One of the PowerPoint slides is included here for your convenience. Chapter 18 pages 440–441 Example 18.3 of the textbook covers the same example and also demonstrates the four–step process (State, Formulate, Solve, Conclude).

Sweetening colas (*continued*)

Is there evidence that storage results in sweetness loss for the new cola recipe at the 0.05 level of significance (α = 5%)?

H_0: $\mu = 0$ versus H_a: $\mu > 0$ (one-sided test)

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{1.02 - 0}{1.196/\sqrt{10}} = 2.70$$

$$df = n - 1 = 9$$

- the critical value t_α = 1.833
  $t > t_\alpha$ thus the result is significant.
- 2.398< t = 2.70 < 2.821, thus 0.02 > p > 0.01
  $p < \alpha$, thus the result is significant.

Taster	Sweetness loss
1	2.0
2	0.4
3	0.7
4	2.0
5	-0.4
6	2.2
7	-1.3
8	1.2
9	1.1
10	2.3
Average	1.02
Standard deviation	1.196

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
One-sided P	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
Two-sided P	.50	.40	.30	.20	.10	.05	.04	.02	.01	.005	.002	.001

The t-test has a significant p-value. We reject H_0.

There is a significant loss of sweetness, on average, following storage.

Row for degrees of freedom df = 9 and columns for 96% and 98% from Table C.

For convenience TABLE C is the very last page in the book, as well as being found on page 687 (Table A is on page 684). So if you are needing to look up t distribution critical values, just flip open the back cover of the Moore textbook.

	A	B
1	New Sweetness Loss	Books sweeting colas data
2	1	2
3	0.4	0.4
4	0.7	0.7
5	1	2
6	-0.4	-0.4
7	1.1	2.2
8	-0.6	-1.3
9	1.2	1.2
10	1.1	1.1
11	1.2	2.3
12		
13	mean (x-bar)	
14	0.67	1.02
15	sample standard deviation	
16	0.665081449	1.196104789
17		
18	t score	
19	3.185664006	2.69668949
20		
21	p-value	
22	0.011083479	0.024526312
23	0.005541739	0.012263156
24		
25		

mean (x-bar)	
=AVERAGE(A2:A11)	=AVERAGE(B2:B11)
sample standard deviation	
=STDEV.S(A2:A11)	=STDEV.S(B2:B11)
t score	
=(A14-0)/(A16/SQRT(10))	=(B14-0)/(B16/SQRT(10))
p-value	
=T.DIST.2T(A19,9)	=T.DIST.2T(B19,9)
=T.DIST.RT(A19,9)	=T.DIST.RT(B19,9)

This shows how Excel 2010 works, including the Functions and Formulas. Some of them are different from the book, which is covering an older version of Microsoft Excel.

See Example 18.3 Sweetening Colas (Pages 440–441 of textbook and your PowerPoint slides handout for Chapter 18).

Column B above here from the Excel spreadsheet is the same data that you see on page 440 in Example 18.3. Column A is different data where some of the larger numbers (all the numbers 2.0 or greater) were made smaller and the smallest number (-1.3) was made less negative, i.e. was made larger.

Note that the Numerator is row 19 formula is A14 – 0 or B14 – 0. On the following page we will be needing to compare the data to 100 to see if the mean is different from 100. So it would be A14 – 100 for those problems, i.e. whatever X–bar is minus 100.

D	E	F
More data s=3	More data s=2.5	Data s=2.2
97.23	101.31	99.94
100.06	99.90	101.77
97.61	102.33	101.09
102.00	102.38	100.88
105.95	95.32	103.61
102.70	101.26	94.26
98.10	104.79	101.18
99.85	100.60	98.74
99.91	100.91	101.13
101.72	100.28	101.58

The null hypothesis is that the mean is = 100.

The alternative hypothesis is that the mean is > 100.

1. Calculate X–bar and s for each sample.
2. Calculate the margin of error for each sample.
3. Calculate the t-score for each sample.
4. Using Table C, look up the p-value and give a range for the p-value.
5. Calculate the z-score for each sample as you assume that sigma is known and is as stated in the column heading (sigma is 3, or 2.5, or 2.2).
6. How do the z-scores compare to the t-scores?
7. Using Table A, look up the p-value for each group.
8. What do you conclude using t score approach with alpha = 0.05?
9. What do you conclude using z-score approach with alpha = 0.05?

Part of the solution to questions 1–9 is shown below here. See columns D, E and F of the Excel spreadsheet.
We will finish going over this in–class exercise on Friday and review the calculator techniques.

A	B	C	D	E	F
New Sweetness Loss	**Books sweeting colas data**	**New data for mean = 100**	**More data s=3**	**More data s=2.5**	**Data s=2.2**
1	2	98.462869	97.23	101.31	99.94
0.4	0.4	101.228692	100.06	99.90	101.77
0.7	0.7	100.549389	97.61	102.33	101.09
1	2	101.560408	102.00	102.38	100.88
-0.4	-0.4	105.306166	105.95	95.32	103.61
1.1	2.2	100.328238	102.70	101.26	94.26
-0.6	-1.3	103.917332	98.10	104.79	101.18
1.2	1.2	103.883608	99.85	100.60	98.74
1.1	1.1	104.973728	99.91	100.91	101.13
1.2	2.3	105.147842	101.72	100.28	101.58
mean (x-bar)					
0.67	1.02	102.535827	100.513722	100.9090426	100.418549
sample standard deviation					
0.665081449	1.196104789	2.40910874	2.66789586	2.409969901	2.49617635
t score					
3.185664006	2.69668949	3.32861247	0.60891874	1.192813659	0.53023805
p-value					
0.011083479	0.024526312	0.00881854	0.55763335	0.263439509	0.60877827
0.005541739	0.012263156	0.00440927	0.27881668	0.131719755	0.30438914

Homework due Friday, July 6th – <u>two problems from Chapter 18</u>:

Exercise 18.26 Alcohol in wine. (See page 452)

Exercise 18.28 Learning Blissymbols. (See page 453)