

**Text Exercise Set 24**

**NAME:**

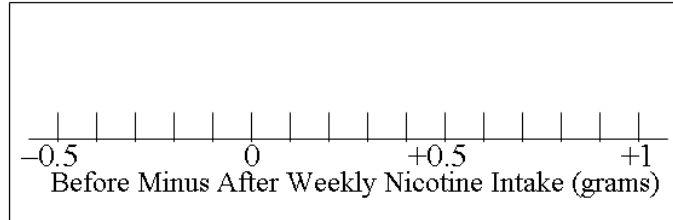
**24-1** A study is conducted to see if there is any evidence that the mean weekly nicotine intake for smokers is smaller three weeks after participation in a series of seminars. A 0.05 significance level is chosen for a hypothesis test. The smokers who participated in the seminars are treated as a simple random sample. Weekly nicotine intake for each smoker who participated in the seminars is recorded in grams before and three weeks after participation with the following results:

Smoker	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	#11	#12
Before	1.6	1.9	2.4	3.2	2.7	1.7	2.8	1.6	2.0	3.0	2.6	2.3
After	1.3	2.0	2.2	2.4	3.0	1.9	1.8	0.9	2.0	2.5	3.1	1.7

(a) Obtain the differences resulting from subtracting the weekly nicotine intake after the seminars from the weekly nicotine intake before the seminars for each individual; then verify that the paired  $t$  test statistic is  $t_{11} = +1.813$ .

(b) Complete the four steps of the hypothesis test by completing the following:

Step 1  $H_0$ :  
 $H_1$ :  
 $\alpha =$



Step 2

Step 3

Step 4

(c) Complete the construction of the box plot above, and comment on whether the paired  $t$  statistic appears to be appropriate.

(d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.

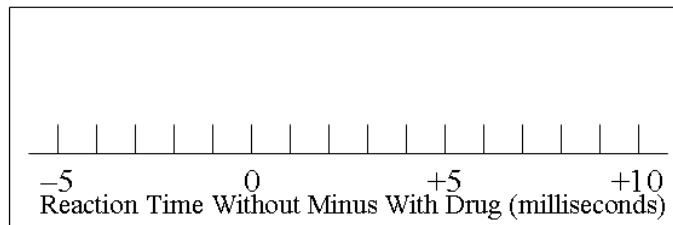
(e) Decide whether  $H_0$  would have been rejected or would not have been rejected with each of the following significance levels: (i)  $\alpha = 0.01$ , (ii)  $\alpha = 0.10$ .

**24-2** A study is conducted to see if there is any evidence that the mean reaction time of rats to a particular stimulus is faster when injected with a specific drug. A 0.10 significance level is chosen for a hypothesis test. The available rats are treated as a simple random sample. The reaction time is measured in milliseconds for each available rat, once with the drug and once without the drug in random order with the following results:

Rat	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10	#11	#12
No Drug	62	87	52	60	71	69	67	70	69	78	75	73
Drug	65	78	54	56	68	70	67	72	74	73	68	67

- (a) Obtain the differences resulting from subtracting the reaction time with the drug from the reaction time without the drug for each rat; then verify that the paired  $t$  test statistic is  $t_{11} = +1.349$ .
- (b) Complete the four steps of the hypothesis test by completing the following:

Step 1  $H_0$ :  
 $H_1$ :  
 $\alpha =$



Step 2

Step 3

Step 4

- (c) Complete the construction of the box plot above, and comment on whether the paired  $t$  statistic appears to be appropriate.
- (d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (e) Decide whether  $H_0$  would have been rejected or would not have been rejected with each of the following significance levels: (i)  $\alpha = 0.01$ , (ii)  $\alpha = 0.05$ .

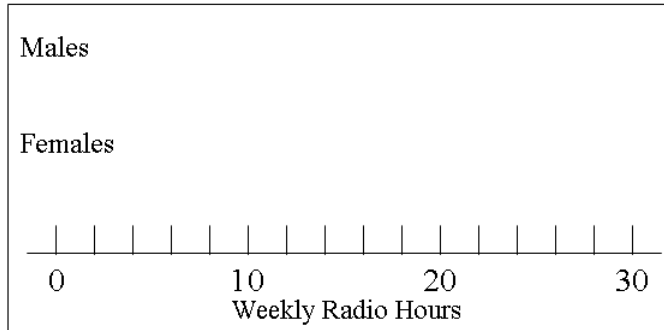
**24-3** A 0.05 significance level is chosen to see if there is any evidence of a difference between male and female voters in the mean time spent listening to the radio weekly in a state. The 15 males and 15 females selected for the SURVEY DATA, displayed as Data Set 1-1 at the end of Unit 1, are treated as two independent simple random samples. This data (in hours) is reproduced here as follows:

Males 15 20 15 18 30 10 11 12 20 4 14 15 23 15 24  
 Females 13 17 11 14 14 10 15 27 25 12 27 15 25 27 18

- (a) Verify that, when subtracting the mean for females from the mean for males, the separate two sample  $t$  test statistic is  $t_{28} = -0.687$ .
- (b) Complete the four steps of the hypothesis test by completing the following:

Step 1  $H_0$ :  
 $H_1$ :  
 $\alpha =$

Step 2



Step 3

Step 4

- (c) Complete the construction of the box plots above, and comment on whether the two sample  $t$  statistic appears to be appropriate.
- (d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (e) Decide whether  $H_0$  would have been rejected or would not have been rejected with each of the following significance levels: (i)  $\alpha = 0.01$ , (ii)  $\alpha = 0.10$ .

