

## *Mind on Statistics*

### Chapter 4

#### Sections 4.1

**Questions 1 to 4:** The table below shows the counts by gender and highest degree attained for 498 respondents in the General Social Survey.

Gender	Highest Degree					Total
	No High School Degree	High School Degree	Junior College	Bachelor Degree	Graduate Degree	
Male	49	95	11	39	23	217
Female	52	166	14	37	12	281
<b>Total</b>	101	261	25	76	35	498

- What percent of the sample were males?
  - 43.6%
  - 48.5%
  - 56.4%
  - 77.2%

KEY: A

- What percent of the sample were males with no high school degree?
  - 9.8%
  - 20.3%
  - 22.6%
  - 48.5%

KEY: A

- What percent of the sample did not graduate from high school?
  - 18.5%
  - 20.3%
  - 22.6%
  - 52.4%

KEY: B

- What percent of females had a graduate degree?
  - 2.4%
  - 4.3%
  - 7.0%
  - 56.4%

KEY: B

**Questions 5 to 8:** The table below shows the number of Olympic medals won by the three countries with the most medals during the 2000 Olympics in Sydney, Australia. There were a total of 244 medals won by the three countries.

Country	Type of Medal			Total
	Gold	Silver	Bronze	
USA	39	25	33	97
Russia	32	28	28	88
China	28	16	15	59
<b>Total</b>	99	69	76	244

5. What percent of the medals won among the three countries were won by the USA?

- A. 39.4%
- B. 39.8%
- C. 40.2%
- D. 40.6%

KEY: B

6. What percent of the medals won among the three countries were gold?

- A. 39.4%
- B. 39.8%
- C. 40.2%
- D. 40.6%

KEY: D

7. What percent of the medals won by the USA were gold?

- A. 39.4%
- B. 39.8%
- C. 40.2%
- D. 40.6%

KEY: C

8. What percent of the medals won by China were silver?

- A. 6.6%
- B. 24.2%
- C. 27.1%
- D. 28.3%

KEY: C

**Questions 9 to 13:** A researcher conducted a study on college students to see if there was a link between gender and how often they have cheated on an exam. She asked two questions on a survey:

- (1) What is your gender? Male \_\_\_ Female \_\_\_  
 (2) How many times have you cheated on an exam while in college?  
 Never \_\_\_ 1 or 2 times \_\_\_ 3 or more times \_\_\_

A two-way table of observed counts follows:

Gender	Cheated on an exam?			Total
	Never	1 or 2 times	3 or more times	
Male	60	20	20	100
Female	60	30	10	100
<b>Total</b>	120	50	30	200

9. What percent of the students in the study never cheated on an exam?  
 A. 60%  
 B. 120%  
 C. 50%  
 D. 30%

KEY: A

10. What percent of the students in the study cheated 1 or 2 times on an exam?  
 A. 20%  
 B. 30%  
 C. 50%  
 D. 25%

KEY: D

11. What percent of the students in the study cheated 3 or more times on an exam?  
 A. 20%  
 B. 10%  
 C. 30%  
 D. 15%

KEY: D

12. What percent of the males in the study cheated 3 or more times on an exam?  
 A. 20%  
 B. 10%  
 C. 30%  
 D. 15%

KEY: A

13. What percent of the females in the study cheated 3 or more times on an exam?  
 A. 20%  
 B. 10%  
 C. 30%  
 D. 15%

KEY: B

**Questions 14 to 20:** The table below shows the opinions of 908 respondents in the General Social Survey to the question “Do you believe there is life after death?”

<b>Gender</b>	<b>Life After Death?</b>		
	<b>Yes</b>	<b>No</b>	<b>Total</b>
<b>Male</b>	282	109	391
<b>Female</b>	408	109	517
<b>Total</b>	690	218	908

14. What percent of males believe in life after death?  
KEY: 72.1%

15. What percent of females believe in life after death?  
KEY: 78.9%

16. What percent of respondents in the sample believe in life after death?  
KEY: 76.0%

**Questions 12 to 15:** The table shows the opinions of 953 respondents in the General Social Survey to the question “If your party nominated a woman for President, would you vote for her if she were qualified for the job?”

