

Text Exercise Set 30

NAME:

30-1 A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence of a relationship between hair color and eye color. The data gathered on randomly selected individuals are displayed in the contingency table on the right.

<u>Hair Color</u>	<u>Eye Color</u>	
	<i>Light</i>	<i>Dark</i>
<i>Light</i>	25	38
<i>Dark</i>	60	30

- (a) Circle the labels of each correct way to complete the statement below.

Looking for evidence of a relationship between hair color and eye color is the same as looking for evidence of a

- (i) difference between light and dark.
 - (ii) relationship between light and dark.
 - (iii) difference in the proportion of light eyes and dark eyes.
 - (iv) difference in the proportion of light eyes and dark hair.
 - (v) difference in the proportion of light eyes between those with light hair and those with dark hair.
 - (vi) difference in the proportion of light hair between those with light eyes and those with dark eyes.
- (b) Explain how the data for this hypothesis test is appropriate for a chi-square test concerning independence.

- (c) Complete the four steps of the hypothesis test below. You should find that $\chi^2_1 = 10.929$.

Step 1 H_0 :

H_1 :

$\alpha =$

Step 2

Step 3

Step 4

30-1 - *continued*

- (d) Construct an appropriate graphical display. Then, describe the relationship which appears to exist, if necessary; if this is not necessary, say why not.
- (e) Verify that the sample size is sufficiently large for the χ^2 statistic 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) $\alpha = 0.10$.

Sex	Opinion About the Bill				
	<i>Strongly Oppose</i>	<i>Somewhat Oppose</i>	<i>Neutral</i>	<i>Somewhat Favor</i>	<i>Strongly Favor</i>
<i>Male</i>	7	37	41	35	23
<i>Female</i>	43	34	24	36	38

30-2 A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence of a difference in the distribution of opinions between male and female voters about a recent bill in a state congress. Randomly selected voters of each sex are polled about the bill; each voter is asked to choose strongly opposed, somewhat opposed, neutral, somewhat favor, or strongly favor. The above contingency table summarizes the data.

- (a) Circle the labels of each correct way to complete the statement below.
 Looking for evidence of a difference in the distribution of opinions about the bill between male and female voters is the same as looking for evidence of a
- (i) difference in the distribution of the sexes among the five opinions about the bill.
 - (ii) difference between sex of the voter and opinion about the bill.
 - (iii) relationship between sex of the voter and opinion about the bill.
 - (iv) relationship among the five opinions about the bill.
- (b) Explain how the data for this hypothesis test is appropriate for a chi-square test concerning independence.

(c) Complete the four steps of the hypothesis test below. You should find that $\chi^2_4 = 31.292$.

Step 1 H_0 :

H_1 :

$\alpha =$

Step 2

Step 3

Step 4

30-2 - continued

- (d) Construct an appropriate graphical display. Then, describe the relationship which appears to exist, if necessary; if this is not necessary, say why not.
- (e) Verify that the sample size is sufficiently large for the χ^2 statistic 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) $\alpha = 0.10$.

<u>Sex</u>	<u>Type of Major</u>			
	<i>Mathematical Sciences</i>	<i>Natural Sciences</i>	<i>Social Sciences</i>	<i>Other</i>
<i>Male</i>	181	185	27	7
<i>Female</i>	143	136	92	29

30-3 A 0.05 significance level is chosen for a hypothesis test to see if there is any evidence of a relationship between the sex of the student and type of major selected. Randomly selected college students of each sex are surveyed, and the above contingency table summarizes the data.

- (a) Circle the labels of each correct way to complete the statement below.
 Looking for evidence of a relationship between the sex of the student and type of major selected is the same as looking for evidence of a
- (i) difference in the distribution of the sexes among the four major choices.
 - (ii) difference between sex of the student and choice of major.
 - (iii) relationship among the four choices of major.
 - (iv) difference in the distribution of choice of major between males and females.
- (b) Explain how the data for this hypothesis test is appropriate for a chi-square test concerning independence.

