Exercises

1. **Zip Codes** How many 5-digit zip codes are possible if digits can be repeated? If there cannot be repetitions? 100,000; 30,240

2. **Batting Order** How many ways can a baseball manager arrange a batting order of 9 players? 362,880

3. **Video Games** How many different ways can 6 different video game cartridges be arranged on a shelf? 720

4. **Visiting Nurses** How many different ways can a visiting nurse visit 9 patients if she wants to visit them all in one day? 362,880

5. **Laundry Soap Display** A store manager wishes to display 7 different kinds of laundry soap in a row. How many different ways can this be done? 5040 ways

6. **Show Programs** Three bands and two comics are performing for a student talent show. How many different programs (in terms of order) can be arranged? How many if the comics must perform between bands? 120; 12

7. **Campus Tours** Student volunteers take visitors on a tour of 10 campus buildings. How many different tours are possible? (Assume order is important.) 3,628,000

8. **Radio Station Call Letters** The call letters of a radio station must have 4 letters. The first letter must be a K or a W. How many different station call letters can be made if repetitions are not allowed? If repetitions are allowed? 27,600; 35,152

9. **Identification Tags** How many different 3-digit identification tags can be made if the digits can be used more than once? If the first digit must be a 5 and repetitions are not permitted? 1000; 72

10. **Secret Code Word** How many 4-letter code words can be made using the letters in the word *pencil* if repetitions are permitted? If repetitions are not permitted? 1296; 360

11. **Selection of Officers** Six students are running for the positions of president and vice-president, and five students are running for secretary and treasurer. If the two highest vote getters in each of the two contests are elected, how many winning combinations can there be? 600

12. **Automobile Trips** There are 2 major roads from city X to city Y and 4 major roads from city Y to city Z. How many different trips can be made from city X to city Z passing through city Y? 8

13. Evaluate each of these.

    a. 8! 40,320
    b. 10! 3,628,800
    c. 0! 1
    d. 1! 1
    e. ${}_7P_5$ 2520
    f. ${}_{12}P_4$ 11,880
    g. ${}_5P_3$ 60
    h. ${}_6P_0$ 1
    i. ${}_5P_5$ 120
    j. ${}_6P_2$ 30

14. **County Assessments** The County Assessment Bureau decides to reassess homes in 8 different areas. How many different ways can this be accomplished? 40,320

15. **Sports Car Stripes** How many different 4-color code stripes can be made on a sports car if each code consists of the colors green, red, blue, and white? All colors are used only once. 24

16. **Manufacturing Tests** An inspector must select 3 tests to perform in a certain order on a manufactured part. He has a choice of 7 tests. How many ways can he perform 3 different tests? 210

17. **Threatened Species of Reptiles** There are 22 threatened species of reptiles in the United States. In how many ways can you choose 4 to write about? (Order is not important.) 7315

    Source: www.infoplease.com

18. **Inspecting Restaurants** How many different ways can a city health department inspector visit 5 restaurants in a city with 10 restaurants? 30,240

19. How many different 4-letter permutations can be formed from the letters in the word *decagon*? 840

20. **Cell Phone Models** A particular cell phone company offers 4 models of phones, each in 6 different colors and each available with any one of 5 calling plans. How many combinations are possible? 120

21. **ID Cards** How many different ID cards can be made if there are 6 digits on a card and no digit can be used more than once? 151,200

22. **Free-Sample Requests** An online coupon service has 13 offers for free samples. How may different requests are possible if a customer must request exactly 3 free samples? How many are possible if the customer may request up to 3 free samples? 286; 378 (count 0)

23. **Ticket Selection** How many different ways can 4 tickets be selected from 50 tickets if each ticket wins a different prize? 5,527,200

24. **Movie Selections** The Foreign Language Club is showing a four-movie marathon of subtitled movies. How many ways can they choose 4 from the 11 available? 330

25. **Task Assignments** How many ways can an adviser choose 4 students from a class of 12 if they are all assigned the same task? How many ways can the students be chosen if they are each given a different task? 495; 11,880

26. **Agency Cases** An investigative agency has 7 cases and 5 agents. How many different ways can the cases be assigned if only 1 case is assigned to each agent? 2520

27. (ans) Evaluate each expression.

