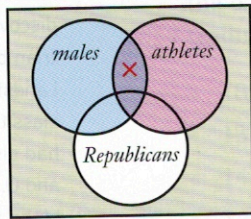


8. The region with the X in the Venn diagram below represents



- a. male Republican athletes.
- b. male Republicans who are not athletes.
- c. male athletes who are not Republicans.

9. Consider again the Venn diagram from Exercise 8. The central region of the diagram represents people who are

- a. male and Republican and athletes.
 - b. male or Republican or athletes.
 - c. neither male nor Republican nor athletes.
10. Look at the data in Table 1.1 (p. 43). The total number of babies born with low birth weight was
- a. 14.
 - b. 18.
 - c. 32.

Exercises 1C

REVIEW QUESTIONS

- What is a set? Describe the use of braces for listing the members of a set.
- What is a Venn diagram? How do we show that one set is a subset of another in a Venn diagram? How do we show disjoint sets? How do we show overlapping sets?
- List the four standard categorical propositions. Give an example of each type, and draw a Venn diagram for each of your examples.
- Briefly discuss how you can put a categorical proposition into one of the standard forms if it is not in such a form already.
- Explain how to draw a Venn diagram for three overlapping sets. Discuss the types of information that can be shown in such diagrams.
- Explain how to read a table such as Table 1.1 and how to show the information in a Venn diagram.

DOES IT MAKE SENSE?

Decide whether each of the following statements makes sense (or is clearly true) or does not make sense (σ is clearly false). Explain your reasoning.

- The payments we make to the electric company are a subset of the payments we make to the phone company.
- I don't know what you mean by the sets "jabbers" and "wocks," but I can still draw a Venn diagram for them if you just tell me if and how they share members.
- I counted an irrational number of students in my class.
- The number of students in my class is a real number.

- My professor asked me to draw a Venn diagram for a categorical proposition, but I couldn't do it because the proposition was clearly false.
- I used a Venn diagram to prove that your opinion is false.

BASIC SKILLS & CONCEPTS

13–28: **Classifying Numbers.** Choose the first set in the list *natural numbers, whole numbers, integers, rational numbers, and real numbers* that describes the following numbers.

- | | |
|---------------|-----------------|
| 13. 23 | 14. -45 |
| 15. 2/3 | 16. -5/2 |
| 17. 1.2345 | 18. 0 |
| 19. π | 20. $\sqrt{8}$ |
| 21. -34.25 | 22. $\sqrt{98}$ |
| 23. $\pi/4$ | 24. 123/456 |
| 25. -13/3 | 26. -145.01 |
| 27. $\pi/129$ | 28. 13,579,023 |

29–36: **Set Notation.** Use set notation (braces) to write the members of the following sets, or state that the set has no members. You may use "..." to indicate patterns.

- The days of the week
- The even numbers between, but not including, 8 and 64
- The states that share a border with Texas
- Every third number between 4 and 20 beginning with 4
- The perfect squares (such as $1^2, 2^2, 3^2$) between 30 and 130
- The kings of America
- Odd numbers between 2 and 30 that are multiples of 3
- The vowels of the English alphabet

37–44: **Venn Diagrams for Two Sets.** Draw Venn diagrams with two circles showing the relationship between the following pairs of sets. Provide an explanation of the diagram you drew.

37. veterinarians and women
38. nurses and skydivers
39. words and verbs
40. reptiles and bacteria
41. musicians and painters
42. atheists and Catholic bishops
43. negative integers and natural numbers
44. limericks and poems

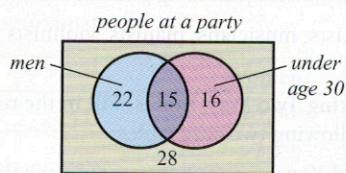
45–52: **Categorical Propositions.** For the given categorical propositions, do the following.

- a. If necessary, rephrase the statement in standard form.
 - b. State the subject and predicate sets.
 - c. Draw a Venn diagram for the proposition and label all regions of the diagram.
45. All widows are women.
 46. No worms are birds.
 47. All U.S. presidents have been over 30 years old.
 48. Every child can sing.
 49. Monkeys don't gamble.
 50. Plumbers don't cheat.
 51. Winners smile.
 52. Some movie stars are redheads.

