10 CHAPTER
Estimation: Single Samples

The chief purchaser for the State Education Commission is reviewing test data for a metal link chain which will be used on children's swing sets in elementary school playgrounds. The average breaking strength for a sample of 50 pieces of chain is 5000 pounds. Based on past experience, the breaking strength of metal chains is known to be normally distributed with a standard deviation of 100 pounds. Estimate the actual mean breaking strength of the metal link chain with 99% confidence.

C.L. 99%

$z = 2.575$

$\bar{x} = 5000$ $\sigma = 100$

$n = 50$

$$\bar{x} \pm z\left(\frac{\sigma}{\sqrt{n}}\right)$$

4963.584001

5036.415999

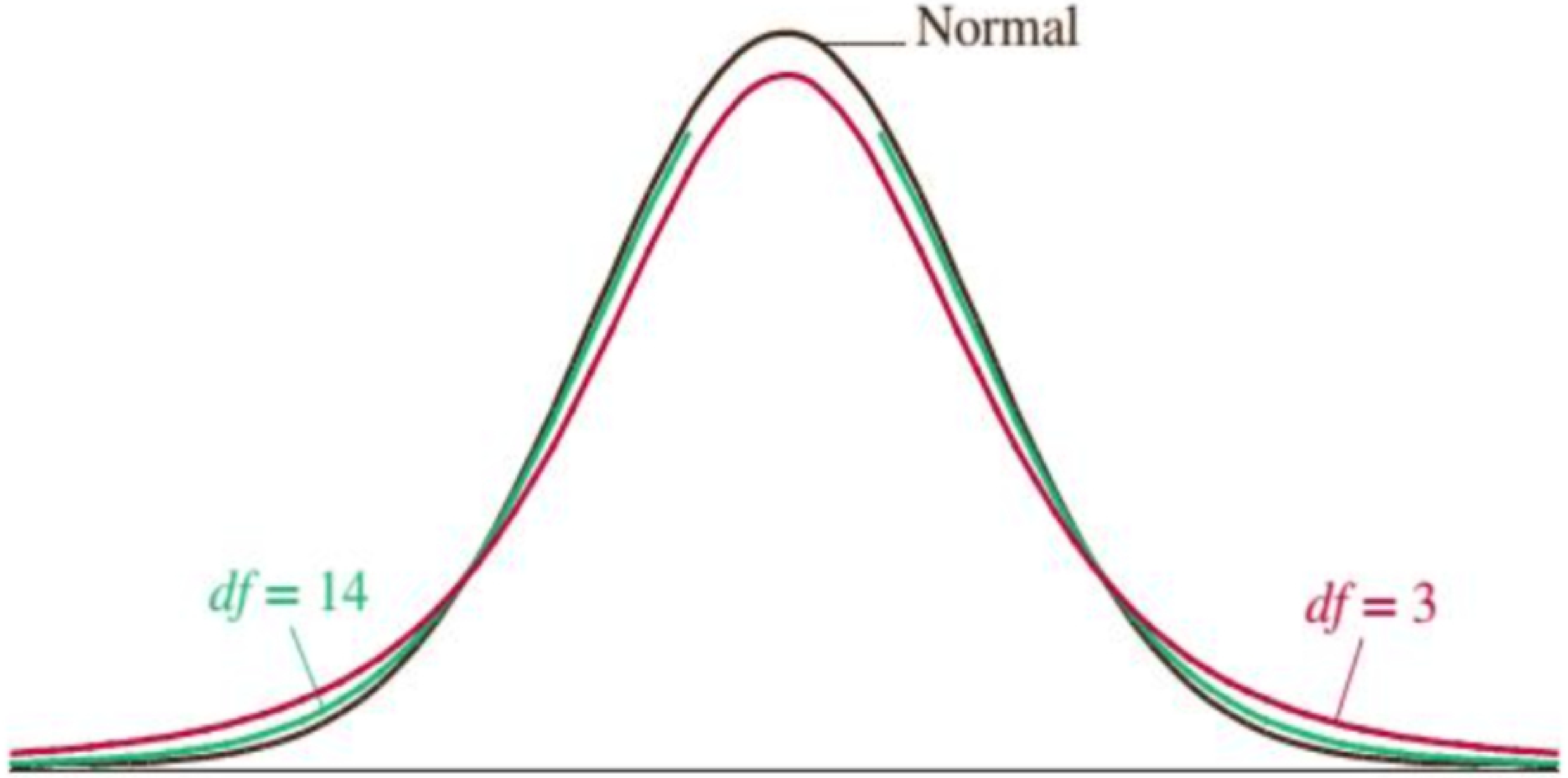

Figure 10.2.5

A manufacturing company is interested in the amount of time it takes to complete a certain stage of the production process. The project manager randomly samples 10 products as they come from the production line and notes the time of completion. The average completion time is 23.45 minutes with a sample standard deviation of 4.32 minutes. Based on this sample, construct a 95% confidence interval for the average completion time for that stage in the production process. Assume that the population distribution of the completion times is approximately normal.

