1 A game consists of flipping a coin twice. Draw a tree diagram which enumerates all possible combined outcomes for the game.

2 A game consists of flipping a coin three times in a row. Draw a tree diagram which enumerates all possible combined outcomes for the game.

3 **Emissions Control** An automobile inspection station inspects vehicles for level of air pollution emissions. Vehicles either pass (P) or fail (F) the inspection. Draw a decision tree which enumerates the possible outcomes associated with five consecutive automobile inspections.

4 **Health Profile** A cancer research project classifies persons in four categories: male or female; heavy smoker, moderate smoker, or nonsmoker; regular exercise program or no regular program; overweight or not overweight. Draw a tree diagram to enumerate all possible classifications of persons.

Use the fundamental counting principle to solve Exercises 5–8.

5 A license plate consists of two letters followed by three single-digit numbers. Determine the number of different license plate codes which are possible. $26 \times 26 \times 10 \times 10 \times 10$

6 **College Admissions** The admissions office at a local university classifies applicants as male or female; in-state or out-of-state; preferred college within the university (Engineering, Business, Liberal Arts, Education, and Pharmacy); above-average, average, or below-average SAT scores; and request for financial aid or no request for financial aid. Determine the number of possible applicant classifications. $2 \times 2 \times 5 \times 3 \times 2$

7 A student is planning his schedule for the fall. For the five courses he is considering there are three possible English instructors, six sociology instructors, four mathematics instructors, eight history instructors, and five political science instructors. Determine the number of different sets of instructors possible for his fall schedule. $3 \times 6 \times 4 \times 8 \times 5$

8 Determine the number of possible seven-digit telephone numbers if none of the first three digits can equal zero and:

(*a*) Any digits can be used for the remaining numbers. $9 \times 9 \times 9 \times 10 \times 10 \times 10 \times 10$

(*b*) The first digit must be odd, alternating after that between even and odd digits.

(*c*) All digits must be even. $4 \times 4 \times 4 \times 5 \times 5 \times 5 \times 5$ $5 \times 4 \times 5 \times 5 \times 5 \times 5 \times 5$

(*d*) No digit can be repeated. $9 \times 8 \times 7 \times 7 \times 6 \times 5 \times 4$

Evaluate the following factorial expressions.

9 $7!$

10 $9!$

11 $15!$

12 $(15 - 8)!$

13 $\dfrac{7!}{4!}$

14 $\dfrac{15!}{6!}$

15 $\dfrac{8! \cdot 5!}{6!}$

16 $\dfrac{15! \cdot 8!}{10!}$

17 $\dfrac{10!}{3! \cdot 6!}$

18 $\dfrac{10!}{8! \cdot 2!} = \dfrac{10 \times 9 \times 8!}{8! \times 2!} = 45$

19 $\dfrac{8!}{0! \cdot 5!}$

20 $\dfrac{9!}{3! \cdot 5!}$

23 ${}_8P_6$ $= \frac{8!}{2!} = 20160$

24 ${}_9P_4$

25 $\binom{5}{5}$

26 $\binom{6}{4} = {}_6C_4 = \frac{6!}{4!2!} = 15$

27 $\binom{8}{4}$

28 $\binom{7}{3}$

29 Ten horses are to be placed within a starting gate for a major sweepstakes race. How many different starting arrangements are possible? $10!$

30 A political candidate wishes to visit eight different states. In how many different orders can she visit these states? $8!$

31 The same political candidate in Exercise 30 has time and funds to visit only four states. How many different combinations of four states can she visit? ${}_8C_4$

32 A credit card company issues credit cards which have a three-letter prefix as part of the card number. A sample card number is ABC1234.

(*a*) If each letter of the prefix is to be different, how many prefixes are possible? $26 \times 25 \times 24$

(*b*) If each of the four numerals following the prefix is to be different, how many different four-digit sequences are possible? $10 \times 9 \times 8 \times 7$

33 Eight astronauts are being considered for the next flight team. If a flight team consists of three members, how many different combinations of astronauts could be considered? ${}_8C_3$

34 A portfolio management expert is considering 30 stocks for investment. Only 15 stocks will be selected for inclusion in a portfolio. How many different combinations of stocks can be considered? ${}_{30}C_{15}$

35 Four persons are to be selected for the board of directors of a local hospital. If twelve candidates have been selected, how many different groups of four could be selected for the board? ${}_{12}C_4$

36 Given a committee of ten persons, in how many ways can we select a chairperson, vice chairperson, and recording secretary? ${}_{10}P_3$

37 Six airline companies have submitted applications for operating over a new international route. Only two of the companies will be awarded permits to operate over the route. How many different sets of airlines could be selected? ${}_6C_2$

38 **Medical Research** A major research foundation is considering funding a set of medical research projects. Fifteen applications have been submitted, but only six will receive funding. How many different sets of projects could be funded? ${}_{15}C_6$

39 A bridge hand consists of 13 cards. How many different bridge hands can be dealt from a deck consisting of 52 cards? ${}_{52}C_{13}$

***40** **Design Team** The president of a major corporation has decided to undertake the development of a major new product which will give the corporation a significant competitive edge. The president wants to appoint a special product design team which will consist of three engineers, one marketing research analyst, one financial analyst, and two production supervisors. There are eight engineers, four marketing research analysts, six financial analysts, and five production supervisors being considered for the team. How many different design teams could be created?

${}_8C_3 \times {}_4C_1 \times {}_6C_1 \times {}_5C_2$

***41** **Education** The chairperson of a high school mathematics department wants to select eight seniors, six juniors, five sophomores, and four freshmen for the high school mathematics team. Ten seniors, eight juniors, eight sophomores, and six freshmen have applied for the team and have qualified on the basis of their mathematics grades. How many different teams could the chairperson select from this group?

${}_{10}C_8 \times {}_8C_6 \times {}_8C_6 \times {}_6C_4$