Chapter 8

Section 8.1

Check Your Understanding, page 476:

Page 476:

1. We are 95% confident that the interval from 2.84 to 7.55 g captures the true standard deviation of the fat content of Brand X hot dogs.
2. In 95% of all possible samples of 10 Brand X hot dogs, the resulting confidence interval would capture the true standard deviation.
3. False. Once the interval is found, either the true standard deviation is in it or not. The 95% refers to the likelihood that, before the data is collected, we will select a sample for which the confidence interval contains the true standard deviation.

Exercises, page 481:

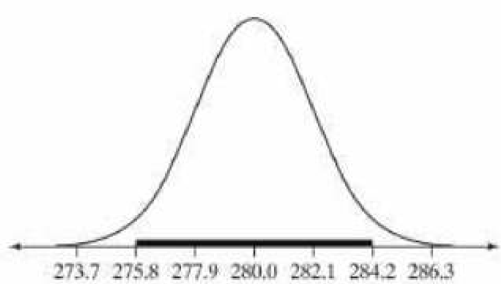
8.1 Compute the mean number of pairs of shoes. In this case $\bar{x} = 30.35$.

8.2 Compute the sample variance of the pairs of shoes. In this case $s_x^2 = 202.77$.

8.3 Compute the sample proportion of those planning to attend the prom. In this case $\hat{p} = 0.72$.

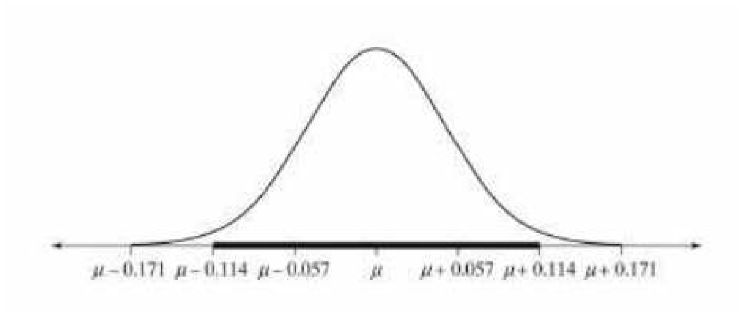
8.4 Compute the sample proportion of those who would report cheating. In this case $\hat{p} = 0.11$.

8.5 (a) The sampling distribution of $\bar{x}$ is approximately Normal with mean $\mu_{\bar{x}} = 280$ and standard deviation $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{60}{\sqrt{840}} = 2.0702$. (b) The mean is 280. One standard deviation from the mean: 277.9 and 282.1; two standard deviations from the mean: 275.8 and 284.2; and three standard deviations from the mean: 273.7 and 286.3.



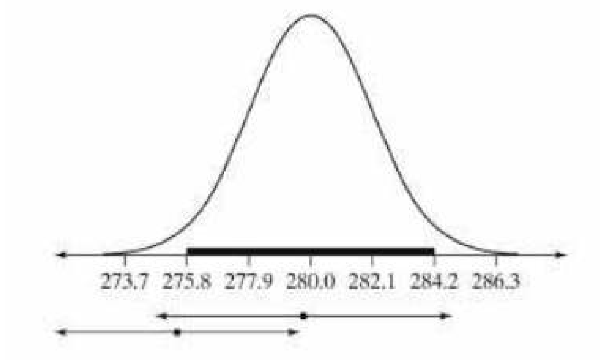
(c) 2 standard deviations; $m = 4.2$. (d) About 95% (by the 68-95-99.7 rule).

8.6 (a) The sampling distribution of $\bar{x}$ is approximately Normal with mean $\mu_{\bar{x}} = \mu$ and standard deviation $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.4}{\sqrt{50}} = 0.0566$. (b) The mean is μ. One standard deviation from the mean: $\mu - 0.0566$ and $\mu + 0.0566$; two standard deviations from the mean: $\mu - 0.1132$ and $\mu + 0.1132$; and three standard deviations from the mean: $\mu - 0.1698$ and $\mu + 0.1698$.

