Chapter 2 Homework Problems
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Section 2.1

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1. An automobile dealer offers five models. Each model comes in a choice of four colors, three types of stereo equipment, and with or without air conditioning. In how many different ways can a customer order an auto from this dealer?

2. A license plate consists of three letters followed by two digits. How many different license plates are possible if the letters must be different and all of the digits are even?

3. How many different four digit numbers are there that are odd and greater than 6000?

4. How many five digit numbers are multiples of five and greater than 29,999?

5. An exam consists of 6 true/false questions and 5 multiple choice questions, each with 4 possible answers. How many ways can the exam be worked if each question is answered?

6. An exam consists of 15 multiple choice questions. The first nine questions each have 4 choices and the last 6 questions each have 6 choices. How many ways can the answer sheet be turned in if students are allowed to leave questions blank?

7. How many three-letter identification codes can be constructed from the first 15 letters of the alphabet if the first letter must be a B, a C, or a D and no letters may occur more than once.

8. Five boys and 4 girls are to be seated in a row that has 9 seats.

   (a) How many ways can this be done if they alternate seats?

   (b) How many ways can this be done if the girls sit together?

9. How many ways can 7 boys and 4 girls be placed in a row and have them alternate seats?

10. Susan, Sara, Jill, Fred, Jim, Jacob, and Randy sit in a row with Jacob or Fred in the middle seat and Randy sitting next to Susan. How many ways can this be done?

11. A license plate in the metropolis Metropolitan Area consists of two letters and then two digits followed by either a bat logo or an S. The two letters must be different and neither digit is permitted to be a zero. How many different license plates are possible?

12. A license plate in the metropolis Metropolitan Area consists of two letters and two digits followed by either a bat logo or an S. The two letters must be different and neither digit is permitted to be a zero. How many different license plates are possible?

13. Serial numbers assigned to a bicycle by a manufacture have a first symbol of J, H, or T to indicate the plant in which made, followed by 01, 02, 03,..., or 12 to indicate the month in which made, followed by four digits. How many different serial numbers are possible?

14. In how many ways can you get a license plate consisting of three letters and two digits in any order with no digit or letter repeated?

15. You have 11 different books to place on a shelf. Four of the books are blue, 5 are green and 2 are red. In how many ways can all of the books be arranged on a shelf if books of the same color are to be placed together?

16. You have 3 different books written by Tom Clancy, 2 different books written by Zane Gray, 6 different books by R.A. Salvatore, and 5 different books written by Jim Butcher. How many ways can you arrange the books on a shelf if the books are grouped by author?

17. A carnival has a game where you roll three dice: one red, one green, and one blue. A player will win money if one or more fives are rolled. How many ways can somebody win at this game?

18. A yellow and black six-sided die are added to the game in problem 17. Now how many ways can somebody win at the game?

19. Four people are asked to write down an integer between 1 and 13 inclusive. How many ways can exactly 2 of the people pick an even number?

20. How many 4 symbol computer codes can be made using the letters **A, B, E, G, H ,I, J** and **K** if the code has to have at least one vowel? An example of a valid code is **ABBA**.

21. For a group of four people. How many ways can two of the people have the same birthday and everybody else have a different birthday?

22. A club is comprised of 6 guys and 9 girls. How many different photos can be made that consist of 5 club members in a row with the guys and girls alternate positions?

23. How many 3 digit numbers have at least one seven in them?

Additional problems covering the multiplication principle with streaming video solutions can be found in Counting Handout #1 located in the extra handout section on the class web page.

Section 2.2

24. Compute the following.

    (a) $C(4,2)C(48,3)+C(4,3)C(48,2)+C(4,4)C(48,1) =$
    (b) $C(52,5) - [C(4,0)C(48,5) + C(4,1)C(48,4)] =$
    (c) $\dfrac{10!}{3!4!2!} =$
    (d) $C(5,3)P(6,3) =$
    (e) $13C(4,3) * 12C(4,2) =$
    (f) $\dfrac{7^3 - 7}{7^3} =$
    (g) $\dfrac{C(12,8)C(13,2) + C(12,9)C(13,1) + C(12,10)}{C(25,10)} =$
    (h) $C(450,1) =$
    (i) $P(450,1) =$
    (j) $C(450,0) =$
    (k) $P(450,0) =$
    (l) $4!C(5,2)P(5,3) =$

25. From a pool of 7 secretaries, three are selected to be assigned to 3 managers, one per manager. In how many ways can they be selected and assigned?

26. How many 6 card hands are possible that have exactly two hearts and exactly three spades?

27. Five freshmen, four sophomores, and two juniors are present at a meeting of students. In how many ways can a six-member committee that contains three freshmen and two sophomores be formed?

28. A child has a set of plastic objects. There are 2 pyramids (all identical), 3 cubes (all identical), and 6 spheres (all identical). How many ways can the child place all of the objects in a row.