$\bar{x} = 23.45$

$n = 10$

$s = 4.32$

$CL = 95\%$

$t = 2.262$

20.35987287

26.54012713

two-tails
df
1
2
3
4
5
6
7
8
9
10

→ Degrees of freedom

df $n-1$

~~cum. prob~~	~~$t_{.50}$~~	~~$t_{.75}$~~	~~$t_{.80}$~~	~~$t_{.85}$~~	~~$t_{.90}$~~	~~$t_{.95}$~~	~~$t_{.975}$~~	~~$t_{.99}$~~	~~$t_{.995}$~~
~~one-tail~~	~~**0.50**~~	~~**0.25**~~	~~**0.20**~~	~~**0.15**~~	~~**0.10**~~	~~**0.05**~~	~~**0.025**~~	~~**0.01**~~	~~**0.005**~~
two-tails	**1.00**	**0.50**	**0.40**	**0.30**	**0.20**	**0.10**	**0.05**	**0.02**	**0.01**
df									
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355
9	0.000	0.703	0.883	1.100	1.383	1.833	$\boxed{2.262}$	2.821	3.250
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169

A hospital would like to determine the mean length of stay for its patients having abdominal surgery. A sample of 15 patients revealed a sample mean of 6.4 days and a sample standard deviation of 1.4 days.

a. Find a 95% confidence interval for the mean length of stay for patients with abdominal surgery.

$\bar{x} = 6.4$ $s = 1.4$ $n = 15$ CL 95%

$t = 2.145$

The State Bureau of Standards must inspect gasoline station pumps on a regular basis to be sure they are operating properly. A recent survey of a randomly selected group of 61 pumps produced a sample mean of 9.75 gallons dispensed for a pump reading ten gallons. If the sample had a standard deviation of 1.12 gallons, find the 80% confidence interval for the mean amount of gas dispensed when a gas pump reads ten gallons.

$n = 61$ $\bar{x} = 9.75$ $s = 1.12$ $CL = 80\%$

$t = 1.296$

9.564151908

9.935848092

Direct Shoes has 250 retail outlets throughout the United States. The firm is evaluating a potential location for a new outlet, based in part, on the mean annual income of the individuals in the marketing area of the new location. A random sample of size 36 was taken from the marketing area; the sample mean income is \$31,100. The population standard deviation is estimated to be \$4500. Construct a confidence interval using a confidence level of 0.95.

$\bar{x} = 31,100$ $n = 36$ $\sigma = 4500$ $CL = 95\%$

$z = 1.96$

29 630

32 570

Voting, Inc. specializes in voter polls and surveys designed to keep political office seekers informed of their position in a race. Using telephone surveys, interviewers ask registered voters who they would vote for if the election were held that day. In a current election campaign, Voting, Inc. has found that 220 registered voters, out of 500 contacted, favor a particular candidate. Find a 95% confidence interval estimate for the proportion of the population of registered voters that favor the candidate.

$$\hat{p} = \frac{220}{500} = 0.44$$

$$\sigma = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{.44(1-.44)}{500}}$$

$$= 0.0222$$

$CL = 95\%$

$n = 500$

$z = 1.96$

0.396488

0.483512

According to the National Funeral Directors Association, the nation's 19,000 funeral homes take in $13 billion a year, with the average cost of a funeral being $7181 in 2014. Suppose that the costs of ten random funerals taking place in an affluent suburb of a Pennsylvania city are given below:

$8206	$5819	$10,225	$6450	$8575
$5450	$7335	$9775	$10,455	$8225

7017.673277

9085.326723

a. Construct a 90% confidence interval for the average funeral this suburb.

$\bar{x} = 8051.5$ $s = 1783.55$ $n = 10$

$t = 1.833$

Standard Deviation, s: **1783.549036799**

Count, N: 10
Sum, Σx: 80515
Mean, x̄: 8051.5
Variance, s^2: 3181047.1666667