a. ${}_5C_2$ 10 *d.* ${}_6C_2$ 15 *g.* ${}_3C_3$ 1 *j.* ${}_4C_3$ 4
b. ${}_8C_3$ 56 *e.* ${}_6C_4$ 15 *h.* ${}_9C_7$ 36
c. ${}_7C_4$ 35 *f.* ${}_3C_0$ 1 *i.* ${}_{12}C_2$ 66

28. Selecting Cards How many ways can 3 cards be selected from a standard deck of 52 cards, disregarding the order of selection? 22,100

29. Selecting Coins How many ways can a person select 3 coins from a box consisting of a penny, a nickel, a dime, a quarter, a half-dollar, and a one-dollar coin? 120

30. Selecting Players How many ways can 4 baseball players and 3 basketball players be selected from 12 baseball players and 9 basketball players? 41,580

31. Selecting a Committee How many ways can a committee of 4 people be selected from a group of 10 people? 210

32. Selecting Christmas Presents If a person can select 3 presents from 10 presents under a Christmas tree, how many different combinations are there? 120

33. Questions for a Test How many different tests can be made from a test bank of 20 questions if the test consists of 5 questions? 15,504

34. Promotional Program The general manager of a fast-food restaurant chain must select 6 restaurants from 11 for a promotional program. How many different possible ways can this selection be done? 462

35. Music Program Selections A jazz band has prepared 18 selections for a concert tour. At each stop they will perform 10. How many different programs are possible? How many programs are possible if they always begin with the same song and end with the same song? 43,758; 12,870

36. Freight Train Cars In a train yard there are 4 tank cars, 12 boxcars, and 7 flatcars. How many ways can a train be made up consisting of 2 tank cars, 5 boxcars, and 3 flatcars? (In this case, order is not important.) 166,320

37. Selecting a Committee There are 7 women and 5 men in a department. How many ways can a committee of 4 people be selected? How many ways can this committee be selected if there must be 2 men and 2 women on the committee? How many ways can this committee be selected if there must be at least 2 women on the committee? 495; 210; 420

38. Selecting Cereal Boxes Wake Up cereal comes in 2 types, crispy and crunchy. If a researcher has 10 boxes of each, how many ways can she select 3 boxes of each for a quality control test? 14,400

39. Hawaiian Words The Hawaiian alphabet consists of 7 consonants and 5 vowels. How many three-letter "words" are possible if there are never two consonants together and if a word must always end in a vowel? 475

40. Selecting a Jury How many ways can a jury of 6 women and 6 men be selected from 10 women and 12 men? 194,040

41. Selecting a Golf Foursome How many ways can a foursome of 2 men and 2 women be selected from 10 men and 12 women in a golf club? 2970

42. Investigative Team The state narcotics bureau must form a 5-member investigative team. If it has 25 agents from which to choose, how many different possible teams can be formed? 53,130

43. Dominoes A domino is a flat rectangular block the face of which is divided into two square parts, each part showing from zero to six pips (or dots). Playing a game consists of playing dominoes with a matching number of pips. Explain why there are 28 dominoes in a complete set. ${}_7C_2$ is 21 combinations + 7 double tiles = 28

44. Charity Event Participants There are 16 seniors and 15 juniors in a particular social organization. In how many ways can 4 seniors and 2 juniors be chosen to participate in a charity event? 191,100

45. Selecting Commercials How many ways can a person select 7 television commercials from 11 television commercials? 330

46. DVD Selection How many ways can a person select 8 DVDs from a display of 13 DVDs? 1287

47. Candy Bar Selection How many ways can a person select 6 candy bars from a list of 10 and 6 salty snacks from a list of 12 to put in a vending machine? 194,040

48. Selecting a Location An advertising manager decides to have an ad campaign in which 8 special calculators will be hidden at various locations in a shopping mall. If he has 17 locations from which to pick, how many different possible combinations can he choose? 24,310

Permutations and Combinations

49. Selecting Posters A buyer decides to stock 8 different posters. How many ways can she select these 8 if there are 20 from which to choose? 125,970

50. Test Marketing Products Anderson Research Company decides to test-market a product in 6 areas. How many different ways can 3 areas be selected in a certain order for the first test? 120

51. Selecting Rats How many different ways can a researcher select 5 rats from 20 rats and assign each to a different test? 1,860,480

52. Selecting Musicals How many different ways can a theatrical group select 2 musicals and 3 dramas from 11 musicals and 8 dramas to be presented during the year? 3080