4.3 EXERCISES

List the first twenty counting numbers in each of the following bases.

1. seven (Only digits 0 through 6 are used in base seven.)

2. eight (Only digits 0 through 7 are used.)

3. nine (Only digits 0 through 8 are used.)

4. sixteen (The digits 0, 1, 2, . . . , 9, A, B, C, D, E, F are used in base sixteen.)

For each of the following, write (in the same base) the counting numbers just before and just after the given number. (Do not convert to base ten.)

5. 14_{five} **6.** 555_{six} **7.** $\text{B6F}_{\text{sixteen}}$ **8.** 10111_{two}

Determine the number of distinct symbols needed in each of the following positional systems.

9. base three **10.** base seven **11.** base eleven **12.** base sixteen

Determine, in each of the following bases, the smallest and largest four-digit numbers and their decimal equivalents.

13. three **14.** sixteen

Convert each of the following to decimal form by expanding in powers and by using the calculator shortcut.

EXERCISES

15. 24_{five} **16.** 62_{seven} **17.** 1011_{two} **18.** 35_{eight}

19. $3BC_{\text{sixteen}}$ **20.** 34432_{five} **21.** 2366_{seven} **22.** 101101110_{two}

23. 70266_{eight} **24.** $ABCD_{\text{sixteen}}$ **25.** 2023_{four} **26.** 6185_{nine}

27. 41533_{six} **28.** 88703_{nine}

Convert each of the following from decimal form to the given base.

29. 86 to base five **30.** 65 to base seven **31.** 19 to base two

32. 935 to base eight **33.** 147 to base sixteen **34.** 2730 to base sixteen

35. 36401 to base five **36.** 70893 to base seven **37.** 586 to base two

38. 12888 to base eight **39.** 8407 to base three **40.** 11028 to base four

41. 9346 to base six **42.** 99999 to base nine

Make the following conversions as indicated.

EXERCISES

43. 43_{five} to base seven **44.** 27_{eight} to base five

45. 6748_{nine} to base four **46.** $C02_{\text{sixteen}}$ to base seven

Convert each of the following from octal form to binary form.

47. 367_{eight} **48.** 2406_{eight}

Convert each of the following from binary form to octal form.

49. 100110111_{two} **50.** 11010111101_{two}

Make the following conversions as indicated.

EXERCISES

51. DC_{sixteen} to binary **52.** $F111_{\text{sixteen}}$ to binary

53. 101101_{two} to hexadecimal **54.** $101111011101000_{\text{two}}$ to hexadecimal

Identify the largest number from each list in Exercises 55 and 56.

55. 42_{seven}, 37_{eight}, $1D_{\text{sixteen}}$ **56.** 1101110_{two}, 407_{five}, $6F_{\text{sixteen}}$

There is a theory that twelve would be a better base than ten for general use. This is mainly because twelve has more divisors (1, 2, 3, 4, 6, 12) *than ten* (1, 2, 5, 10), *which makes fractions easier in base twelve. The base twelve system is called the* **duodecimal system.** *Just as in the decimal system we speak of a* one, *a* ten, *and a* hundred *(and so on), in the duodecimal system we say a* one, *a* dozen *(twelve), and a* gross *(twelve squared, or one hundred forty-four).*

57. Otis Taylor's clients ordered 9 gross, 10 dozen, and 11 copies of *The Minnie Minoso Story* during 2002. How many copies was that in base ten?

58. Which amount is larger: 3 gross, 6 dozen or 2 gross, 19 dozen?

One very common method of converting symbols into binary digits for computer processing is called ASCII (American Standard Code of Information Interchange). The uppercase letters A *through* Z *are assigned the numbers* 65 *through* 90, *so* A *has binary code* 1000001 *and* Z *has code* 1011010. *Lowercase letters* a *through* z *have codes* 97 *through* 122 *(that is,* 1100001 *through* 1111010*). ASCII codes, as well as other numerical computer output, normally appear without commas.*

Write the binary code for each of the following letters.

59. C **60.** X **61.** k

Break each of the following into groups of seven digits and write as letters.

62. 1001000100010110011001010000 **63.** 10000111001000101010110000111001011

Translate each word into an ASCII string of binary digits. (Be sure to distinguish upper and lowercase letters.)

64. New **65.** Orleans

66. Explain why the octal and hexadecimal systems are convenient for people who code for computers.

67. There are thirty-seven counting numbers whose base eight numerals contain two digits but whose base three numerals contain four digits. Find the smallest and largest of these numbers.

Refer to Table 9 for Exercises 68–71.

68. After observing the binary forms of the numbers 1–31, identify a common property of all Table 9 numbers in each of the following columns.

(a) Column A **(b)** Column B **(c)** Column C **(d)** Column D **(e)** Column E

69. Explain how the "trick" of Table 9 works.

70. How many columns would be needed for Table 9 to include all ages up to 63?

71. How many columns would be needed for Table 9 to include all numbers up to 127?

In our decimal system, we distinguish odd and even numbers by looking at their ones (or units) digits. If the ones digit is even (0, 2, 4, 6, *or* 8), *the number is even. If the ones digit is odd* (1, 3, 5, 7, *or* 9), *the number is odd. For Exercises 72–79, determine whether this same criterion works for numbers expressed in the given bases.*

72. two **73.** three **74.** four **75.** five

76. six **77.** seven **78.** eight **79.** nine

80. Consider all even bases. If the criterion works for all, explain why. If not, find one that does work for all even bases.

81. Consider all odd bases. If the criterion works for all, explain why. If not, find one that does work for all odd bases.

Determine whether the given base five numeral represents one that is divisible by five.

82. 3204_{five} **83.** 200_{five} **84.** 2310_{five} **85.** 342_{five}