

Problems For You To Do (Sections 7.1 - 7.4)

1. Find the critical value $z_{\alpha/2}$ that would be used for each of the following confidence levels.
 a) 75% b) 92% c) 85% d) 99%

2. Suppose that the Statistics Canada survey was based on a random sample of 200 Vancouver drivers. If these 200 drivers produced an average daily commute time of 70 minutes and an SD of 20 minutes, construct a 99% confidence interval for the average daily commute time for all Vancouver drivers.

Show the calculation details and present the result of your CI calculation in full sentence form.

SUN, MARCH 17, 2000
ERIC BEAUCHESNE SOUTHAM NEWSPAPERS
OTTAWA – Canadians, especially those living in Toronto and Vancouver, are increasingly finding themselves alone and trapped in a jam – a traffic jam that is. “If you feel like you’ve been spending more time in traffic tie-ups, you’ve got company,” Statistics Canada says. “Across Canada, traffic congestion is increasing.” In Toronto and Vancouver drivers spent an average 70 minutes per day commuting by car.

3. How large a random sample of adult Canadians is needed to estimate the average number of hours spent on the Internet last night between 8:00 PM and 11:00 PM if we want our estimate to be within 5 minutes with 95% confidence? Show the calculation steps and round properly.
4. Find the critical value $t_{\alpha/2}$ that would be used for
 a) a 95% CI for the mean based on a sample of 15 measurements.
 b) a 98% CI for the mean based on a sample of 6 measurements.
 c) a 99% CI for the mean based on a sample of 10 measurements.
 d) a 90% CI for the mean based on a sample of 23 measurements.

5. a) What assumption(s) is required to use the t -distribution to construct a confidence interval for a population mean? Be specific, don't use "it".
 b) A random sample of 5 students produced the data in the table to the right. Under the assumptions of Part a), construct a 90% confidence interval for the mean hours of sleep for the population of all students.

Sleep Time (Hours)
4.7
8.5
7.5
6.3
7.0

6. A random sample of 50 Vancouver households produced a 95% CI of $15 \text{ kg} \pm 2 \text{ kg}$ for the population mean weight of garbage produced per week. How large a random sample of households is needed to reduce the margin of error for the 95% CI to 0.5 kg?
7. A consumer advocacy agency encourages visitors to its web site to submit the annual repair bill for a particular type of car. As of April 20 a total of 225 visitors to the site had submitted repair bills, which averaged \$560 with a standard deviation of \$123. Based on this the consumer agency wants to publish a 95% confidence interval estimate for this type of car and calculates the interval to be $\$560 \pm \16 . As the statistical advisor to the agency would you agree with this calculation and recommend that the interval be published? Justify your answer.

8. Which would give a smaller margin of error in the estimation of a population mean
- a) a random sample of 100 with a confidence level of 0.90? *or* b) a random sample of 200 with a confidence level of 0.99?

SUN, APRIL 16, 1999

Support your answer with appropriate calculations.

9. How large a random sample is needed to estimate the percentage of Vancouverites that cycles to work if the estimate is to be accurate within 2% at the 90% confidence level? (Accept as fact that Vancouver lags behind Toronto in the percentage cycling to work.)

The city lags behind Toronto, where six per cent opt to pedal
CELIA SANKAR
VANCOUVER SUN

Still, for all its sporty image, Vancouver lags behind Toronto, where six percent of commuters use pedal power, Vancouver city officials say. "We've got a good start," said Forrest Klotzbach, city engineer with the neighbourhood transportation branch. "But we'd like to see the numbers double at least in the next few years."

10. A Penn State University study indicates that 53 percent of cigarette butts from "light" brands scooped out of ashtrays show evidence that smokers blocked the vent holes around the filters when they smoked the cigarettes. "The finding suggests that consumers of 'light' cigarettes mistake these dangerous products as 'safer' than 'full-strength' ones," says Dr. Lynn Kozlowski, head of the bio-behavioral health program at Penn State and the study's leader. In the current issue of the *Journal of Substance Abuse*, the researchers describe how they analyzed 158 discarded "light" cigarette butts and found some vent blocking in 53 percent of the butts. The tiny, almost-invisible vent holes on "light" and "ultra-light" brands most often circle a cigarette's filter about a half inch from the tip. Cigarette makers use the vents to allow air to enter the filters, diluting what a smoker inhales compared to "full-strength" brands. Consumers block the holes with their lips or fingertips.