<b>Gender</b>	<b>Vote for Qualified Woman?</b>		
	<b>Yes</b>	<b>No</b>	<b>Total</b>
<b>Male</b>	335	64	399
<b>Female</b>	488	66	554
<b>Total</b>	823	130	953

17. What percent of males would vote for a woman president?  
KEY: 84.0%

18. What percent of females would vote for a woman president?  
KEY: 88.1%

19. What percent of respondents in the sample would vote for a woman president?  
KEY: 86.4%

20. What percent of respondents in the sample were female?  
KEY: 58.1%

**Questions 21 to 24:** In a survey of 1000 adults, respondents were asked about the expense of a college education and the relative necessity of financial assistance. The correspondents were classified as to whether they currently had a child in college or not (college status), and whether they thought the loan obligation for most college students was too high, about right, or too little (loan obligation opinion). The table below summarizes some of the survey results. Use these results to answer the following questions.

College Status	Loan Obligation Opinion			Total
	Too High	About Right	Too Little	
Child in College	350	80	10	440
No Child in College	250	200	110	560

21. What percent of adults with a child in college surveyed think loan obligations are too high?

KEY:  $350/440 = 79.5\%$

22. What percent of adults with no child in college surveyed think loan obligations are too high?

KEY:  $250/560 = 44.6\%$

23. What percent of all adults surveyed think loan obligations are too high?

KEY:  $(350+250)/1000 = 60\%$

24. The table below shows the row percentages.

College Status	Loan Obligation Opinion			Total
	Too High	About Right	Too Little	
Child in College	79.5%	18.2%	2.3%	100%
No Child in College	44.6%	35.7%	19.6%	100%

Based on these percentages, describe the relationship between loan obligation opinion and college status.

KEY: There does appear to be some association between loan obligation opinion and college status. The parents with a child in college are much more likely to say the loan obligations are too high as compared to parents with no child in college (79.5% to 44.6%). On the other extreme, the parents with no child in college are much more likely to say the loan obligations are too little as compared to parents with a child in college (19.6% to 2.3%).

## Section 4.2

25. If there is no difference in the risk of a disease for smokers and non-smokers, then the relative risk of the disease for smokers compared to non-smokers would be:
- A. 0
  - B. 0.5
  - C. 1
  - D. It depends on the actual risks.

KEY: C

26. The relative risk of a disease for group 1 compared to group 2 is close to the odds ratio under which of these circumstances?
- A. When the numbers with the disease in each group are small compared to the total in each group.
  - B. When the numbers with the disease are about equal to the numbers without the disease in each group.
  - C. When the numbers with the disease in each group are almost equal to the total in each group.
  - D. The relative risk and the odds ratio are never close to each other.

KEY: B

27. If the relative risk of having an accident while eating when driving (compared to not eating) is 5, and the risk of having an accident when not eating is 1 in 10000, then the risk of having an accident while eating is:
- A. 1 in 5000
  - B. 1 in 50000
  - C. 1 in 2000
  - D. None of the above.

KEY: C

**Questions 28 to 31:** The table below shows the responses from a sample of 680 people in the General Social Survey to the question, “Do you sometimes drink more than you think you should?”

<b>Gender</b>	<b>Drink more than should?</b>		<b>Total</b>
	<b>Yes</b>	<b>No</b>	
<b>Male</b>	151	177	328
<b>Female</b>	92	260	352
<b>Total</b>	243	437	680

28. What is the risk (or percentage) of men thinking they drank more than they should?

- A. 22.2%
- B. 35.7%
- C. 46.0%
- D. 62.1%

KEY: C

29. What is the risk (or percentage) of women thinking they drank more than they should?

- A. 13.5%
- B. 26.1%
- C. 35.7%
- D. 37.9%

KEY: B

30. What is the relative risk for women thinking they drank more than they should compared to men?

- A. 0.41
- B. 0.57
- C. 1.76
- D. 2.41

KEY: B

31. What is the odds ratio for women thinking they drank more than they should compared to men?

- A. 0.41
- B. 0.57
- C. 1.76
- D. 2.41

KEY: A

**Questions 32 to 37:** The table below summarizes, by gender of respondent, the responses from 1,033 people to the question, “Do you smoke?”