(c) Complete the four steps of the hypothesis test below. You should find that $\chi^2_3 = 60.885$.

Step 1 H_0 :
 H_1 :
 $\alpha =$

Step 2

Step 3

Step 4

30-3 - *continued*

(d) Construct an appropriate graphical display. Then, describe the relationship which appears to exist, if necessary; if this is not necessary, say why not.

(e) Verify that the sample size is sufficiently large for the χ^2 statistic 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) $\alpha = 0.10$.

30-4 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

Residence	Favorite Channel			
	<i>Cartoon</i>	<i>Comedy</i>	<i>Sci Fi</i>	<i>Western</i>
<i>Rural</i>	28	7	17	53
<i>Suburban</i>	22	34	36	46
<i>Urban</i>	19	51	60	27

Channel, and the Science Fiction Channel. A 0.05 significance level is chosen for a hypothesis test is to see if there is any evidence that the distribution of favorite channel choices is not the same in the rural, suburban, and urban areas. The results from a poll of 400 randomly selected customers are organized into the contingency table displayed above.

- (a) Circle the labels of each correct way to complete the statement below.
 Looking for evidence that the distribution of favorite channel is not the same in the rural, suburban, and urban areas is the same as looking for evidence of a
- (i) difference in the distribution of the three areas of residence among the favorite channel choices.
 - (ii) relationship among the favorite channel choices.
 - (iii) difference between area of residence and favored channel choice.
 - (iv) relationship between area of residence and favored channel choice.
- (b) Explain how the data for this hypothesis test is appropriate for a chi-square test concerning independence.

- (c) Complete the four steps of the hypothesis test below. You should find that $\chi^2_6 = 59.927$.

Step 1 H_0 :

H_1 :

$\alpha =$

Step 2

Step 3

Step 4

30-4 - continued

- (d) Construct an appropriate graphical display. Then, describe the relationship which appears to exist, if necessary; if this is not necessary, say why not.
- (e) Verify that the sample size is sufficiently large for the χ^2 statistic 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) $\alpha = 0.10$.

30-5 A 0.05 significance level is chosen for a hypothesis test to see if the mean length of ball bearings produced by the Nuketown factory is larger than for those produced by the Highville factory. A simple random sample of ball bearings produced by each of the two factories resulted in the following data (in inches):

Nuketown 1.28 1.33 1.45 1.40 1.49 1.41 1.39 1.21

Highville 1.39 1.24 1.19 1.16 1.25 1.22 1.28 1.31 1.55 1.34 1.37

(a) 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.

(b) Using the difference resulting from subtracting the mean for Highville from the mean for Nuketown, complete the four steps of the hypothesis test below. You should find that the separate two sample t test statistic is $t_{17} = +1.506$.

Step 1 H_0 :

H_1 :

$\alpha =$

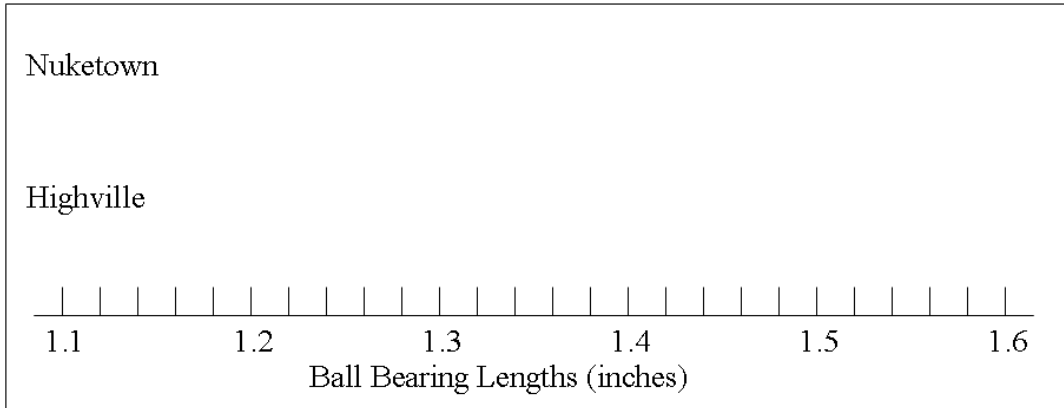
Step 2

Step 3

Step 4

(c) Considering the results of the hypothesis test, explain why a confidence interval for the difference in mean length of ball bearings produced by the Nuketown and Highville factories would not be of interest.