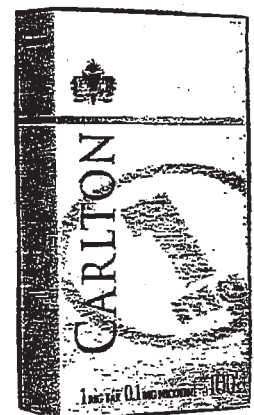
<http://www.hhdev.psu.edu/research/vents.htm>

Use the results of this research to find a 95% confidence interval for the true proportion of "light" brand cigarette smokers who block the cigarette's vents when they smoke.

11. The 1 mg tar appearing on the box of Carlton cigarettes is a mean tar value per cigarette as determined by testing done on a smoking machine (not a person). A researcher believes that the tar level inhaled by humans has a higher mean value. He conducts an experiment measuring the tar content inhaled by human smokers of this brand of cigarette and records the following tar levels per cigarette (mg) for a random sample of 8 smokers:

1.1 0.7 1.6 1.1 0.9 1.4 1.2 1.3

- a) Use the sample data to construct a 90% CI.
 b) State precisely what this CI is estimating.
 c) Interpret your results from Part a) in the form of a complete sentence.
 d) Clearly state any assumptions required for the validity of the calculations.
 e) If the results in Part a) are viewed as a pilot study, how large a random sample of Carlton cigarette smokers must be taken to estimate the mean tar content inhaled by human smokers to within 0.1 mg with confidence level 99%?



12. A random sample of 100 female Capilano College students produced heights with an average of 66 inches and an SD of 3.2 inches. Determine the following:
- the margin of error for an 80% CI.
 - the width of a 90% CI.
 - a 99% CI for the mean height of all Capilano College female students.
13. a) A potato chip manufacturer weighed 90 bags of potato chips where each bag had an advertised weight of 350 grams. The weights of the sample had a mean of 351.4 grams and a standard deviation of 3.1 grams. Based on this sample, construct
- an 85% CI for the mean weight of all bags of potato chips of the above type.
 - a 98% CI for the mean weight of all bags of potato chips of the above type.
- b) Another random sample of 200 bags of the (advertised) 250 gram BBQ chips yielded a mean weight of 250.8 grams and a SD of 2.2 grams. Construct a 99% CI for the mean weight of all 250 gram bags of BBQ chips. What is the margin of error for this sample?
- c) How large a random sample is needed to be 99.5% confident that the sample mean weight is within 1 gram of the mean weight of all bags of BBQ chips with advertised weights of 250 grams? What assumption did you have to make to come up with this number?
14. A sample of 6 grizzly bears in a national park yielded the following weights (in kilograms):
359, 405, 378, 325, 330, 382.
- What assumption(s) are required to construct a CI for the population mean weight?
 - Under the assumptions in Part a), construct a
 - 98% CI for the mean weight of all grizzlies in the park.
 - 95% CI for the mean weight of all grizzlies in the park.
 - Interpret your answer in Part b) ii) in the form of a complete sentence.
15. Assume that the maximum amount that a Grey Cup spectator spends on food and drink at a Grey Cup game is \$20. How large a random sample of spectators would you need to estimate the average amount that Grey Cup spectators spend on food and drink at the game accurate within \$1.00 with 95% confidence?
16. A random sample of 100 people selling their cars that they had bought new produced a 95% CI of 7.2 ± 2.1 years for the length of time that they had owned their car.
- How large a random sample is required to reduce the margin of error of the 95% CI to 1.5 years?
 - How large a random sample is required to obtain a 90% CI width of 2 years?

17. The table below shows the results of a random sample of 36 male students aged 18 - 22 years. Each student was first asked to self evaluate his fitness level using the scale Very Good (VG) Good (G) OK Poor (P) Very Poor (VP) and then was tested for lung capacity as measured by the volume (in litres) of air that he was able to expel in one second.

- a) What is the level of measurement used for the self evaluation of fitness?
- b) Find a 99% confidence interval for the mean amount of air expelled by male students aged 18 - 22 years.