Gender	Smoke?		Total
	Yes	No	
Male	142	302	444
Female	171	418	589
<b>Total</b>	313	720	1033

32. What are the odds of smoking (to not smoking) for a man?

- A. 0.14
- B. 0.32
- C. 0.45
- D. 0.47

KEY: D

33. What are the odds of smoking (to not smoking) for a woman?

- A. 0.17
- B. 0.39
- C. 0.41
- D. 0.55

KEY: C

34. What is the odds ratio for women smoking (to not smoking) compared to men?

- A. 0.87
- B. 0.91
- C. 1.10
- D. 1.15

KEY: A

35. What is the odds ratio for men smoking (to not smoking) compared to women?

- A. 0.87
- B. 0.91
- C. 1.10
- D. 1.15

KEY: D

36. What is the relative risk for women smoking compared to men smoking?

- A. 0.87
- B. 0.91
- C. 1.10
- D. 1.15

KEY: B

37. Based on the National Household Survey on Drug Abuse, the percentage of 17-year olds who ever tried cigarette smoking is 56.2%. The relative risk of ever smoking for a 17-year old versus a 12-year old is 3.6. What is the risk of smoking for a 12-year-old (i.e. what was the percentage of 12-year olds who ever tried smoking)?

- A. 14.1%
- B. 15.6%
- C. 50.0%
- D. 56.2%

KEY: B

**Questions 38 to 40:** A survey asked people how often they exceed speed limits. The data are then categorized into the following contingency table of counts showing the relationship between age group and response.

Age	Exceed Limit if Possible?		Total
	Always	Not Always	
<b>Under 30</b>	100	100	200
<b>Over 30</b>	40	160	200
<b>Total</b>	140	260	400

38. Among people with age *over 30*, what's the "risk" of always exceeding the speed limit?

- A. 0.20
- B. 0.40
- C. 0.33
- D. 0.50

KEY: A

39. Among people with age *under 30* what are the odds that they always exceed the speed limit?

- A. 1 to 2
- B. 2 to 1
- C. 1 to 1
- D. 50%

KEY: C

40. What is the relative risk of always exceeding the speed limit for people under 30 compared to people over 30?

- A. 2.5
- B. 0.4
- C. 0.5
- D. 30%

KEY: A

**Questions 41 and 42:** A newspaper article reported that "Children who routinely compete in vigorous after-school sports on smoggy days are three times more likely to get asthma than their non-athletic peers." (*Sacramento Bee*, Feb 1, 2002, p. A1)

41. Of the following, which is the most important additional information that would be useful before making a decision about participation in school sports?

- A. Where was the study conducted?
- B. How many students in the study participated in after-school sports?
- C. What is the baseline risk for getting asthma?
- D. Who funded the study?

KEY: C

42. The newspaper also reported that "The number of children in the study who contracted asthma was relatively small - 265 of 3,535." From this information and the information given in the original quote, which of the following could *not* be computed?

- A. The baseline risk of getting asthma without participating in after-school sports.
- B. The overall risk of getting asthma for the children in this study.
- C. The relative risk of getting asthma for children who routinely participate in vigorous after-school sports on smoggy days and their non-athletic peers.
- D. All of the above could be computed.

KEY: A

**Questions 43 and 44:** A study done by the Center for Academic Integrity at Rutgers University surveyed 2116 students at 21 colleges and universities. Some of the schools had an "honor code" and others did not. Of the students at schools with an honor code, 7% reported having plagiarized a paper via the Internet, while at schools with no honor code, 13% did so. (*Sacramento Bee*, Feb 29, 2000, D1.)

43. For this study, the relative risk of a student having plagiarized a paper via the Internet at a school with no honor code, compared to a school with an honor code is:
- A.  $13/7 = 1.857$
  - B.  $7/13 = 0.538$
  - C.  $13/87 = 0.149$
  - D.  $87/13 = 6.692$

KEY: A

44. Which of the following statements about *percent increase in risk* is correct for this study?
- A. There is a 185.7% increase in the risk of plagiarism at a school with no honor code, compared to a school with an honor code.
  - B. There is an 85.7% increase in the risk of plagiarism at a school with no honor code, compared to a school with an honor code.
  - C. There is a 53.8% increase in the risk of plagiarism at a school with no honor code, compared to a school with an honor code.
  - D. There is a 6% increase in the risk of plagiarism at a school with no honor code, compared to a school with an honor code.