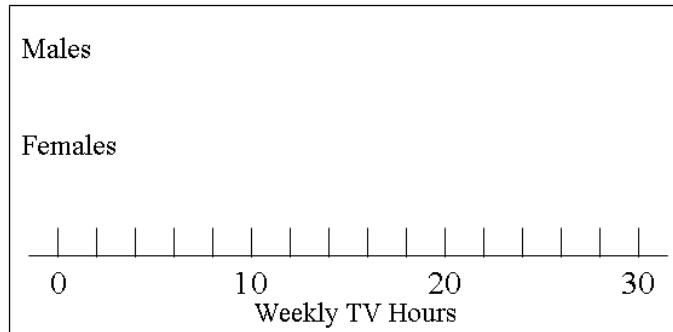
**24-4** A 0.05 significance level is chosen to see if there is any evidence of a difference between male and female voters in the mean time spent watching television weekly in a state. The 15 males and 15 females selected for the SURVEY DATA, displayed as Data Set 1-1 at the end of Unit 1, are treated as two independent simple random samples. This data is reproduced here as follows:

Males 15 12 14 11 12 21 18 17 8 27 14 15 10 13 9  
 Females 20 18 10 8 12 8 11 8 9 9 6 11 5 8 10

- (a) Verify that, when subtracting the mean for females from the mean for males, the separate two sample  $t$  test statistic is  $t_{27} = +2.558$ .
- (b) Complete the four steps of the hypothesis test by completing the following:

Step 1  $H_0$ :  
 $H_1$ :  
 $\alpha =$

Step 2



Step 3

Step 4

- (c) Complete the construction of the box plots above, and comment on whether the two sample  $t$  statistic appears to be appropriate.
- (d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (e) Decide whether  $H_0$  would have been rejected or would not have been rejected with each of the following significance levels: (i)  $\alpha = 0.01$ , (ii)  $\alpha = 0.10$ .

**24-5** A 0.10 significance level is chosen to see if there is any evidence that the mean yearly income per household is higher in Basin City than in Middletown. In a simple random sample of 13 households from Basin City, the mean is found to be 23.162 thousand dollars, and the standard deviation is 4.899 thousand dollars. In a simple random sample of 9 households from Middletown, the mean is found to be 19.209 thousand dollars, and the standard deviation is 4.359 thousand dollars.

- (a) Verify that, when subtracting the mean for Middletown from the mean for Basin City, the separate two sample  $t$  test statistic is  $t_{19} = +1.987$ .
- (b) Complete the four steps of the hypothesis test by completing the following:

Step 1  $H_0$ :  
 $H_1$ :  
 $\alpha =$

Step 2

Step 3

Step 4

- (c) What would the presence of one or more outliers in the data suggest about using the two sample  $t$  statistic?
- (d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (e) Decide whether  $H_0$  would have been rejected or would not have been rejected with each of the following significance levels: (i)  $\alpha = 0.01$ , (ii)  $\alpha = 0.05$ .

**24-6** A 0.01 significance level is chosen to see if there is any evidence that the mean score on an exam is higher when a new method to teach French is used than when the standard method to teach French is used. Two classes of the same French course are treated as two independent random samples, where one is taught with the new method, and the other is taught with the standard method. In the class taught with the new method, 50 students took the exam, and the mean and standard deviation of the exam scores were respectively 88.8 and 6.2. In the class taught with the standard method, 45 students took the exam, and the mean and standard deviation of the exam scores were respectively 85.2 and 5.6.

- (a) Verify that, when subtracting the mean for standard method from the mean for the new method, the separate two sample  $t$  test statistic is  $t_{93} = +2.974$ .
- (b) Complete the four steps of the hypothesis test by completing the following:

Step 1  $H_0$ :  
 $H_1$ :  
 $\alpha =$

Step 2

Step 3

Step 4

- (c) What would the presence of one or more outliers in the data suggest about using the two sample  $t$  statistic?
- (d) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (e) Decide whether  $H_0$  would have been rejected or would not have been rejected with each of the following significance levels: (i)  $\alpha = 0.05$ , (ii)  $\alpha = 0.10$ .

**24-7** Suppose the hypothesis test  $H_0: \mu_A - \mu_B = 0$  vs.  $H_1: \mu_A - \mu_B < 0$  is performed with  $\alpha = 0.05$ .

- (a) If you were told that  $\bar{x}_A = 8.9$  and  $\bar{x}_B = 11.1$ , explain why you do not have enough information to know whether or not  $H_0$  is rejected.
  
  
  
  
  
  
  
  
  
  
- (b) If you were told that  $\bar{x}_A = 11.1$  and  $\bar{x}_B = 8.9$ , explain why this is enough information to know that  $H_0$  will not be rejected.

**24-8** Suppose the hypothesis test  $H_0: \mu_Q - \mu_R = 0$  vs.  $H_1: \mu_Q - \mu_R > 0$  is performed with  $\alpha = 0.05$ .

- (a) If you were told that  $\bar{x}_Q = 0.77$  and  $\bar{x}_R = 0.32$ , explain why you do not have enough information to know whether or not  $H_0$  is rejected.
  
  
  
  
  
  
  
  
  
  
- (b) If you were told that  $\bar{x}_Q = 0.32$  and  $\bar{x}_R = 0.77$ , explain why this is enough information to know that  $H_0$  will not be rejected.

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