Subject Number	Fitness Level	Air Expelled (l)
1	VG	4.5
2	OK	4.1
3	VG	4.8
4	G	4.2
5	OK	3.8
6	G	4.1
7	P	3.6
8	VP	3.4
9	OK	4.0
10	G	4.3
11	OK	4.3
12	OK	3.9
13	P	3.5
14	G	3.9
15	VG	4.3
16	VP	3.3
17	OK	3.9
18	P	3.7
19	P	4.1
20	G	4.2
21	VG	4.8
22	G	4.6
23	G	4.2
24	OK	4.0
25	VP	3.5
26	VP	3.1
27	G	4.2
28	OK	4.1
29	P	4.0
30	VG	4.2
31	VG	4.9
32	OK	3.8
33	OK	3.8
34	OK	4.1
35	P	3.7
36	G	4.4

18. a) In a random sample of 700 North Shore adult residents, 33% indicated that they had a university degree. Estimate with 96% confidence the true percentage of North Shore adult residents with a university degree.
- b) The same survey indicated that 72 of the 700 respondents had travelled overseas within the last year. What is the margin of error in a 95% CI for the proportion of all North Shore residents who had travelled overseas within the past year?
- c) How large a sample is required to estimate the true proportion in Part b) within 0.01 with a confidence of 99%, if, based on the above sample, it is assumed that the proportion will not exceed 0.15?
19. How large a random sample is needed to estimate the percentage of trucks on the road with faulty brakes accurate within 2 percentage points 24 times out of 25 if:
- a) no information about the percentage is available?
- b) it is known that the percentage is no more than 20%?
20. a) If the Harris poll in the article was based on a random sample of 1000 online computer users, and if these 1000 produced a mean surfing time of 6 hours per week and a SD of 2.3 hours per week, construct
- i) a 90% CI for the mean weekly surfing time of all online computer users in the U.S.
- ii) a 98% CI for the mean weekly surfing time of all online computer users in the U.S.
- b) If there were 280 online users in the 30 - 39 year old age group, and they had an average of 9 hours of Internet use per week with an SD of 3.7 hours per week, construct a 99% CI for the average weekly Internet use for this age group.
- c) In what sense are you "99% confident" that the interval in Part b) contains the population mean?
21. How large a random sample of adult Canadians is needed to estimate the average number of hours of TV watched last night (per person) between 5:00 PM and 11:00 PM if we want our estimate accurate within 10 minutes of the population average with 95% confidence?
22. A random sample of 100 patients on a diet produced a 95% CI of 4.3 ± 2.8 kg for the population mean weight loss. How large a random sample do we need to reduce the margin of error of the 95% CI to 0.7 kg?
23. a) What assumption(s) is required to use the t -distribution to construct a confidence interval for the population mean?
- b) A random sample of 6 reaction times (in seconds) produced the following sample results:
7.8, 6.4, 8.1, 5.7, 6.6, 6.8
Under the assumptions of Part a), construct a 90% CI for the mean reaction time.

SUN, MARCH 25, 1999

Surfing average '6 hours a week'

REUTERS

WASHINGTON - The average online computer user in the United States spends six hours a week surfing the Internet, says a new poll.

The poll, conducted by Louis Harris and Associates Inc., said the six hours did not include time spent sending and receiving e-mail, which is the most popular online tool.

Sixty-two per cent of those surveyed used a computer an average of 15 hours per week. The 30 - 39 year-old age group led the pack, using computers an average of 21 hours per week, including nine Internet hours, the poll said.

24. To determine the potential demand for daycare facilities, a large university randomly samples 500 students and determines that 75 of these students have young children in daycare. Estimate with a 90% confidence interval the true proportion of students at this university that have children in daycare.

25.

In the NEWSWEEK Poll, 46% of Republicans want George W. Bush as their nominee in 2000

FOR THIS NEWSWEEK POLL, PRINCETON SURVEY RESEARCH ASSOCIATES INTERVIEWED 750 ADULTS MARCH 3-4. THE MARGIN OF ERROR IS 4 PERCENTAGE POINTS. THE NEWSWEEK POLL © 1999 BY NEWSWEEK, INC.

If we assume that this poll is based on a random sample of Republicans, what confidence level should be given for this margin of error?