KEY: B

45. A study on the use of seat belts versus belted booster seats for children ages 4 and 5 reported that "Using seat belts instead of booster seats was associated with increased risk for serious injury in an accident; the relative risk was 2.4." Based on this, it can be concluded that for this study:
- A. Children ages 4 and 5 in a booster seat were 2.4 times more likely to have serious injuries in an accident than were children wearing seatbelts.
  - B. Children ages 4 and 5 wearing seatbelts were 2.4 times more likely to have serious injuries in an accident than were children in a booster seat.
  - C. The percent of children ages 4 and 5 in a booster seat was 2.4 times higher than the percent of children wearing seatbelts.
  - D. The percent of children ages 4 and 5 wearing seatbelts was 2.4 times higher than the percent of children in a booster seat.

KEY: B

46. The relative risk of allergies for children of parents who smoke compared to children of parents who don't smoke is 3.0. Suppose that the risk of allergies for the children of non-smokers is 0.15 (15%). What is the risk of allergies for the children of smokers?
- A. 3%
  - B. 5%
  - C. 30%
  - D. 45%

KEY: D

47. An article in the *Sacramento Bee* (May 8, 2000, p A12) reported that "Early results from a study of more than 2000 pregnant women in Alabama show that pregnant mothers with severe gum disease are up to eight times more likely to have underweight premature babies than moms with healthy mouths." The phrase "eight times more likely" indicates what in our statistical language?

KEY: A relative risk of eight.

48. A 1995 Washington Post-ABC News Poll on Affirmative Action reported that 76 percent of men and 69 percent of women opposed giving preferences to women in hiring, promotions and college admissions. What are the odds that a woman was opposed to giving preferences versus not opposed?

KEY: The odds of being opposed to not being opposed for women are 69 opposed to 31 not opposed.

49. The relative risk of a 25-year-old woman developing invasive breast cancer within 5 years is 5.72 times greater than for a 20-year-old woman. If the 5-year risk of breast cancer for a 20 year old woman is 0.007%, what is the risk for a 25 year old woman?

KEY: 0.040%

**Questions 50 to 52:** The table below shows the opinions of 908 respondents in the General Social Survey to the question "Do you believe there is life after death?"

Gender	Life After Death?		Total
	Yes	No	
Male	282	109	391
Female	408	109	517
<b>Total</b>	690	218	908

50. What are the odds of believing in life after death for males?

KEY:  $282/109 = 2.59$

51. What are the odds of believing in life after death for females?

KEY:  $408/109 = 3.74$

52. What is the odds ratio for males versus females who believe in life after death?

KEY:  $2.59/3.74 = 0.69$

### Section 4.3

53. Simpson's Paradox occurs when
- no baseline risk is given, so it is not know whether or not a high relative risk has practical importance.
  - a confounding variable rather than the explanatory variable is responsible for a change in the response variable.
  - the direction of the relationship between two variables changes when the categories of a confounding variable are taken into account.
  - the results of a test are statistically significant but are really due to chance.

KEY: C

**Questions 54 to 59:** The table below shows the ratings given by 200 students in an introductory statistics course. There were two instructors for the course, each with 100 students.

Instructor	Rating		Total
	High Quality	Not High Quality	
<b>Jones</b>	38	62	100
<b>Smith</b>	62	38	100
<b>Total</b>	100	100	200

54. What percent of Jones' students rated the teaching as high quality?
- 38%
  - 62%
  - 50%

KEY: A

55. What percent of Smith's students rated the teaching as high quality?
- 38%
  - 62%
  - 50%

KEY: B

56. Which instructor has the highest percentage of high quality teaching ratings?
- Jones
  - Smith
  - They had the same percentages.

KEY: B

**Questions 54 to 59 continued:** Another question on the evaluation was whether or not the student considered themselves as being good at math or not. The tables below show the ratings for each instructor for these two groups of students.