53–58: **Venn Diagrams for Three Sets.** Draw Venn diagrams with three overlapping circles (eight regions) for the following groups of three sets. Describe the members of each region or state that a region has no members.

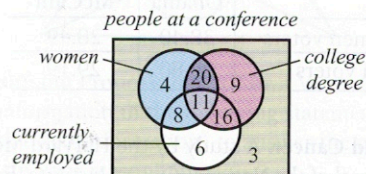
53. women, dentists, and kindergarten teachers
54. hockey players, figure skaters, and women
55. published works, novels, and songs
56. oceans, bodies of salt water, and bodies of fresh water
57. words that begin with S, verbs, and words with fewer than 4 letters
58. teachers, swimmers, and tall people

59–60: **Venn Diagram with Numbers.** Use the Venn diagram to answer the following questions.



59. a. How many women at the party are under 30?
b. How many men at the party are not under 30?
c. How many women are at the party?
d. How many people are at the party?
60. a. How many men at the party are under 30?
b. How many women at the party are over 30?
c. How many men are at the party?
d. How many people at the party are not under 30?

61–62: **Venn Diagram with Numbers.** Use the Venn diagram to answer the following questions.



61. a. How many people at the conference are unemployed women with a college degree?
b. How many people at the conference are employed men?
c. How many people at the conference are employed women without a college degree?
d. How many men are at the conference?
 62. a. How many people at the conference are employed men without a college degree?
b. How many people at the conference are unemployed women?
c. How many people at the conference are unemployed men without a college degree?
d. How many people are at the conference?
- 63–64: **Venn Diagrams from Data.** Draw Venn diagrams that represent the following situations. Mark each region of the diagram with the correct number.
63. One hundred people who grew up in either New York or Los Angeles were surveyed to determine whether they preferred hip-hop music or rock music (*both* and *neither* were not acceptable responses). Of those who grew up in Los Angeles, 20 preferred hip-hop and 40 preferred rock. Of those who grew up in New York, 30 preferred hip-hop.
 64. In a trial of a new allergy medicine, 120 people were given the medicine and 80 were given a placebo. Of those given the medicine, 90 showed improvement in their allergies. Of those given the placebo, 20 did not show improvement.

FURTHER APPLICATIONS

65–66: **Venn Diagram Analysis.** Draw two-circle Venn diagrams for the following situations and answer the questions.

65. Of the 45 theater performances that a critic reviewed, 23 were comedies. She gave favorable reviews to 8 of the comedies and unfavorable reviews to 12 of the non-comedies.

How many comedies received unfavorable reviews? How many non-comedies received favorable reviews?

66. All cyclists who competed in a race were given a drug test. Of the 18 who tested positive, 3 finished in the top 10. Twenty-five cyclists tested negative. How many cyclists who tested negative did not finish in the top 10? How many cyclists were tested?
67. **Election Results.** The following table gives popular vote counts (in millions) for the two leading candidates in the 2008 U.S. presidential election. Draw a two-circle Venn diagram that represents the results.

	Obama	McCain
Women voters	38.40	28.49
Men voters	29.80	29.19

68. **Tomatoes and Cancer.** A study by the Harvard Medical School (*Journal of the National Cancer Institute*, February 17, 1999) reviewed 72 previous studies of the effect of tomatoes on cancer. The data showed convincingly that “high consumers of tomatoes and tomato products are at substantially decreased risk of numerous cancers, although probably not all cancers.” Consider the following table that shows the incidence of oral cancer for a group of people who ate an average of one tomato a day and another group of people who ate fewer than three tomatoes per week. Draw a Venn diagram for the data.

	No oral cancer	Oral cancer
One tomato per day	191	9
Fewer than three tomatoes per week	164	16

69. **Coffee and Gallstones.** A study on the effect of coffee on gallstones (*Journal of the American Medical Association*, June 9, 1999) resulted (in small part) in the data shown below. The category *Coffee* means more than four cups of caffeinated coffee per day. The category *No coffee* means no caffeinated coffee. Draw a Venn diagram for the data.

