

**Text Exercise Set 29**

**NAME:**

**29-1** A cafeteria offers a choice of five flavors of ice cream: chocolate, vanilla, strawberry, peach, and banana. The manager of the cafeteria believes that these flavors are equally preferred by customers. In a random sample of 200 customers, 59 prefer chocolate, 48 prefer vanilla, 38 prefer strawberry, 27 prefer peach, and 28 prefer banana. A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence against this belief.

(a) Explain how the data for this hypothesis test is appropriate for a chi-square goodness-of-fit test.

(b) Complete the four steps of the hypothesis test below. You should find that  $\chi^2_4 = 18.550$ .

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

Step 2

Step 3

Step 4

**29-1 - continued**

- (c) If multiple comparison is necessary, apply Bonferroni's method and state the results; if multiple comparison is not necessary, explain why not.
- (d) Verify that the sample size is sufficiently large for the  $\chi^2$  statistic to be appropriate.
- (e) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (f) 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)  $\alpha = 0.10$ .
- (g) In the list below, circle the best graphical display for this data and say why.
- (i) a bar chart or pie chart      (ii) scatter plot      (iii) multiple box plots

**29-2** A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence that the following five opinion choices about a particular bill are not equally distributed among voters in the state: strongly opposed, somewhat opposed, neutral, somewhat favor, strongly favor. A random sample of 318 voters in a particular state are polled, and each voter in the sample is asked to choose which choice best reflects his/her opinion about the bill. In the random sample, 50 strongly oppose the bill, 71 somewhat oppose the bill, 65 are neutral, 71 somewhat favor the bill, and 61 strongly favor the bill.

(a) Explain how the data for this hypothesis test is appropriate for a chi-square goodness-of-fit test.

(b) Complete the four steps of the hypothesis test below. You should find that  $\chi^2_4 = 4.767$ .

Step 1  $H_0$ :

$H_1$ :

$\alpha =$

Step 2

Step 3

Step 4

**29-2** - *continued*

- (c) If multiple comparison is necessary, apply Bonferroni's method and state the results; if multiple comparison is not necessary, explain why not.
- (d) Verify that the sample size is sufficiently large for the  $\chi^2$  statistic to be appropriate.
- (e) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (f) 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)  $\alpha = 0.10$ .
- (g) In the list below, circle the best graphical display for this data and say why.
- (i) a bar chart or pie chart      (ii) scatter plot      (iii) multiple box plots

**29-3** Based on surveys done several years ago concerning consumer preferences for various brands of toothpaste, a salesman believes that 35% of all consumers prefer Whito, 30% prefer Nocav, 25% prefer Cheepo, and 10% prefer other brands. In a random sample of surveyed consumers, 323 prefer Whito, 219 prefer Nocav, 199 prefer Cheepo, and 89 prefer other brands. Construct an appropriate graphical display for the data used in this hypothesis test. A 0.01 significance level is chosen for a hypothesis test to see if there is any evidence against this belief.

(a) Explain how the data for this hypothesis test is appropriate for a chi-square goodness-of-fit test.

(b) Complete the four steps of the hypothesis test below. You should find that  $\chi^2_3 = 8.032$ .

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

Step 2

Step 3

Step 4

**29-3** - *continued*

- (c) If multiple comparison is necessary, apply Bonferroni's method and state the results; if multiple comparison is not necessary, explain why not.
- (d) Verify that the sample size is sufficiently large for the  $\chi^2$  statistic to be appropriate.
- (e) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (f) 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)  $\alpha = 0.10$ .
- (g) In the list below, circle the best graphical display for this data and say why.
- (i) a bar chart or pie chart      (ii) scatter plot      (iii) multiple box plots

**29-4** A satellite TV company is going to consider the addition of one or more of four channels: the Cartoon Channel, the Comedy Channel, the Western Channel, and the Science Fiction Channel. Based on past experience, it is believed that when asked to choose a preference from among these four channels, 20% of the customers prefer the Cartoon Channel, 10% of the customers prefer the Comedy Channel, 40% of the customers prefer the Science Fiction Channel, and 30% of the customers prefer the Western Channel. A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence that the stated percentages are not correct. The results from a poll of 400 randomly selected customers are organized into the contingency table displayed in Text Exercise 30-4. From the column totals of this contingency table, you should find that among the polled customers, 69 prefer the Cartoon Channel, 92 prefer the Comedy Channel, 113 prefer the Science Fiction Channel, and 126 prefer the Western Channel.

(a) Explain how the data for this hypothesis test is appropriate for a chi-square goodness-of-fit test.

(b) Complete the four steps of the hypothesis test below. You should find that  $\chi^2_3 = 83.219$ .