29. A company has five vacancies in its executive trainee program. In how many ways can the company select five trainees from a group of ten female and eight male applicants if the vacancies must be filled by two women and three men?

30. Codes to identify entries in a computer file are formed by using sequences of four zeros and six ones. How many such sequences are possible?

31. A prize committee is awarding prizes to 7 different people. In how many ways can 3 different prizes be awarded so that no person can win more than two prizes?

32. The Scholarship Committee needs to select a recipient for each of 4 different scholarships from a pool of 15 applicants. How many ways can the scholarships be awarded to the applicants, if no applicant can win more than one scholarship?

33. How many 6-person committees are possible from a group of 12 people if:

    (a) Jim, Susan, and Mary must be on the committee?
    (b) Only one of the group of Jim, Susan, or Mary must be on the committee?

34. How many different ways can the letters of the work **BOOKKEEPER** be arranged?

35. How many different ways can I rearrange the letters of the word **Millimicron**?

36. A box contains 2 red, 5 green and 7 black balls. A sample of three balls is to be picked from the box. In how many ways can a sample be selected so that

    (a) Exactly two of the balls are the same color?
    (b) At least 2 of the balls will be green?

37. From a shipment of 60 transistors, 10 of which are defective, a sample of 7 is selected at random.

    (a) How many samples contain 4 defective transistors?
    (b) How many samples contain at most 6 defective transistors?

38. A box has 5 red balls, 6 green balls, and 4 purple balls. A sample of 6 balls is selected.

    (a) In how many ways can you get at least 3 red and at least 1 purple?
    (b) In how many ways can you get exactly 2 red or exactly 3 purple?

39. Two freshmen, 5 sophomores and 12 juniors all apply to attend a national conference. If three of these students are selected to attend the conference, how many ways can

    (a) All the students have the same classification.
    (b) More freshmen than juniors are selected.

40. A student taking an examination is required to answer 10 out of 15 questions. In how many ways can the 10 questions be selected if exactly 2 of the first 3 questions must be answered?

41. A child has three pennies, five nickels, and four dimes. In how many ways can two coins of the same denomination be selected?

42. David is selecting 10 kids from a group of 30 kids to form a summer basketball team. The group of 30 kids is made up of 9 thirteen-year-olds, 13 fourteen-year-olds, and 8 fifteen-year-olds.

    (a) In how many ways can any of the 10 kids be selected?

(b) In how many ways can the 10 kids be selected if due to league rules a team has to have exactly 3 kids that are fifteen-years-old?

43. A box contains 7 red, 6 green, 5 black, and 3 purple balls. How many ways can a sample of 7 balls be selected that contains only three red and only 2 black?

44. A box contains 7 red, 4 green, 5 black, and 2 purple balls. How many ways can a sample of 4 be selected such that

   (a) All the same color.

   (b) Exactly three of the balls the same color.

45. A fruit stand has 30 apples, 14 peaches, 6 plums, and 15 pears. If you buy 7 pieces of fruit,

   (a) How many ways can you select exactly 2 apple and exactly 4 peaches?

   (b) How many ways can you select exactly 4 plums or exactly 3 pears?

46. Billy has 43 baseball cards and Scottie has 36. How many ways can Billy trade three of his cards for three of Scottie's cards?

47. A box contains 10 green, 7 yellow, and 5 pink balls. How many ways can a sample of 4 balls be selected that contains at least two yellow balls?

48. Your chemistry exam is going to be 20 questions. Your prof, in a fit of kindness, tells you that 7 of the questions have the answer A, 2 of the questions have the answer B, four of the questions have the answer C, six of the questions have the answer D and one question has the answer E. Using this information, how many ways can you answer the exam?

49. How many 6 card hands have exactly 2 hearts or exactly 3 spades?

50. You have 10 blocks that are identical except for their color. Six of them are red and 4 are green. You also have 15 identical sheets of notebook paper. You want to place the sheets of paper in a row and put the blocks on the sheets of paper such no piece of paper has more than one block. How many ways can this be done?

51. An exam is written so that it has 3 parts. The number of questions in each part is in the table.

	Part A	Part B	Part C
number of questions	5	6	4

The prof has stipulated that you must answer exactly 3 questions from part A and at least 4 questions from part B. In how many ways can you select 10 questions to answer.

See counting handout #2 and counting handout #3, found in the extra handout section on the class web page, for additional counting problems. Also has streaming video solutions.

Section 2.3

52. A child has eight cans of soft drinks, four different brands with one regular and one diet drink for each brand. The child arranges four of the cans in a row in a random manner. Find the probability that the first two are diet drinks and the second two are regular.

53. Fifteen cards are numbered 1 through 15. The cards are shuffled, and three cards are drawn and arranged in a row.

   (a) Find the probability that the first is odd and the second is even.