	Gallstone disease	No disease
No coffee	385	14,068
Coffee	91	4,806

70. **Readership Survey.** A (hypothetical) survey revealed the following results about the news sources that a sample of 130 people use:

TV/radio only	20	TV/radio and Internet only	12
Internet only	29	TV/radio and newspapers only	18
Newspapers only	15	Internet and newspapers only	22
None	6	All three sources	8

- a. Draw a three-circle Venn diagram that summarizes the results of the survey.
- b. How many people use (at least) TV/radio and newspapers?
- c. How many people use TV/radio or Internet?
- d. How many people use TV/radio or Internet, but not newspapers?
- e. How many people use Internet, but not TV/radio?
- f. How many people use TV/radio, but not newspapers?
71. **Hospital Drug Use.** Patients in a (hypothetical) hospital on a single day were taking antibiotics (A), blood pressure medication (BP), and pain medication (P) in the following numbers:

A only	12	A and BP only	15
BP only	8	A and P only	24
P only	22	BP and P only	16
None	2	All three	20

- a. Draw a three-circle Venn diagram that summarizes the results in the table.
- b. How many patients took antibiotics or blood pressure medication?
- c. How many patients took blood pressure medication, but not pain medication?
- d. How many patients took (at least) pain medication?
- e. How many patients took antibiotics and blood pressure medicine, but not pain medication?
- f. How many patients took antibiotics or blood pressure medicine or pain medication?
72. **Is It Possible?** In a taste test, shoppers are asked to sample three brands of vanilla ice cream. Each shopper is allowed to choose *all* of the brands that she or he finds acceptable (a shopper could list 0, 1, 2, or 3 brands). Is it possible to use a two-circle Venn diagram to display how many shoppers find each combination of brands acceptable? Is it possible to use a three-circle Venn diagram? Explain.

73–76: More Than Three Sets. Draw a Venn diagram that illustrates the relationships among the following sets. The diagram should have one circle for each set. In this case, a circle may lie entirely inside of other circles, it may overlap other circles, or it may be completely separate from other circles.

73. animals, house pets, dogs, cats, canaries
74. athletes, women, professional soccer players, amateur golfers, sedentary doctors
75. things that fly, birds, jets, hang gliders, eagles
76. painters, artists, musicians, pianists, violinists, abstract painters

77–78: Completing Two-Way Tables. Fill in the remaining entries in the following two-way tables.

77. A survey of 120 patrons at a restaurant gave the following preferences for entrees and drinks.

	Vegetarian	Meat/fish	Total
Wine	20		60
No wine		15	
Total			120

78. A car insurance company issued a monthly report showing the following numbers of claims filed by clients.

	Women	Men	Total
No claims			50
At least one claim		40	
Total	50	60	

79. **TV Demographics.** According to Nielsen Media Research, of the 113.1 million U.S. households with at least one television set in 2008, 53% have three or more television sets, 73% have a VCR player, and 88% receive basic cable service. Assume that a television set is needed in order to have a VCR or receive cable service. Answer the following questions or state that not enough information is given.

- What is the percentage of households (in the survey) with fewer than three television sets?
- What is the percentage of households with VCRs and basic cable?
- What is the percentage of households without a VCR?
- What is the percentage of households with three or more television sets and basic cable?
- How many households have three or more television sets?

80. **Health Clinic Data.** The records for a student health clinic show that during one month

- Of the 120 men who visited with flu or anemia, 60 had flu only and 10 had flu and anemia.
- Of the 150 women who visited with flu or anemia, 80 had flu only and 50 had anemia only.

a. Fill in the following table.

	Women	Men
Flu		
Anemia		
Both		
Total		

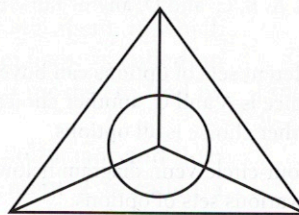
b. Draw a three-circle Venn diagram that represents the data. Which two regions of the diagram have no members?

81. **Obama Vote Breakdown.** The popular vote received by Barack Obama in the 2008 presidential election can be divided according to gender and party as follows (vote counts in millions are approximate).

	Women	Men
Democrats	23.80	21.11
Republicans	2.19	1.95
Independents and others	10.34	9.17

a. Show how a three-circle Venn diagram can be used to display the data in the table. Which regions of the diagram are not used? Label the regions and insert the numbers in the correct regions.

b. Show how all regions of the diagram below can be used to display the data in the table. Label the regions and insert the numbers in the correct regions.



82–84: **Organizing Propositions.** Draw a Venn diagram that represents the information in the following statements. Use the diagram (and no other information) to answer the questions that follow. Explain your reasoning.