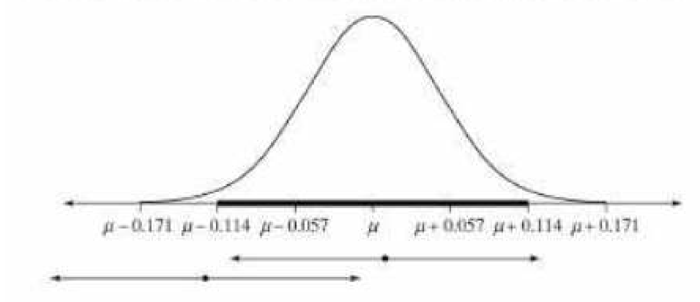


(c) 2 standard deviations; $m = 0.1132$. (d) About 95% (by the 68-95-99.7 rule).

8.7 The sketch is given below. Both will have the same length, but the interval with the value of $\overline{x}$ in the shaded region will contain the true population mean, while the other will not.



8.8 The sketch is given below. Both will have the same length, but the interval with the value of $\overline{x}$ in the shaded region will contain the true population mean, while the other will not.



8.9 The figure shows that 4 of the 25 confidence intervals did not contain the true parameter. This amounts to 16%. Therefore 84% of the intervals actually did contain the true parameter which suggests that these were 80% intervals (though they could have been 90%).

8.10 The figure shows that all of the 25 confidence intervals did contain the true mean. This suggests that the confidence level was quite high – probably 99%, but possibly 95%.

8.11 (a) If we were to repeat the sampling procedure many times, on average, the sample proportion would be within 3 percentage points of the true proportion in 95% of samples. (b) The 95% confidence interval is 0.63 to 0.69. We are 95% confident that the interval from 0.63 to 0.69 captures the true proportion of those who favor an amendment to the Constitution that would permit organized prayer in public schools. (c) If we were to repeat the sampling procedure many times, about 95% of the confidence intervals computed would contain the true proportion of those who favor an amendment to the Constitution that would permit organized prayer in public schools.

8.12 (a) If we were to repeat the sampling procedure many times, on average, the sample proportion would be within 3 percentage points of the true proportion in 95% of samples. (b) The 95% confidence interval is 0.56 to 0.62. We are 95% confident that the interval from 0.56 to 0.62 caputres the true proportion of those who would like to lose weight. (c) If we were to repeat the sampling procedure many times, about 95% of the confidence intervals computed would contain the true proportion of those who would like to lose weight.

8.13 Some of the practical difficulties would include non-response (those who either do not answer the phone or those who refuse to answer) and undercoverage of those who do not have telephones. Also, the description says that the random numbers formed were for "residential numbers" which suggests that they did not include cell phones so they would have undercoverage of those people who only have cell phones.

8.14 There could be sources of error due to many sampling issues such as undercoverage (if calls were only made on certain days or time of day) and non-response bias (many people will not participate in telephone or mail-in surveys).

8.15 We are 95% confident that the interval from 10.9 to 26.5 captures the true difference in the average number of pairs of shoes owned by girls and boys (girls – boys). That is, we are 95% confident that, on average, girls own between 10.9 and 26.5 more pairs of shoes than boys. When we say 95% confident, we mean that if this sampling method were employed many times, approximately 95% of the resulting confidence intervals would capture the true difference between the average number of pairs of shoes owned by girls and boys.

8.16 We are 95% confident that the interval from 0.120 to 0.297 captures the true difference in the proportions of younger teens and older teens who include false information on their profiles (younger – older). That is, we are 95% confident that between 12% and 29.7% more younger teens publish false information on their profiles than older teens. When we say 95% confident, we mean that if this sampling method were employed many times, approximately 95% of the resulting confidence intervals would capture the true difference between the proportions of younger teens and older teens who include false information on their profiles.