**Good at Math**

Instructor	Rating		Total
	High Quality	Not High Quality	
Jones	14	6	20
Smith	56	24	80
<b>Total</b>	70	30	100

**Not Good at Math**

Instructor	Rating		Total
	High Quality	Not High Quality	
Jones	24	56	80
Smith	6	14	20
<b>Total</b>	30	70	100

57. Among those students who consider themselves good at math, which instructor has the highest percentage of high quality teaching ratings?
- Jones
  - Smith
  - They had the same percentages.

KEY: C

58. Among those students who consider themselves good at math, which instructor has the highest percentage of high quality teaching ratings?
- Jones
  - Smith
  - They had the same percentages.

KEY: C

59. Which phrases best complete this sentence? Those students who are \_\_\_\_\_ at math generally gave higher instructor ratings and instructor \_\_\_\_\_ had a higher percentage of these type of students, giving the inaccurate impression that this instructor was *best* overall.
- good, Jones
  - good, Smith
  - not good, Jones
  - not good, Smith

KEY: A

**Questions 60 to 64:** The table below shows the decisions for 1200 applicants for financial aid at a local college by gender.

Gender	Decision		Total
	Received	Did not receive	
Female	490	210	700
Male	280	220	500
<b>Total</b>	770	430	1200

60. What percent of females received some sort of financial aid?

KEY:  $490/700 = 70\%$

61. What percent of males received some sort of financial aid?

KEY:  $280/500 = 56\%$

**Questions 62 to 64 continued:** There are two main programs at this college and the tables below show the financial aid results by gender for each program.

Nursing Program			
Gender	Decision		Total
	Received	Did not receive	
Female	480	120	600
Male	180	20	200
<b>Total</b>	660	140	800

Engineering Program			
Gender	Decision		Total
	Received	Did not receive	
Female	10	90	100
Male	100	200	300
<b>Total</b>	110	290	400

62. For the nursing program, what are the percentages of females and of males that received some sort of financial aid?

KEY: For females:  $480/600 = 80\%$ ; for males:  $180/200 = 90\%$

63. For the engineering program, what are the percentages of females and of males that received some sort of financial aid?

KEY: For females:  $10/600 = 10\%$ ; for males:  $100/300 = 33\%$

64. Explain how each program can have a higher percentage of males receiving financial aid, yet overall there was a higher percentage of females receiving financial aid. Think about the differences between these two programs in terms of financial aid being given, and the distribution of gender for each program.

KEY: The overall rates for receiving financial aid are much higher for those in the nursing program and a higher percentage of females are in this program. The overall rates for receiving financial aid are much lower for those in the engineering program and a higher percentage of males are in this program.

65. Explain in your own words or through an example what Simpson's paradox is.

KEY: Simpson's paradox occurs when the direction of a relationship between two categorical variables changes when the categories of a confounding variable are taken into account.

## Section 4.4

**Questions 66 to 68:** The table below shows the opinions of 321 respondents from the General Social Survey by whether they owned a gun (or not) and whether they favored (or opposed) a law requiring a permit to own a gun.

Own Gun?	Gun Law Opinion		Total
	Oppose	Favor	
Yes	35	110	145
No	20	156	176
<b>Total</b>	55	266	321

Chi-Square = 9.137, DF = 1, P-Value = 0.003

66. The percentage of gun owners in favor of the gun law was

- A. 34%
- B. 41%
- C. 76%
- D. 83%

KEY: C

67. The percentage of non-gun owners in favor of the gun law was

- A. 49%
- B. 59%
- C. 83%
- D. 89%

KEY: D

68. Based on the chi-square statistic and  $p$ -value, one can conclude that

- A. the difference between the support for the gun law between gun owners and non-gun owners is not statistically significant.
- B. the difference between the support for the gun law between gun owners and non-gun owners is statistically significant.
- C. the difference between the support for the gun law between gun owners and non-gun owners is not practically significant.
- D. the difference between the support for the gun law between gun owners and non-gun owners is practically significant.