Step 1  $H_0$ :

$H_1$ :

$\alpha =$

Step 2

Step 3

Step 4

**29-4 - continued**

- (c) If multiple comparison is necessary, apply Bonferroni's method and state the results; if multiple comparison is not necessary, explain why not.
- (d) Verify that the sample size is sufficiently large for the  $\chi^2$  statistic to be appropriate.
- (e) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (f) 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)  $\alpha = 0.10$ .
- (g) In the list below, circle the best graphical display for this data and say why.
- (i) a bar chart or pie chart      (ii) scatter plot      (iii) multiple box plots

**29-5** The variables "High School GPA" and "Freshman Year College GPA" in the GPA DATA, displayed as Data Set 23-3 at the end of Unit 23, are being used to see if there is any evidence of a difference in mean high school GPA (grade point average) and mean college GPA among college bound high school graduates. A 0.01 significance level is chosen for a hypothesis test. GPAs from the GPA DATA are as follows:

High School	3.38	4.23	3.95	2.89	3.26	3.25	3.92	3.79	3.33	3.20	3.70	3.43
College	3.26	3.48	3.59	1.84	2.77	2.22	3.53	3.22	2.82	3.46	2.53	1.98
High School	3.38	3.40	3.12	2.71	2.92	3.66	2.63	2.87	3.72	3.18	2.83	3.35
College	2.70	3.48	2.59	2.04	2.58	2.90	2.50	2.46	2.44	2.61	2.82	3.23

- (a) Explain how the data for this hypothesis test is not appropriate for a chi-square goodness-of-fit test.
- (b) Decide whether the data for this hypothesis test is appropriate for a paired  $t$  test or for a two-sample  $t$  test, and explain your choice.
- (c) Obtain the differences resulting from subtracting college GPA from high school GPA for each student, and complete the four steps of the hypothesis test below. You should find that  $t_{23} = +6.129$ .

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

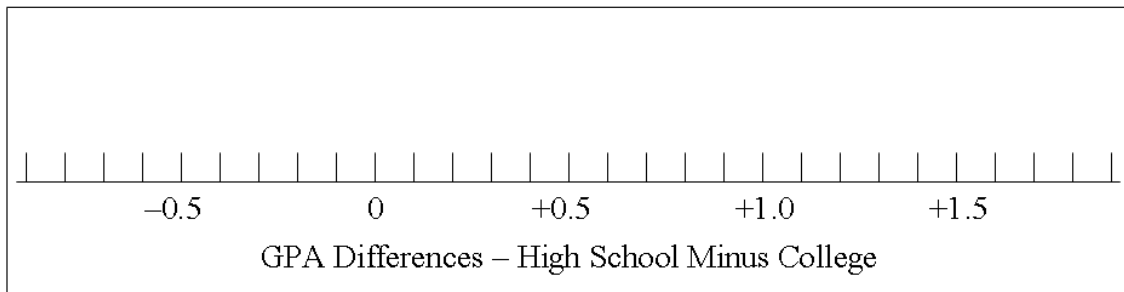
Step 2

Step 3

Step 4

29-5 - continued

- (d) Considering the results of the hypothesis test, explain why a confidence for the mean difference in high school and college grade point average would be of interest; then, verify that when subtracting college GPA from high school GPA,  $n = 24$ ,  $\bar{d} = 0.5438$ , and  $s_d = 0.43463$ , and find and interpret a 99% confidence interval for the mean difference.



- (e) Complete the construction of the box plot above, and comment on whether the paired  $t$  statistic appears to be appropriate.
- (f) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (g) 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)  $\alpha = 0.10$ .

**29-6** A particular company has chosen a 0.05 significance level to see if there is any evidence that the mean number of sales per salesperson tends to be higher in Bombsville than Slumsville. Several salespersons were each assigned to both cities for one week. The number of sales for each salesperson in each city was recorded as displayed in the table on the right.

<b>Sales in the Cities of Slumsville and Bombsville</b>		
<u>Salesperson</u>	<u>Slumsville</u>	<u>Bombsville</u>
JS	100	115
TK	150	135
EP	160	171
BC	95	95
ES	100	118
VW	95	87
ME	125	142
JH	115	129
EC	108	88
HH	131	137
KC	99	120
MG	120	132

- (a) Explain how the data for this hypothesis test is not appropriate for a chi-square goodness-of-fit test.
- (b) Decide whether the data for this hypothesis test is appropriate for a paired  $t$  test or for a two-sample  $t$  test, and explain your choice.
- (c) Obtain the differences resulting from subtracting Slumsville sales from Bombsville sales for each salesperson, and complete the four steps of the hypothesis test below. You should find that  $t_{11} = + 1.503$ .

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

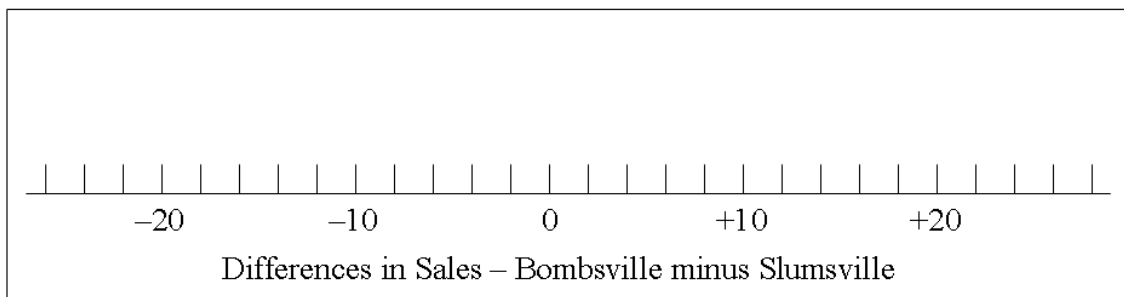
Step 2

Step 3

Step 4

29-6 - continued

- (d) Considering the results of the hypothesis test, explain why a confidence interval for the mean difference in number of sales between Bombsville and Slumsville sales would not be of interest.



- (e) Complete the construction of the box plot above, and comment on whether the paired  $t$  statistic appears to be appropriate.
- (f) Considering the results of the hypothesis test, decide which of the Type I or Type II errors is possible, and describe this error.
- (g) 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)  $\alpha = 0.10$ .