinks that business has improved lately. Last year the daily revenue for the firm was \$5,000 on average. A random sample of 20 recent days reveals a mean daily revenue of \$5,200 with a standard deviation of \$507
- (a) Do the data support the owner's belief? Use the P-value for the appropriate statistical test. { $P(t \geq 1.7642) = 0.0469$ }
- (b) Suppose that testing was carried out at a 5% significance level. What would be your conclusion? Use the results of (a) (i.e. the p-value) to make your decision. Explain why you reached your decision, and, hence, your conclusion. {p-value < α , Rho}
- (c) Same question as (b) except now assume that $\alpha = 0.01$. {p-value > α , Aho}
18. A cereal manufacturer sells boxes of cereal that list the weight as 19 oz. A random sample of 60 boxes had a mean fill of 19.2 oz with a standard deviation of 0.67 oz. Would this data indicate that the actual mean fill of all boxes of this cereal differs from the weight listed on the box?
- (a) Carry out the appropriate hypothesis test to answer this question, using a 5% significance level. { $z_{\text{calc}} = 2.312 > 1.96$, Rho}
- (b) Determine the p-value of the test carried out in (a) {0.0208}
19. Big Burger claims that their deluxe special has at least 0.25 pounds of beef. A sample of 100 burgers made by this company had a mean of 0.237 pounds of beef with a variance of 0.0036.
- (a) Is Big Burger guilty of false advertising? Suppose that you are prepared to accept a 5% chance of making a Type I error when carrying out the statistical test on the data. { $z_{\text{calc}} = -2.1667 < -1.645$, Rho}
- (b) What is the minimum significance level for which you would conclude that Big Burger is guilty of false advertising? {0.015}
20. An economist claims that the unemployment rate for non-English speaking people is at least 30% in a specific region of the country. In a random sample of 400 non-English-speaking people in this region 90 were found to be unemployed.
- (a) Determine a 95% confidence interval estimate of the proportion of non-English-speaking people in the region that are unemployed. Do these data support the economist's claim? Explain why or why not {0.1841, 0.2659}
- (b) Do the data indicate that the economist's claim may not be true? Carry out the appropriate statistical test at a 2.5% significance level. { $z_{\text{calc}} = -3.2733 < -1.96$, Rho}
- (c) Determine the p-value of the test carried out in (b). Interpret {0.0005}
- (d) How large a sample should be used to estimate the proportion of non-English-speaking unemployed people in the region if we want to be 98% sure that our estimate is in error by no more than 0.02? Determine the sample required if (i) you make use of the sample information given above, and if (ii) you want to know the maximum sample size required to meet the specifications. {2367, 3394}
- (e) What change should you consider to the specifications made in (d) that will reduce the sample size for either Case (i) or (ii)
21. In a survey of 1002 people, 701 said that they voted in the recent presidential election. Test to see if this is significantly different from the actual proportion who voted (.61 of the population). Use a 5% significance level. [$z = 5.81$, Rho]