KEY: B

**Questions 69 to 71:** A researcher conducted a study on college students to see if there was a link between gender and how often they have cheated on an exam. She asked two questions on a survey:

- (1) What is your gender? Male \_\_\_ Female \_\_\_  
 (2) How many times have you cheated on an exam while in college?  
 Never \_\_\_ 1 or 2 times \_\_\_ 3 or more times \_\_\_

A two-way table of observed counts follows:

Gender	Cheated on an exam?			Total
	Never	1 or 2 times	3 or more times	
Male	60	20	20	100
Female	60	30	10	100
Total	120	50	30	200

Chi-Square = 5.33, DF = 2, P-Value = 0.0696

69. The percentage of males who cheated 1 or 2 times was

- A. 20%
- B. 30%
- C. 50%
- D. 25%

KEY: A

70. The percentage of females who cheated 1 or 2 times was

- A. 20%
- B. 30%
- C. 50%
- D. 25%

KEY: B

71. Based on the chi-square statistic and  $p$ -value, what conclusion can be made about the relationship between gender and response to the question about cheating, using  $\alpha = 0.05$ ?

- A. The result is not statistically significant so there does not appear to be a relationship.
- B. The result is not statistically significant so there does appear to be a relationship.
- C. The result is statistically significant so there does not appear to be relationship.
- D. The result is statistically significant so there does appear to be a relationship.

KEY: A

**Questions 72 to 74:** In the General Social Survey, respondents were asked “Would you approve of an adult male punching a stranger if the stranger was drunk and bumped into the man and his wife on the street?” A two-way table summarizing the results for 1006 respondents, by gender, is shown below:

Gender	Would you approve of punch?		Total
	Yes	No	
Female	46	523	569
Male	35	402	437
<b>Total</b>	81	925	1006

Chi-Square = 0.002, DF = 2, P-Value = 0.9990

72. The percentage of males who responded ‘Yes’ was

- A. 8.1%
- B. 4.6%
- C. 8.0%
- D. 3.5%

KEY: C

73. The percentage of females who responded ‘Yes’ was

- A. 8.1%
- B. 4.6%
- C. 8.0%
- D. 3.5%

KEY: A

74. Based on the chi-square statistic and  $p$ -value, what conclusion can be made about the relationship between gender and response to the question about approving of a punch, using  $\alpha = 0.05$ ?

- A. The result is not statistically significant so there does not appear to be a relationship.
- B. The result is not statistically significant so there does appear to be a relationship.
- C. The result is statistically significant so there does not appear to be relationship.
- D. The result is statistically significant so there does appear to be a relationship.

KEY: A

**Questions 75 and 76:** Students in a statistics class were asked, “With whom do you find it easier to make friends: person of the same sex, person of opposite sex, or no preference?” A table summarizing the responses by gender is given below. Minitab results for a chi-square test for these data were “Chi-Sq = 7.15 DF=2 P-value = 0.028.”

Gender	With whom is it easier to make friends?			Total
	no preference	opposite sex	same sex	
Male	40	50	30	120
Female	40	20	20	80
Total	80	70	50	200

75. Among females, what percent said “same sex?”

- A. 15%
- B. 25%
- C. 30%
- D. 60%

KEY: B

76. Assume these students represent a random sample of all students. Based on the chi-square test, what conclusion can be made about the relationship between gender and response to the question about friends, using  $\alpha = 0.05$ ?

- A. The result is not statistically significant so there does not appear to be a relationship.
- B. The result is not statistically significant so there does appear to be a relationship.
- C. The result is statistically significant so there does not appear to be relationship.
- D. The result is statistically significant so there does appear to be a relationship.

KEY: D

77. A study done by the Center for Academic Integrity at Rutgers University surveyed 2116 students at 21 colleges and universities. Some of the schools had an "honor code" and others did not. Of the students at schools with an honor code, 7% reported having plagiarized a paper via the Internet, while at schools with no honor code, 13% did so. (*Sacramento Bee*, Feb 29, 2000, D1.) Although the data provided are not sufficient to carry out a chi-square test of the relationship between whether or not a school has an honor code and whether or not a student would plagiarize a paper via the Internet, suppose such a test were to show a statistically significant relationship on the basis of this study. What would be the correct conclusion?