82. All hairy animals are mammals. No mammals are fish. Some mammals can swim. No fish can walk on land.

Questions: Could there be hairy fish? Could there be hairy animals that swim? Could there be walking mammals? Could there be hairy animals that walk on land?

83. All meat has protein. All dairy products have protein. Some beans have protein. All beans, but no meat or dairy products, are plants.

Questions: Could there be beans that are dairy products? Could there be meat that is a dairy product? Could there be dairy products that are plants? Could there be plants with protein?

84. No Republicans are Democrats. No Republicans are Green Party members. All Republicans are conservative. Some liberals are Democrats. No liberals are conservatives.

Questions: Could there be conservative Democrats? Could there be liberal Green Party members? Could there be liberal Republicans?

85. **Organizing Politicos.** You are at a conference attended by men and women of various political parties. The conference organizer tells you that none of the women are Republicans and some (but not all) of the Democrats are women.

a. Draw a Venn diagram to organize the given information.

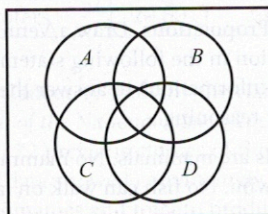
b. Based on the given information, is it possible to meet a woman who is neither a Republican nor a Democrat?

c. Based on the given information, is it possible that there are any male Republicans?

86. **Organizing Literature.** In reviewing for an exam in your literature survey course, you notice the following facts about the writers that you studied:

- Some of the novelists are also poets.
- None of the novelists are playwrights.
- All of the novelists were born in the 20th century.
- All of the writers born in the 19th century are playwrights.

- a. Organize these facts in a Venn diagram.
- b. Could you have studied a novelist born in the 19th century?
- c. Could you have studied a poet born in the 19th century?
- d. Could you have studied a writer born in the 20th century who was both a playwright and a poet?
87. **N-set Diagrams.** A computer store offers a basic computer with four options A, B, C, and D, any or none of which buyers can select.
- a. How many different sets of options can buyers choose? For example, one choice is A and C, another choice is no options, and another choice is all options.
- b. Consider the four-circle Venn diagram below. Label the regions with the various sets of options.



- c. Does the diagram in part b represent all the sets of options? If not, which sets of options are missing?
- d. Suppose the computer store offered five options A, B, C, D, and E. How many different sets of options would be available?
- e. Generalizing from parts a–d, how many different sets of options are available if the store offers N options, where $N = 2, 3, 4, \dots$?

WEB PROJECTS

88. **State Politics.** Determine from the Web how many states have a Republican majority in the State House and how many states have a Republican majority in the State Senate. Draw a Venn diagram to illustrate the situation.
89. **U.S. Presidents.** Use the Web to learn the following facts about each past American president:
- Bachelor or married (classify as married if married for part of the term)
 - Inaugurated before or after age 50
 - Served one term (or less) or more than one term
- Make a three-circle Venn diagram to represent your results.
90. **Web Venn Diagrams.** You can find many Venn diagrams on the Web (an image search may help). Choose one with interesting categories, and describe what it shows.

IN YOUR WORLD

91. **Categorical Propositions.** Find at least three examples of categorical propositions in news articles or advertisements. State the sets involved in each proposition and draw a Venn diagram for each proposition.
92. **Venn Diagrams in Your Life.** Describe a situation in your own life that could be described or organized using a Venn diagram.
93. **Quantitative Diagram.** Find a news article or research report with a table similar to Table 1.1 or Table 1.2. Draw a Venn diagram to represent the data in the table.

UNIT 1D Analyzing Arguments

With the skills acquired in the previous units, we are now ready to analyze arguments. Recall that an argument begins with a set of premises that are intended to support one or more conclusions (see Unit 1A). If an argument is well constructed, its conclusions follow from its premises in a compelling way. But how do we determine whether an argument is well constructed and compelling? We'll examine this question in this unit.

Two Types of Argument: Inductive and Deductive

Arguments come in two basic types, known as *inductive* and *deductive*. The following two arguments illustrate the two types. As you read each one carefully, ask yourself whether its premises lead to its conclusion in a compelling way.

Argument 1 (Inductive)

- Premise: Birds fly into the air but eventually come back down.
- Premise: People who jump into the air fall back down.
- Premise: Rocks thrown into the air come back down.
- Premise: Balls thrown into the air come back down.
- Conclusion:** What goes up must come down.