8.17 (a) Incorrect; the interval refers to the mean BMI of all women, not to individual BMI's which will be much more variable. (b) This is not quite correct, although it is closer than the explanation given in part (a). 95% of future samples will be within ±0.6 of the *true mean* not within ±0.6 of 26.8 (unless it happens that the true mean is 26.8). That is, future samples will not necessarily be close to the results of this sample; instead, they should be close to the *truth*. (c) Correct; we have given an interval which we believe contains the true mean. Therefore, the values in that interval are values which are believable as being that true mean. (d) Incorrect: it suggests that the population mean will be different in some samples (in 5% of samples it will not be between 26.2 and 27.4?). The population mean always stays the same, regardless of the sample taken. (e) Incorrect: we are reasonably sure that the population mean is between 26.2 and 27.4, but that does not rule out any other possibility absolutely.

8.18 (a) Incorrect; the probability is either 0 or 1, but we don't know which. (b) Incorrect; the general form of these confidence intervals is $\bar{x} \pm m$, so $\bar{x}$ will always be in the center of the confidence interval. (c) Correct. (d) Incorrect; there is nothing magic about the interval from this one sample. Our method

Section 8.2

Check Your Understanding, page 487:

1. Random: this is not met – this was a convenience sample. They asked the first 100 students who arrive that day and there may be a relationship between them (e.g. siblings). Normal: this condition is met – they have 17 successes (those who had slept 8 hours the previous night) and 83 failures (those who hadn't). Both of these are greater than 10. Independent: this is met as long as there are at least 1000 student in the school so that the 10% condition is met.
2. Random: this is met – the inspector chose a SRS of bags. Normal: this condition is not met. There were only 3 successes (bags with too much salt) which is less than 10. Note that there were 22 failures (bags with an appropriate amount of salt) which is greater than 10, but both values must be greater than 10 for this condition to be met. Independent: this condition is met because we are taking a sample of less than 10% of the population (25 out of "thousands").

Check Your Understanding, page 490:

1. The population of interest is U.S. college students and the parameter of interest is the true proportion who are classified as binge drinkers.
2. Random: the statement says that the students were chosen randomly. Normal: there were 2486 successes (binge drinkers) and 8418 failures (non-binge drinkers), both of which are at least 10. Independent: 10,904 is clearly less than 10% of all U.S. college students. All conditions are met.
3. For a 99% confidence interval, using Table A, we get $z^* = 2.576$. For this sample $\hat{p} = \frac{2486}{10904} = 0.228$ so the confidence interval is $0.228 \pm 2.576\sqrt{\frac{0.228(1-0.228)}{10904}} = 0.228 \pm 0.010$. The interval is from 0.218 to 0.238.
4. We are 99% confident that the interval from 21.8% and 23.8% captures the true proportion of U.S. college students would be classified as binge drinkers.

Check Your Understanding, page 494:

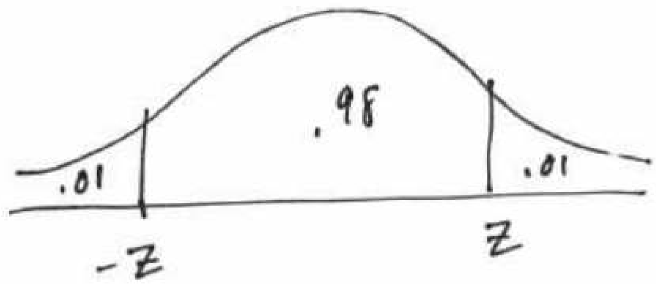
1. In this case we need to solve $\left(\frac{1.96}{0.03}\right)^2 \hat{p}(1-\hat{p}) \le n$, but this time using $\hat{p} = 0.80$. This gives $\left(\frac{1.96}{0.03}\right)^2 0.8(1-0.8) = 682.95 \le n$. So we should select a sample size of 683.
2. If the company president demands 99% confidence instead, the sample size will be larger. For this example the required sample size will increase to $\left(\frac{2.575}{0.03}\right)^2 0.8(1-0.8) = 1178.78 \approx 1179$.

Exercises, page 496:

8.27 The conditions are not met here. In particular, the independent condition is not met since Latoya sampled 50 of the 175 seniors living in the dormitory. This sample size is more than 10% of the population.

