

**7.4.22.** In athletic contests, a wide-spread conviction exists that the home team has an advantage. However, one explanation for this is that a team schedules some much weaker opponents to play at home. To avoid this bias, a study of college football games considered only games

between teams ranked in the top twenty-five. For three hundred seventeen such games, the margin of victory ( $y =$  home team score–visitors score) was recorded. For these data,  $\bar{y} = 4.57$  and  $s = 18.29$ . Does this study confirm the existence of a home field advantage? Test  $H_0 : \mu = 0$  versus  $H_1 : \mu > 0$  at the 0.05 level of significance.

**9.2.1.** Some states that operate a lottery believe that restricting the use of lottery profits to supporting education makes the lottery more profitable. Other states permit general use of the lottery income. The profitability of the lottery for a group of states in each category is given below.

<i>State Lottery Profits</i>			
For Education		For General Use	
State	% Profit	State	% Profit
New Mexico	24	Massachusetts	21
Idaho	25	Maine	22
Kentucky	28	Iowa	24
South Carolina	28	Colorado	27
Georgia	28	Indiana	27
Missouri	29	Dist. Columbia	28
Ohio	29	Connecticut	29
Tennessee	31	Pennsylvania	32
Florida	31	Maryland	32
California	35		
North Carolina	35		
New Jersey	35		

*Data from: New York Times, National Section, October 7, 2007, p. 14.*

Test at the  $\alpha = 0.01$  level whether the mean profit of states using the lottery for education is higher than that of states permitting general use. Assume that the variances of the two random variables are equal.

**9.2.17.** A person exposed to an infectious agent, either by contact or by vaccination, normally develops antibodies to that agent. Presumably, the severity of an infection is related to the number of antibodies produced. The degree of antibody response is indicated by saying that the person's blood serum has a certain *titer*, with higher titers indicating greater concentrations of antibodies. The following table gives the titers of twenty-two persons involved in a tularemia epidemic in Vermont (21). Eleven were quite ill; the other eleven were asymptomatic. Use Theorem 9.2.3 to test  $H_0: \mu_X = \mu_Y$  against a one-sided  $H_1$  at the 0.05 level of significance.

The sample standard deviations for the "Severely Ill" and "Asymptomatic" groups are 428 and 183, respectively.

Severely Ill		Asymptomatic	
Subject	Titer	Subject	Titer
1	640	12	10
2	80	13	320
3	1280	14	320
4	160	15	320
5	640	16	320
6	640	17	80
7	1280	18	160
8	640	19	10
9	160	20	640
10	320	21	160
11	160	22	320

**7.5.10.** How much interest certificates of deposit (CDs) pay varies by financial institution and also by length of the investment. A large sample of national one-year CD offerings in 2009 showed an average interest rate of 1.84 and a standard deviation  $\sigma = 0.262$ . A five-year CD ties up an investor's money, so it usually pays a higher rate of interest. However, higher rates might cause more variability. The table lists the five-year CD rate offerings from  $n = 10$  banks in the northeast United States. Find a 95% confidence interval for the standard deviation of five-year CD rates. Do these data suggest that interest rates for five-year CDs are more variable than those for one-year certificates?

Bank	Interest Rate (%)
Domestic Bank	2.21
Stonebridge Bank	2.47
Waterfield Bank	2.81
NOVA Bank	2.81
American Bank	2.96
Metropolitan National Bank	3.00
AIG Bank	3.35
iGObanking.com	3.44
Discover Bank	3.44
Interinvest National Bank	3.49

*Data from:* Company reports.

**10.3.4.** Show that the common belief in the propensity of babies to choose an inconvenient hour for birth has a basis in observation. A maternity hospital reported that out of one year's total of 2650 births, some 494 occurred between midnight and 4 A.M. (179). Use the goodness-of-fit test to show that the data are not what we would expect if births are assumed to occur uniformly in all time periods. Let  $\alpha = 0.05$ .

**10.5.1.** While there are a number of diet and physical causes of childhood obesity, there could also be an economic element. Use the table below to test if childhood obesity is related to family income. Use  $\alpha = 0.10$ .

		Obese	
		Yes	No
Family Income	Low	121	501
	Middle-Upper	54	324