Comparing Two Populations

1) Suppose you own a plumbing repair business and employ 15 plumbers. You are interested in estimating the difference in the average number of calls completed per day between two of the plumbers. A random sample of 40 days of plumber A's work results in a sample average of 5.3 calls, with a population variance of 1.99. A random sample of 37 days of plumber B's work results in a sample mean of 6.5 calls, with a population variance of 2.36. Use this information and a 95% level of confidence to estimate the difference in population mean daily efforts between plumber A and plumber B. Interpret the results. Is it possible that, for these populations of days, the average number of calls completed between plumber A and plumber B do not differ?
2) The Bureau of Labor Statistics shows that the average insurance cost to a company per hour worked for an employee by major industry group is $3.22 for construction workers and $3.97 for manufacturing workers. Suppose these figures were obtained from 14 construction workers and 15 manufacturing workers and that their respective population standard deviations are $1.38 and $1.51. Assume that such insurance costs are normally distributed in the population.
    a. Calculate a 98% confidence interval to estimate the difference in the mean hourly company expenditures for insurance for these two groups. What is the value of the point estimate?
    b. Test to determine whether there is a significant difference in the hourly rates employers pay for insurance between construction workers and manufacturing workers. Use a 2% level of significance.
3) A company's auditor believes the per diem cost in Nashville, Tennessee, rose significantly between 2008 and 2019. To test this belief, the auditor samples 51 business trips from the company's records for 2008; the sample average was $212 per day, with a population standard deviation of $38.50. The auditor selects a second random sample of 47 business trips from the company's records for 2019; the sample average was $231 per day, with a population standard deviation of $35.60. If he uses a risk of committing a Type I error of .01, does the auditor find that the per diem average expense in Nashville has gone up significantly?
4) The Trade Show Bureau conducted a survey to determine why people go to trade shows. The respondents were asked to rate a series of reasons on a scale from 1 to 5, with 1 representing little importance and 5 representing great importance. One of the reasons suggested was general curiosity. The following responses for 50 people from the computer/electronics industry and 50 people from the food/beverage industry were recorded for general curiosity. Use these data and $\alpha = .01$ to determine whether there is a significant difference between people in these two industries on this question. Assume the variance for the computer/electronics population is 1.0188 and the variance for the food/beverage population is 0.9180 and the data are interval in level.

Computer/Electronics					Food/Beverage				
1	2	1	3	2	3	3	2	4	3
0	3	3	2	1	4	5	2	4	3
3	3	1	2	2	3	2	3	2	3
3	2	2	2	2	4	3	3	3	3
1	2	3	2	1	2	4	2	3	3
1	1	3	3	2	2	4	4	4	4
2	1	4	1	4	3	5	3	3	2
2	3	0	1	0	2	0	2	2	5
3	3	2	2	3	4	3	3	2	3
2	1	0	2	3	4	3	3	3	2

5) Based on an indication that mean daily car rental rates may be higher for Boston than for Dallas, a survey of eight car rental companies in Boston is taken and the sample mean car rental rate is $47, with a sample standard deviation of $3. Further, suppose a survey of nine car rental companies in Dallas results in a sample mean of $44 and a sample standard deviation of $3. Use $\alpha = .05$ to test to determine whether the average daily car rental rates in Boston are significantly higher than those in Dallas. Assume car rental rates are normally distributed and the population variances are equal.
6) What is the difference in average daily hotel room rates between Minneapolis and New Orleans? Suppose we want to estimate this difference by taking hotel rate samples from each city and using a 98% confidence level. The data for such a study follow. Use these data to produce a point estimate for the mean difference in the hotel rates for the two cities. Assume the population variances are approximately equal and hotel rates in any given city are normally distributed.

Minneapolis	New Orleans
$n_M = 20$	$n_{NO} = 22$
$\bar{x}_M = \$128$	$\bar{x}_{NO} = \$144$
$s_M = \$24$	$s_{NO} = \$29$

7) Some studies have shown that in the United States, men spend more than women buying gifts and cards on Valentine's Day. Suppose an analyst wants to test this hypothesis by randomly sampling 9 men and 10 women with comparable demographic characteristics from various large cities across the United States to be in a study. Each study participant is asked to keep a log beginning one month before Valentine's Day and record all purchases made for Valentine's Day during that one-month period. The resulting data are shown below. Use these data and a 1% level of significance to test to determine if, on average, men actually do spend significantly

more than women on Valentine's Day. Assume that such spending is normally distributed in the population and that the population variances are equal.

Men	Women
$107.48	$125.98
143.61	45.53
90.19	56.35
125.53	80.62
70.79	46.37
83.00	44.34
129.63	75.21
154.22	68.48
93.80	85.84
	126.11

8) A study was made to compare the costs of supporting a family of four Americans for a year in different foreign cities. The lifestyle of living in the United States on an annual income of $75,000 was the standard against which living in foreign cities was compared. A comparable living standard in Toronto and Mexico City was attained for about $64,000. Suppose an executive wants to determine whether there is any

Toronto	Mexico City
$69,000	$65,000
64,500	64,000
67,500	66,000
64,500	64,900
66,700	62,000
68,000	60,500
65,000	62,500
69,000	63,000
71,000	64,500
68,500	63,500
67,500	62,400

difference in the average annual cost of supporting her family of four in the manner to which they are accustomed between Toronto and Mexico City. She uses the following data, randomly gathered from 11 families in each city, and an alpha of .01 to test this

difference. She assumes the annual cost is normally distributed and the population variances are equal. What does the executive find?

9) The vice president of marketing brought to the attention of sales managers that most of the company's manufacturer representatives contacted clients and maintained client relationships in a disorganized, haphazard way. The sales managers brought the reps in for a three-day seminar and training session on how to use an organizer to schedule visits and recall pertinent information about each client more effectively. Sales reps were taught how to schedule visits most efficiently to maximize their efforts. Sales managers were given data on the number of site visits by sales reps on a randomly selected day both before and after the seminar. Use the following data to test whether significantly more site visits were made after the seminar ($\alpha = .05$). Assume the differences in the number of site visits are normally distributed.

Rep	Before	After
1	2	4
2	4	5
3	1	3
4	3	3
5	4	3
6	2	5
7	2	6
8	3	4
9	1	5

10) Lawrence and Glover published the results of a study in the *Journal of Managerial Issues* in which they examined the effects of accounting firm mergers on auditing delay. Auditing delay is the time between a company's fiscal year-end and the date of the auditor's report. The hypothesis is that with the efficiencies gained through mergers the length of the audit delay would decrease. Suppose that to test their hypothesis, they examined the audit delays on 27 clients of Big Six firms from both before and after the Big Six firm merger (a span of five years). Suppose further that the mean difference in audit delay for these clients from before merger to after merger was a decrease in 3.71 days and the standard deviation of difference was five days. Use these data and $\alpha = .01$ to test whether the audit delays after the merger were significantly lower than before the merger. Assume that the differences in auditing delay are normally distributed in the population.
11) How long are resale houses on the market? One survey by the Houston Association of Realtors reported that in Houston, resale houses are on the market an average of 112 days. Of course, the length of time varies by market. Suppose random samples of 13 houses in Houston and 11 houses in Chicago that are for resale are traced. The data

shown here represent the number of days each house was on the market before being sold. Use the given data and a 1% level of significance to determine whether the population variances for the number of days until resale are different in Houston than in Chicago. Assume the numbers of days resale houses are on the market are normally distributed.

Houston		Chicago	
132	126	118	56
138	94	85	69
131	161	113	67
127	133	81	54
99	119	94	137
126	88	93	
134			