8.28 The conditions are met here. Random: the sample was a SRS. Normal: there were 38 successes (think tuition is too high) and 12 failures (do not think tuition is too high), both of which are greater than 10. Independent: the sample size (50) was less than 10% of the population size (2400).

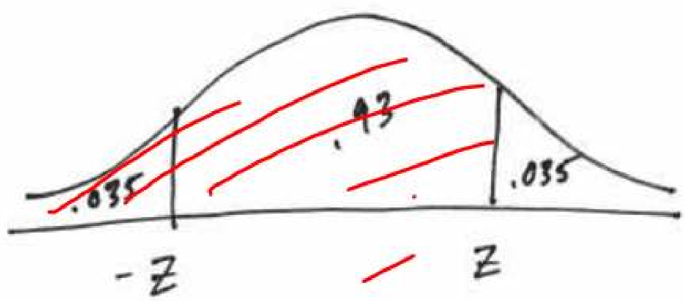
8.29 The conditions are not met here. Random: We do not know how the people were contacted. It may be that this condition is not met, but we are not sure. Normal: Since 0.2% of the sample were successes, 31)



invNorm (.01, 0, 1) = -2.33 or

invNorm (.99, 0, 1) = 2.33

32)



invNorm (.035, 0, 1) = -1.81 or

invNorm (.965, 0, 1) = 1.81

Table entry for p and C is the critical value t^* with probability p lying to its right and probability C lying between $-t^*$ and t^*.

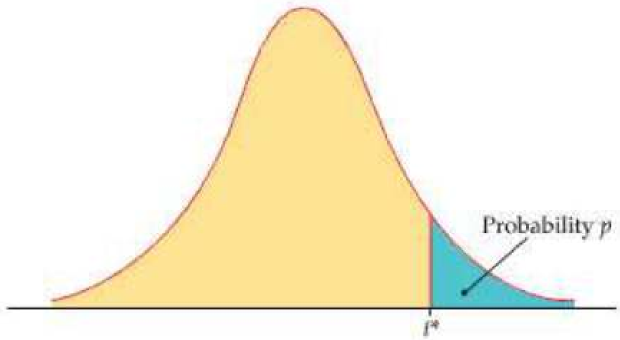


TABLE D

t distribution critical values

	Upper-tail probability p											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z^*	0.674	0.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level C											

33) P $\quad p$ = true <u>proportion</u> of seniors at Tonya's HS who plan to attend prom

A 1) Random sample used

2) Sampling distribution normal:

$$n\hat{p} = \cancel{50\left(\frac{36}{50}\right)} = 36 \geq 10$$

$$n(1-\hat{p}) = \cancel{50\left(\frac{14}{50}\right)} = 14 \geq 10$$

3) Total seniors $> 10(50) > 500$

I

$$\left.\begin{aligned} CI &= \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \\ CI &= .72 \pm 1.645 \sqrt{\frac{(.72)(.28)}{50}} \end{aligned}\right\} \text{1-Prop Z Interval}$$

$$CI = (.62, .82)$$

S I am 90% confident that the interval from .62 to .82 captures the true proportion of all seniors at Tonya's HS who plan to attend prom

34) P p = true proportion of undergrads at a large university who would report cheating

A 1) Random sample used

2) Sampling distribution normal

$$n\hat{p} = 172\left(\frac{19}{172}\right) = 19 \geq 10$$

$$n(1-\hat{p}) = 172\left(\frac{153}{172}\right) = 153 \geq 10$$

3) Large Univ > 10 (172) > 1720 students

I

$$\left.\begin{aligned} CI &= \hat{p} \pm z^{*}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \\ CI &= .11 \pm 2.576\sqrt{\frac{(.11)(.89)}{172}} \\ CI &= (.05, .17) \end{aligned}\right\} \text{1-Prop Z Int}$$

S I am 99% confident that the interval from .05 to .17 captures the true proportion of all undergrads at this large university who would report cheating