26. How large a random sample is needed to estimate the percentage of Vancouver drivers who lease their vehicles if the estimate is to be accurate within 3 percentage points at a 99% confidence level assuming

- a) that there is no available information on this lease percentage?
- b) that it is known that the lease percentage is at most 20%?

27. A random sample of 80 males on a diet produced a sample average weight loss of 13 kg and a standard deviation of 3 kg. Construct a 90% confidence interval for the average weight loss for all males on this diet.

28. A random sample of 100 6-year old Vancouver boys produced a 95% confidence interval of 26 kg to 32 kg for the mean weight of all 6-year old Vancouver boys.

- a) What is the margin of error?
- b) How large a random sample would be required to cut the width of this 95% confidence interval in half? Justify your answer.
- c) Is it correct to conclude that we are confident that 95% of the weights of 6-year old Vancouver boys are in the interval 26 kg to 32 kg? Justify your answer.

29. How large a random sample is required to estimate the average amount paid by a student buying something for lunch at the Birch cafeteria if we want the estimate to be within 50 cents at the 99% confidence level?

30. A random sample of 9 sixty-minute parking meters produced the data given in the table to the right. Construct a 95% confidence interval for the mean time difference for all parking meters. What assumption is needed for the validity of this interval?

Time Difference [Actual time given by the meter minus 60 minutes]
2
-1
3
0
4
-2
1
2
0

31. To estimate the proportion of Skytrain passengers who do not have a valid ticket, a random sample of 800 passengers was taken and 48 of the 800 did not have a valid ticket. Estimate with a 99% confidence interval the true proportion of Skytrain passengers who do not have a valid ticket.
32. How large a random sample is needed to estimate the percentage of Vancouver adults who own a cell phone if the estimate is to be accurate within 4 percentage points 19 times in 20?
33. If we accept the Telus claim that fewer than 10% of all cell phone customers use prepaid cards, how large a random sample is needed to estimate the percentage of prepaid card customers if the estimate is to be accurate within 3% at the 90% confidence level?

SUN, NOVEMBER 27, 1999

WILLIAM BOEI
SUN BUSINESS REPORTER

Telus Mobility said Friday it will proceed with rule changes for pre-paid calling cards, despite complaints from cell-phone users that the company is breaking faith with them.

Telus customers have been calling *The Vancouver Sun* every day this week. Several accused Telus of unethical behaviour, and one said he may start a class action suit.

Telus would not reveal the number of customers using prepaid cards, "for competitive reasons." But it amounts to fewer than 10 per cent of cell-phone subscribers, and only a fraction of those are low-use customers, Strachan said.

34. The price of Santa's toys is normally distributed. A random sample of 15 toys produced an average value of \$22.35 and a SD of \$4.05.
- Determine the margin of error for a 90% confidence interval. (include units)
 - Determine the 90% CI for the mean price of all of Santa's toys.
35. A sample of 8 adults was taken and the number of hours per month spent on leisure activities was given as: 45 12 31 16 28 14 18 26
- Find the 95% confidence interval for the mean number of hours per month spent on leisure activities.
 - What fact(s) not explicitly stated in the question do you have to assume for the above to be valid?
 - How many adults need to be sampled to be 93% confident that the sample mean is within 2 hours of the population mean?
36. In a random sample of 50 students, 14 owned their own car. Find a 90% confidence interval for the proportion of students who own a car. Interpret your results in the form of a complete sentence.
37. In a study to determine the proportion of college students who held down a job while attending school, a random sample of 100 college students found the 95% confidence interval for the population proportion to be between 0.45 and 0.53.
- What was the margin of error?
 - How many college students in the survey said that they held down a job while attending school?