- A. Because this is an observational study, it can be concluded that implementing an honor code at a college or university will reduce the risk of plagiarism.
- B. Because this is a randomized experiment, it can be concluded that implementing an honor code at a college or university will reduce the risk of plagiarism.
- C. Because this is an observational study and confounding variables are likely, it cannot be concluded that implementing an honor code at a college or university will reduce the risk of plagiarism.
- D. Because this is a randomized experiment and confounding variables are likely, it cannot be concluded that implementing an honor code at a college or university will reduce the risk of plagiarism.

KEY: C

78. The statistical significance of the association or relationship between two categorical variables is examined using a value known as the chi-square statistic, and a corresponding  $p$ -value that assesses the chance of getting this value for the Chi-square statistic or one even larger. Suppose the  $p$ -value of the test turns out to be 0.18. In this case, we should decide that

- A. there is only an 18% chance that the observed relationship occurred by chance, so we can say that the relationship is statistically significant.
- B. the observed relationship most likely did not occur by chance, so we can say that the relationship is statistically significant.
- C. the observed relationship most likely did not occur by chance, so we cannot say that the relationship is statistically significant.
- D. the observed relationship could have occurred by chance, so we cannot say that the relationship is statistically significant

KEY: D

79. The following two-way cross-tabulation (contingency table) of counts summarizes the relationship between gender and smoking status:

Gender	Smoking Status		Total
	Smoker	Non-smoker	
Male	150	450	600
Female	100	300	400
Total	250	750	1000

Of the males, what percentage smokes?

- A. 600/1000, or 60%
- B. 150/1000, or 15%.
- C. 150/600, or 25%.
- D. 150/250, or 60%.

KEY: C

80. A statistically significant relationship between two categorical variables is illustrated in the sample as one that
- A. is small enough that it is likely to have occurred in the observed sample even if there is no relationship in the population.
  - B. is small enough that it is unlikely to have occurred in the observed sample if there is no relationship in the population.
  - C. is large enough that it is likely to have occurred in the observed sample even if there is no relationship in the population
  - D. is large enough that it is unlikely to have occurred in the observed sample if there is no relationship in the population

KEY: D

81. What is the primary purpose of doing a chi-square test?
- A. to determine if there is a significant relationship between two quantitative variables
  - B. to determine if there is a significant relationship between two categorical variables
  - C. to determine if there is a significant relationship between two continuous variables
  - D. to estimate a population proportion

KEY: B

82. A chi-square test involves a set of counts called “expected counts.” What are the expected counts?
- A. Hypothetical counts that would occur if the alternative hypothesis were true.
  - B. Hypothetical counts that would occur on average if the null hypothesis were true.
  - C. The actual counts that did occur in the observed data.
  - D. The long-run counts that would be expected if the observed counts are representative

KEY: B

83. Pick the choice that best completes the following sentence. If a relationship between two variables is called statistically significant, it means the investigators think the variables are
- A. related in the population represented by the sample.
  - B. not related in the population represented by the sample.
  - C. related in the sample due to chance alone.
  - D. very important.

KEY: A

84. A statement that claims that changes in the explanatory variable will have no effect on the response variable is an example of a(n) \_\_\_\_\_ hypothesis.
- A. negative
  - B. dependent
  - C. null
  - D. alternative

KEY: C

85. In a newspaper article about whether the regular use of Vitamin C reduces the risk of getting a cold, a researcher is quoted as saying that Vitamin C performed better than placebo in an experiment, but the difference was not larger than what could be explained by chance. In statistical terms, the researcher is saying the results are \_\_\_\_\_
- A. due to non-sampling errors.
  - B. definitely due to chance.
  - C. statistically significant.
  - D. not statistically significant.

KEY: D

**Questions 86 to 89:** The table shows the opinions of 1027 respondents in the General Social Survey to the question “Is there any area right around here – that is, within a mile – where you would be afraid to walk alone at night?” The purpose of examining the data is to see if there is a gender difference in how people would respond to this question.

Gender	Area afraid to walk at night?		Total
	Yes	No	
Male	84	359	443
Female	321	263	584
<b>Total</b>	405	622	1027

86. State the null and alternative hypotheses for this study.

KEY: Null hypothesis: There is no relationship between gender and response to the question about being afraid to walk alone in one’s neighborhood at night.