   (b) Find the probability that the first two are odd, and the third is an even number greater than 9.

54. Jason has 11 posters that have been categorized into three categories: sport cars (5 posters), bands (4 posters), and athletes (2 posters). Assume that none of the posters are duplicates. What is the probability that when Jason hangs the posters on a wall in a row that the posters of the same category are grouped together?

55. City Transit Authority is hiring 10 bus drivers. Twenty guys and 30 girls apply for the job. If it is stipulated that and equal number of men and women are to be selected (5 men and 5 women), what is the probability that Bob, Phill and Sara are hired?

56. One hundred people are applying for 10 jobs as lifeguards at a local beach. A group of seven friends are among those that applying. What is the probability that exactly 3 of the friends will be hired as lifeguards?

57. Four couples attend a concert and sit in a row that has eight seats. If the couples are randomly seated, what is the probability that each couple is seated together?

58. A box has 4 red blocks and 5 green blocks. If two blocks are selected at random, find the probability that they are the same color.

59. A box contains 10 red, 8 green, and 6 blue marbles. What is the probability that a sample of 6 marbles contains exactly 4 green marbles or exactly 2 blue marbles?

60. Rita is setting up a window display in her flower shop. She wants to display 12 different flower arrangements on three shelves. Each shelf will hold 4 flower arrangements. What is the probability that the 4 arrangements that feature roses are placed on the same shelf?

61. There are 12 freshmen, 9 sophomores and 1 senior in a class. If three students are selected at random, find the probability that at least two are freshmen.

62. A shipment of 10 typewriters contain 2 that are defective. Find the probability that a sample of 4,

    (a) will not contain any defective typewriter.

    (b) will contain exactly one defective typewriter.

63. A manager at a music store wants to feature four of the top 8 local artist: A, B, C, D, E, F, G, and H in the store for the next month. What is the probability that he will select artist A and B?

64. There are 10 banks in a city and 6 of them offer students a discount on checking accounts. A student calls 6 banks at random and asks if they offer a discount. Find the probability that exactly 5 of the banks questioned offer a discount.

65. A student studying for a vocabulary test knows the meanings of 13 words from a list of 25 words. If the test contains 10 word from the study list, what is the probability that at least 9 of the words on the test are words that the student knows?

66. Find the probability that in a group of 7 people that at least two of them were born in July. Assume that all months are equally likely.

67. Find the probability that in a group of 20 people that

    (a) everybody was born on a different day.

    (b) at least two people were born on the same day.

68. Three people are selected at random from five females and 7 males. Find the probability that at most two are male.

Section 2.4

69. A biology quiz consists of eight multiple choice questions. Six must be answered correctly to receive a passing grade. Each question has five possible answers of which only one is correct. If a student randomly guesses at each question,

    (a) Find the probability that they get only the first six questions correct.

    (b) Find is the probability that they will pass the examination.

70. The probability of an adverse reaction to a flu shot is 0.15. Flu shots are given to a group of 80 people.

    (a) Find the probability that exactly 5 of these people will have an adverse reaction to the shot.

    (b) Find the probability that less than 16 people will have an adverse reaction to the shot.

    (c) Find the probability that at least 3 and less than 11 people will have an adverse reaction to the shot

    (d) Find the probability that at most 20 and more than 12 people will have an adverse reaction to the shot.

71. Bob is taking a 10 question multiple choice exam and he will answer all of the questions. Each question has 6 choices with only one correct answer. If Bob guesses at all of the questions,

    (a) What is the probability that he will only get the first four questions correct?

    (b) What is the probability that Bob will get at most 3 questions correct?

    (c) What is the probability that Bob will get exactly 1, 2, or 6 questions correct?

72. The probability that a certain machine turns out a defective item is 0.05. A run of 75 items is produced. Find the probability that exactly 5 defective items are obtained.

73. A die is rolled 12 times. Find the probability of rolling the following.

    (a) Exactly 6 ones.

    (b) no more then 3 ones.

74. Brian makes 65% of his free throws in basketball. Find the probability that he makes at least three out of five free throws assuming that there is independence between his free throw shots.

75. A new drug cures 70% of the people taking it. Suppose 20 people take the drug; find the probability of the following

    (a) exactly 18 people are cured.

    (b) at least 17 people are cured.

    (c) exactly 10, 11, 12, 15, or 16 are cured.

76. Find the probability that in a group of 7 people that at least two of them were born in July.

    (a) Assume that all months are equally likely.

    (b) Assume that all days are equally likely.

77. In a group of 18 people, find the probability that more than 3 were born in the months of June, July or August. Assume that months are equally likely.

78. 6 cards are drawn from a standard deck of cards, with replacement after each draw.

    (a) Find the probability that only the first four draws give a card with an even number on it.

    (b) Find the probability that exactly four of the draws give a card with an even number on it.