30-5 - continued



- (d) Complete the construction of the box plots above, and comment on whether the two sample t statistic appears 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) $\alpha = 0.10$.

30-6 A 0.10 significance level is chosen for a hypothesis test to see if there is any evidence of a difference in mean yield, measured in bushels per acre, between two varieties of corn, labeled V and W. Yields in bushels per acre are recorded for each of several plots where variety V corn was grown and each of several plots where variety W corn was grown with the following results:

Variety V	64.4	80.7	73.5	83.5	76.7	73.0
Variety W	74.5	90.6	88.7	80.9	84.8	

- (a) 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.
- (b) Using the difference resulting from subtracting the mean for variety V from the mean for variety W, complete the four steps of the hypothesis test below. You should find that the separate two sample t test statistic is $t_9 = -2.162$.

Step 1 H_0 :
 H_1 :
 $\alpha =$

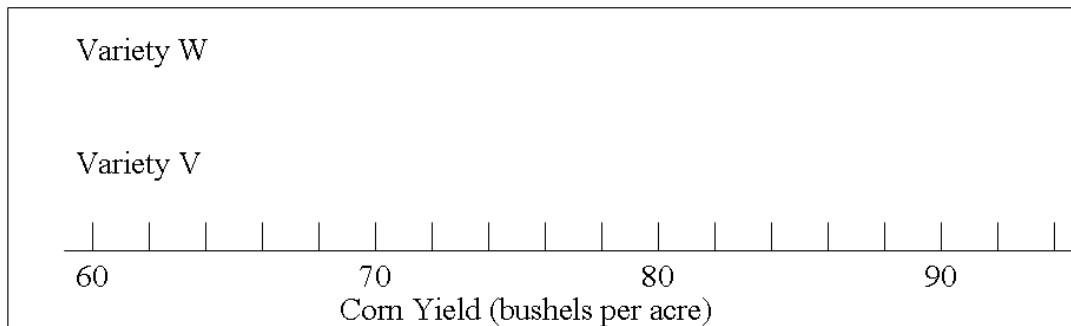
Step 2

Step 3

Step 4

30-6 - continued

- (c) Considering the results of the hypothesis test, explain why a confidence interval for the difference in mean yield between the two varieties of corn V and W would be of interest; then, verify that $n_W = 6$, $\bar{x}_W = 75.3$, $s_N = 6.719$, $n_V = 5$, $\bar{x}_V = 83.9$, and $s_H = 6.444$, and find a 90% confidence interval for the difference between in mean yield; use the confidence interval based on the separate t statistic.



- (d) Complete the construction of the box plots above, and comment on whether the two sample t statistic appears 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) $\alpha = 0.05$.

30-7 A hypothesis test is to be performed to see if there is any evidence that the four political party categories Republican, Democrat, Independent, and Other, are not equally likely among voters in a state.

(a) Explain how the data for this hypothesis test is not appropriate for a chi-square test concerning independence.

(b) What type of hypothesis test should be considered, and why?

(c) How large must the size of a random sample be so that the hypothesis test in part (b) will be appropriate?

30-8 The customers who buy apples at a supermarket have a choice of Red Delicious Apples, Green Apples, and Red Supreme Apples. A hypothesis test is to be performed to see if there is any evidence that the different types of apples are not equally preferred.

(a) Explain how the data for this hypothesis test is not appropriate for a chi-square test concerning independence.

(b) What type of hypothesis test should be considered, and why?

(c) How large must the size of a random sample be so that the hypothesis test in part (b) will be appropriate?

[This page is intentionally left blank]