44 a) $CI = \hat{p} \pm \left[\boxed{z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}} \leq .03 \right]$

$$2.576\sqrt{\frac{(.44)(.56)}{n}} \leq .03$$

$$\frac{1.2786}{\sqrt{n}} \leq \frac{.03}{1}$$

$$1.2786 \leq .03\sqrt{n}$$

$$1817 \leq n$$

b) $$\underline{2.576}\sqrt{\frac{(.50)(.50)}{n}} \leq .03$$

$$\frac{1.288}{\sqrt{n}} \leq \frac{.03}{1}$$

$$1.288 \leq .03\sqrt{n}$$

$$1844 \leq n$$

$\downarrow$

conservative approach
requires 27 more adults

45) $CI = \hat{p} \pm \left[Z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \leq .03 \right]$

$$1.96\sqrt{\frac{(.50)(.50)}{n}} \leq .03$$

$$\frac{.98}{\sqrt{n}} \leq \frac{.03}{1}$$

$$.98 \leq .03\sqrt{n}$$

$$1068 \leq n$$

AP/ACP STATISTICS

(Section 8.2)

Name ______________________________

A simple random sample of 1100 males aged 12 to 17 in the United States were asked whether they played massive multiplayer online role-playing games (MMORPGs); 775 said that they did. We want to use this information to construct a 95% confidence interval to estimate the proportion of all U.S. males aged 12 to 17 who play MMORPGs.

(a) State the parameter our confidence interval will estimate.

p = proportion of all US males (12-17) who play MMORPGs

(b) Identify each of the conditions that must be met to use this procedure, and explain how you know that each one has been satisfied.

1) Random Sample Used

2) Normal Sampling Distribution:

$n\hat{p} \geq 10$ $\quad n(1-\hat{p}) \geq 10$

$1100\left(775/1100\right) \geq 10$ $\quad 1100\left(\frac{325}{1100}\right) \geq 10$

$775 \geq 10$ ✓ $\quad 325 \geq 10$ ✓

3) Independent

Number US males (12-17) > 10 (1100) > 11,000 ✓

(c) Find the appropriate critical value and the standard error of the sample proportion.

Critical value (95% CI) = $\boxed{1.960}$

Standard Error $= \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{(.7045)(.2954)}{1100}} = \boxed{.0137}$

(d) Give the 95% confidence interval.

$95\%\ CI = \hat{p} \pm z^{*}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$= .7045 \pm (1.960)(.0137)$

$= (.68, .73)$

1-Prop Z Int

(e) Interpret the confidence interval constructed in part (d) in the context of the problem.

I am 95% confident that the interval from .68 to .73 captures the true proportion of all US males (12-17) who play MMORPGs

(f) Suppose you wanted to estimate the proportion of 12-to-17 year-old males who play MMORPG's with 95% confidence to within ± 2%. Calculate how large a sample you would need.

$MOE \le .02$

$\frac{1.96}{1}\sqrt{\frac{(.50)(.50)}{n}} \le .02$

$\frac{1.96(.50)}{\sqrt{n}} \le \frac{.02}{1}$

$.98 \le .02\sqrt{n}$

$49 \le \sqrt{n}$

$2401 \le n$

(g) If you wanted to have a margin of error of ±2% with 99% confidence, would your sample have to be larger, smaller, or the same size as the sample in part (f)? Explain.

Being more confident would require a larger sample size

99% CI → $n \ge 4148$

(h) This poll was conducted through email. Explain how undercoverage could lead to a biased estimate in this case, and speculate about the direction of the bias.

- Those who seldom or never go online would not respond to the poll
- Sample probably over-estimates the proportion who play MMORPGS (the true proportion is probably less than 70%)

56) $CI = \bar{X} \pm \left[z^* \frac{\sigma}{\sqrt{n}} \le 2 \right]$

$$1.96 \frac{50}{\sqrt{n}} \le 2$$

$$\frac{98}{\sqrt{n}} \le \frac{2}{1}$$

$$98 \le 2\sqrt{n}$$

$$2401 \le n$$

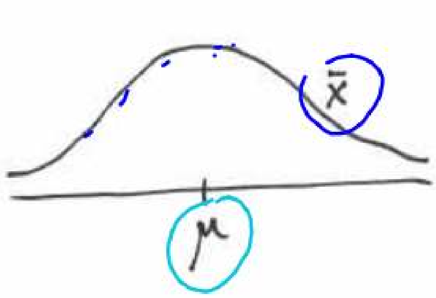
57) a) $t(9) = 2.262$ b) $t(19) = 2.861$