38. A random sample of 250 B.C. households using natural gas heating shows that the mean monthly consumption of natural gas was 2.998 m^3 , with a standard deviation of 0.388 m^3 . Use the statistics to obtain a 94% confidence interval for the mean monthly consumption of natural gas for all B.C. households using gas heating. Show the details of your calculation, use proper notation, and interpret the results of your CI calculation using a full sentence.
39. Carefully list the condition(s) that indicate the use of a t -distribution to construct a CI for a population mean.
40. Nielsen Media Research wants to estimate the mean amount of time (in hours) that full-time college students spend watching TV between 7:00 PM and 10:00 PM each weekday. The estimate is to have a margin of error of 15 minutes, and a 96% degree of confidence is desired. Find the sample size necessary assuming
- no prior information is available.
 - that a pilot study estimated the standard deviation to be 1.35 hours.
41. A random sample of 4 students produced the following data for the number of hours spent studying on the weekend: 8.5 4.2 10.1 9.6
Assuming the conditions of Question 39 are satisfied, construct an 80% confidence interval for the mean study time for the population of all students.
42. A survey of 150 female college students produced a 95% confidence interval of $163 \pm 1.0 \text{ cm}$ for the mean height of all female college students. How large a random sample would be required to reduce the margin of error for the 95% CI to 0.2 cm?
43. a) The Newspaper Audience Databank readership survey done between January and May asked 31 000 people across Canada what newspaper they had read the day before, and 1920 indicated that they had read the National Post. Construct a 99% confidence interval for the true proportion of Canadians that read the National Post. Show your steps, and interpret your answer, correct to 4 decimals, in complete sentence form.
- b) The above survey also indicated that 6.4% of Canadians read the Globe and Mail. If the survey company assumes that the Globe and Mail readership next year will not exceed 7%, determine the size of the sample next year needed to determine the percentage of Globe and Mail readers accurate within one and a half percent, nine times out of ten.

44. a) Show exactly, with all numerical details, how Decima Research arrived at the margin of error quoted at the bottom of the article.
- b) Does the quoted margin of error apply to the estimated average RRSP contribution (\$5,008), or to the percentage of investors (42%) who perceive they must incur higher risk to achieve returns offered by foreign investments, or to both?

Investors have trimmed their Canadian holdings

The Trimark-sponsored survey found 42 per cent of investors perceive they must incur higher risk to achieve the returns offered by foreign investments. The same percentage believe global diversification reduces risk.

The survey of 1,290 RRSP holders also found Canadians intend to contribute \$5,008 to their RRSPs for 1999, an increase of 11 per cent from the \$4,492 average contribution in 1997, the most recent year for which Statistics Canada publishes information.

The Decima poll is considered accurate within 2.7 percentage points, 19 times in 20.

45. To determine the level of support for the federal government's proposed "Endangered Species" legislation, a random sample of 800 Canadians produced 680 in favour and 120 opposed. Estimate with a 99% CI the true proportion of Canadians that support this legislation. Show steps and summarize your answer in complete sentence form.

46. a) Show how this polling company calculated the two margins of error at the bottom of the article.
- b) If 15% of the adults surveyed felt that they would be better off living in the U.S., what is the "most precise" margin of error that you could claim for the result? Support your answer.
- c) If it is safe to assume that at most 25% of those between the ages of 25 and 34 agree they would be better off in the U.S., how large a random sample of 25 to 34 year olds is required to estimate the percentage who think they would be better off in the U.S. if this estimate is to be accurate within 2%, 24 times out of 25?
- d) Which ones, if any, of the margins of error at the bottom of the article apply to the percentages quoted for the subgroups (25 to 34 year olds; those with incomes of \$75,000; business students; engineering and computer science students; self-employed Canadians; Canadians seeking work)? Explain.

SUN, JUNE 23, 2001

Poll debunks talk that most of us want to live in the U.S.

OTTAWA - Canadians are happier with their life in Canada than all the talk about the "brain drain" and the allure of the United States suggests.

A fresh survey says only 15 per cent of Canadians think they would be better off living in the U.S., a finding that Canadian Alliance pollster Dimitri Pantazopoulos admits caught him by surprise.

Among other things, the national survey of 1,500 adults, plus a second one of 2,000 post-secondary students done in conjunction with another firm, said:

- 22 per cent of those between the ages of 25 and 34 agree they would be better off living in the United States.
- 20 per cent with an annual household income of \$75,000 felt the same way, as did 22 per cent of business students, and 21 per cent of engineering and computer science students.
- 22 per cent of self-employed Canadians and 25 per cent of Canadians seeking work agreed their life would improve if they moved south.

The two surveys - conducted in March among the students and April among the adults, are accurate within 2.2 percentage points, and 2.5 percentage points respectively, 19 times out of 20.