Review: Fundamental Counting Principle, Permutations, and Combinations

The Fundamental Counting Principle

1) A briefcase lock has 3 rotating cylinders, each containing 10 digits. How many numerical codes are possible?

$$10 \times 10 \times 10 = 1000$$

2) A golf club manufacturer makes irons with 7 different shaft lengths, 3 different grips, 5 different lies, and 2 different club head materials. How many different combinations are offered?

$$7 \times 3 \times 5 \times 2 = 210$$

3) There are five different routes that a commuter can take from her home to the office. In how many ways can she make a round trip if she uses a different route coming than going?

$$5 \times 4 = 20$$

4) In how many ways can the 4 call letters of a radio station be arranged if the first letter must be W or K and no letters repeat?

$$2 \times 25 \times 24 \times 23 = 27,600$$

5) How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1?

$$8 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 8,000,000$$

6) How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1 and if no digit can be repeated?

$$8 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 = 483,840$$

7) The letters A, B, C, and D are used to form four-letter passwords for entering a computer file. How many passwords are possible if letters can be repeated any number of times?

$$4 \times 4 \times 4 \times 4 = 256$$

8) How many ways can the first five letters of the alphabet be arranged if each is used only once?

$$5! = 120$$

9) A restaurant serves 5 main dishes, 3 salads, and 4 desserts. How many different meals could be ordered if each has a main dish, a salad and a dessert?

$$5 \times 4 \times 3 = 60$$

10) How many different ways can 4 different books be arranged on the shelf?

$$4! = 24$$

11) How many 5-digit even numbers can be formed using digits 2, 4, 6, 7, 8, if digits can be repeated any number of times?

$$5 \times 5 \times 5 \times 5 \times 4 = 2500$$

12) How many 4-digit positive even integers are there?

$9 \times 10 \times 10 \times 5 = 4500$

13) How many license plate numbers consisting of three letters followed by three numbers are possible when repetition is allowed?

$26 \times 26 \times 26 \times 10 \times 10 \times 10 = 17,576,000$

14) How many combinations are possible using the information in problem 13 if no repetition is allowed?

Permutations $26 \times 25 \times 24 \times 10 \times 9 \times 8 = 11,232,000$

How many different ways can the letters of each word be arranged?

15) CANADA $\dfrac{6!}{3!} = 120$

16) ILLINI $\dfrac{6!}{3!2!} = 60$

17) ANNUALLY $\dfrac{8!}{2!2!2!} = 5040$

18) MEMBERS

19) MONDAY $\dfrac{7!}{2!2!} = 1260$

20) MOM $6! = 720$

21) STEREO $\dfrac{3!}{2!} = 3$

$\dfrac{6!}{2!} = 360$

22) A photographer is taking a picture of a bride and groom together with 6 attendants. How many ways can he arrange the 8 people in a line if the bride and groom stand in the middle? must be bride or groom

$6 \times 5 \times 4 \times \underline{2 \times 1} \times 3 \times 2 \times 1 = 1440$

23) How many ways can 3 identical pen sets and 5 identical watches be given to 8 graduates if each receives one item? $\dfrac{8!}{5!3!} = 56$

24) How many ways can 8 members of a family be seated side-by-side in a movie theater if the father is seated on the aisle?

$1 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5040$

25) How many ways can 3 books be placed on a shelf if chosen from a selection of 7 different books?

$7 \cdot 6 \cdot 5 = 210$

Combinations

26) How many 4-person bobsled teams can be chosen from a group of 9 athletes?

$$9C4 = 126$$

27) From a dessert cart in a fine restaurant, customers are allowed to pick 3 desserts from the 10 that are displayed. How many combinations are possible?

$$10C3 = 120$$

28) How many diagonals does a polygon with 12 sides have?

$$12C2 \ -12 \ = \ 54$$

29) How many 5-sided polygons can be formed by joining any 5 of 11 points located on a circle?

$$11C5 \ = 462$$

30) There are 15 different books. How many groups of 6 books can be selected?

$$15C6 \ = \ 5005$$

31) How many tennis teams of 6 players can be formed from 14 players without regard to position played?

$$14C6 = 3003$$

32) From a group of 10 men and 12 women, how many committees of 5 men and 6 women can be formed?

$$(10C5)(12C6) \ = \ 232,848$$

33) From a standard deck of 52 cards, how many ways can 5 cards be drawn?

$$52C5 \ = \ 2,598,960$$

34) An urn contains 8 white, 6 blue, and 9 red balls. How many ways can 6 balls be selected to meet each condition.

$9C6$ a. All balls are red 84

$(6C3)(8C2)(9C1)$ b. Three are blue, 2 are white and 1 is red. 5040

$(6C2)(9C4)$ c. Two are blue, 4 are red. 1890

$(8C4)(15C2)$ d. Exactly 4 balls are white. 7350

Determine whether each situation involves a permutation or a combination.

35) Arrangement of 10 books on a shelf. P

36) Selection of a committee of 3 from 10 people. C

37) A hand of 6 cards from a deck of 52 cards. C

38) A subset of 12 elements contained in a set of 26. C

39) A guest list of 3 friends that your family has said you can invite to dinner.

C