58) a) $t(11) = 1.796$ b) $t(29) = 2.045$

59) $SE = \boxed{\frac{9.3}{\sqrt{27}}} = \boxed{1.7898}$

↓

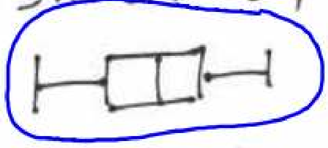
In repeated sampling, the average distance between sample means and the population mean will be about 1.7898 units



63) P μ = actual average fuel efficiency for this vehicle

A 1) Data comes from random sample

2) Since $n < 30$, check data:



> symmetric, no outliers

> npp roughly linear

3) Number records for mpg > 10 (20) > 200 ?

I $CI = \bar{x} \pm t^* \frac{s}{\sqrt{n}}$

$CI = 18.48 \pm \underline{2.093}\left(\frac{3.116}{\sqrt{20}}\right)$

$CI = (17.02, 19.94)$

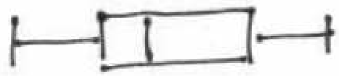
T Interval

S I am 95% confident that the interval from 17.02 mpg to 19.94 mpg captures the actual average miles per gallon for this car

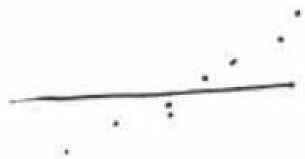
64) P μ = Mean amount of vitamin C in the CSB from this production run

A 1) Random sample used

2) Since $n < 30$, check data:



> Moderately skewed with no outliers



> npp linear

3) Production run > 10 (8) > 80 ?

I $CI = \bar{x} \pm t^* \frac{s}{\sqrt{n}}$

$CI = 22.5 \pm 2.365 \frac{7.19}{\sqrt{8}}$

$CI = (16.49, 28.51)$

T Interval

S I am 95% confident that the interval from 16.49 to 28.51 mg/100 captures the actual average amount of vitamin C in this production run

65) For $t(57)$ use $t(50) = 2.678$ in Table

(Using technology, $t(57) = 2.665$)

66) For $t(76)$ use $t(60) = 1.671$ in Table

(Using technology, $t(76) = 1.665$)

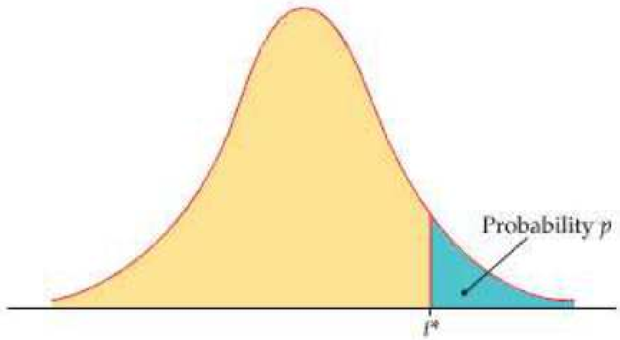


Table entry for p and C is the critical value t^* with probability p lying to its right and probability C lying between $-t^*$ and t^*.

TABLE D

t distribution critical values

	Upper-tail probability p											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z^*	0.674	0.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level C											

68a) P μ = average HAV angle for all patients with condition

A 1) Random sample used

2) Though $n < 30$, we are told there are no outliers or strong skewness

3) # Patients > 10 (21) > 210 ?