Alternative hypothesis: There is a relationship between gender and response to the question about being afraid to walk alone in one’s neighborhood at night.

87. Assuming the null hypothesis is true, calculate the expected number of women in the sample who would be afraid to walk alone in their neighborhood at night.

KEY: 230.3

88. If the null hypothesis is true, calculate the expected number of men in the sample who would be afraid to walk alone in their neighborhood at night.

KEY: 174.7

89. To test whether there is a relationship in the population between gender and fear of walking alone at night, the chi-square statistic = 136.7 and the  $p$ -value < 0.001. Are the results statistically significant or not statistically significant? State your conclusion.

KEY: The results are statistically significant. The conclusion is that there is a relationship in the population between gender and response to the question about being afraid to walk alone in one’s neighborhood at night.

**Questions 90 to 93:** The table below shows the opinions of 1027 respondents in the General Social Survey to the question “Everything considered, would you say that in general, you approve or disapprove of wiretapping?” The purpose of examining the data is to see if there is a gender difference in how people would respond to this question.

<b>Wiretapping Opinion</b>			
<b>Gender</b>	<b>Approve</b>	<b>Disapprove</b>	<b>Total</b>
<b>Male</b>	134	272	406
<b>Female</b>	126	421	547
<b>Total</b>	260	693	953

90. State the null and alternative hypotheses for this study.

KEY: Null hypothesis: There is no relationship between gender and approval of wiretapping.

Alternative hypothesis: There is a relationship between gender and approval of wiretapping.

91. Assuming the null hypothesis is true, calculate the expected number of women in the sample who would approve of wiretapping.

KEY: 149.2

92. Assuming the null hypothesis is true, calculate the expected number of men in the sample who would approve of wiretapping.

KEY: 110.8

93. To test whether there is a relationship in the population between gender and support for wiretapping, the chi-square statistic = 11.7 and the  $p$ -value = 0.001. Are the results statistically significant or not statistically significant? State your conclusion.

KEY: The results are statistically significant. The conclusion is that there is a relationship between gender and approving of the practice of wiretapping.

**Questions 94 to 96:** In the General Social Survey, respondents were asked, “Do you agree with the following statement? “In spite of what some people say, the lot (situation/condition) of the average man is getting worse, not better.” The results, for 989 respondents by gender, are shown below.

Gender	“Lot is getting worse”		
	Agree	Disagree	Total
Female	356	200	556
Male	234	199	433
<b>Total</b>	590	399	989

94. How many females in the sample agreed with the statement?

KEY: 356

95. Assuming there is no relationship between gender and opinion about the lot of the average man, how many females would we be expected to agree with the statement?

KEY:  $(556)(590)/989 = 331.7$

96. To test whether there is a relationship in the population between gender and opinion about the lot of the average man, the chi-square statistic = 10.09 and the  $p$ -value = 0.0015. Are the results statistically significant at the 5% level? State your conclusion.

KEY: Yes, the results are statistically significant. The conclusion is that there is a relationship between gender and opinion about the lot of the average man for the population represented by this sample.

**Questions 97 to 100:** The table below shows the opinions of 1447 respondents in the General Social Survey to the question “Do you favor or oppose the death penalty for persons convicted of murder?” The purpose of examining the data is to see if there is a gender difference in how people would respond to this question.

Gender	Death Penalty Opinion		Total
	Favor	Oppose	
Male	534	102	636
Female	600	211	811
<b>Total</b>	1134	313	1447

97. State the null and alternative hypotheses for this study.

KEY: Null hypothesis: There is no relationship between gender and opinion on the death penalty.

Alternative hypothesis: There is a relationship between gender and opinion on the death penalty.

98. Assuming the null hypothesis is true, calculate the expected number of women in the sample who would favor the death penalty

KEY: 635.6

99. Assuming the null hypothesis is true, calculate the expected number of men in the sample who would favor the death penalty.

KEY: 498.4

100. To test whether there is a relationship in the population between gender and support for the death penalty, the chi-square statistic = 20.9 and the  $p$ -value  $< 0.001$ . Are the results statistically significant or not statistically significant? State your conclusion.

KEY: The results are statistically significant. The conclusion is that there is a relationship between gender and opinion about the death penalty.