$\underline{I}$ $CI = \bar{x} \pm t^* \frac{s}{\sqrt{n}}$

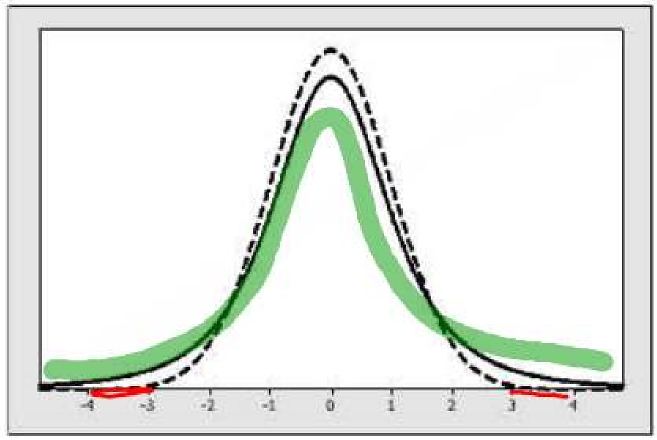
$$\left.\begin{aligned} CI &= 24.76 \pm 1.725 \frac{6.34}{\sqrt{21}} \\ CI &= (22.37, 27.15) \end{aligned}\right\} \text{T Interval}$$

S I am 90% confident that the interval from 22.37 to 27.15 degrees captures the true average HAV angle for all patients

b) Including the outlier would increase the mean and standard deviation; it would also make a T-interval inappropriate and inaccurate

Quiz 8.3A AP Statistics Name:

1. Below are the graphs of a standard Normal distribution and a t-distribution with 3 degrees of freedom.



See P. 505

(a) Indicated which graph is which and explain how you know.

Dotted graph = Stand Normal

Solid graph = T Distribution

↓

Less Peaked

More Tail Area

(b) On the same figure sketch a graph of a t-distribution with 1 degree of freedom.

2. Find the critical t^* value for each of the following confidence intervals:

(a) 95% confidence interval with 8 degrees of freedom.

$t^* = 2.306$

(b) 80% confidence interval when $n = 20$ $df = 19$

$t^* = 1.328$

3. You want to estimate the mean fuel efficiency of Ford Focus automobiles with 99% confidence and a margin of error of no more than 1 mile per gallon. Preliminary data suggests that $\sigma = 2.4$ miles per gallon is a reasonable estimate of the standard deviation for all cars of this make and model. How large a sample do you need?

$z^* \frac{\sigma}{\sqrt{n}} \leq 1$

$(2.57)\left(\frac{2.4}{\sqrt{n}}\right) \leq 1$

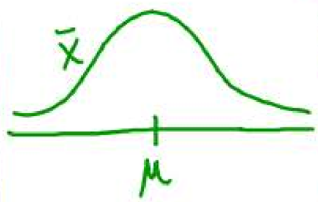
$n > 38.044 > 39$

4. National Fuelsaver Corporation manufactures the Platinum Gasaver, a device they claim "may increase gas mileage by 30%." Here are the percent changes in gas mileage for 15 identical, randomly-selected vehicles, as presented in one of the company's advertisements:

–2.4	6.9	10.4	10.8	24.8
28.7	28.7	33.7	34.6	38.5
40.2	44.6	46.8	46.9	48.3

(a) The sample mean is $\bar{x} = 29.43$ and the sample standard deviation is $s = 16.23$. Calculate and interpret the standard error of the mean for these data.

$$SE = \frac{s}{\sqrt{n}} = \frac{16.23}{\sqrt{15}} = 4.19$$



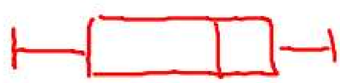
The average distance between a sample mean and population mean is about 4.19

(b) Construct and interpret a 90% confidence interval to estimate the mean change (in percent) in gas mileage. Does the data support the company's claim? Use the four-step process.

P) M = actual mean percentage change in gas mileage when Platinum Gasaver is used

A) Random - vehicles selected randomly

·Normal - check...



Mod Boxplot shows no outliers; slightly skewed left but ok

Indpdt - N > 10(15) > 150 ✓

I) $CI = 29.43 \pm 1.761\left(\frac{16.23}{\sqrt{15}}\right) = (22.05, 36.81)$

S) We are 90% confident that the actual mean percent change is captured in the interval from 22.05% to 36.81%

