

Chapter 7 Homework Problems

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Additional problems over chapter 7, with video solutions, can be found in the handout section of the class web page.

Section 7.1

1. An experiment consists of tossing a fair coin and drawing a ball from a box that contains 3 red and 2 white balls.

- (a) What is the sample space?
 (b) Give two events that are mutually exclusive for this experiment.

2. Seven slips of paper are numbered with a different digit from the digits 1, 2, 3, 4, 5, 6, and 7 and placed in a box. After being mixed, two slips are drawn simultaneously.

- (a) Write out the sample space for this experiment.
 (b) Write out the event E that both slips are marked with an odd number.
 (c) Write out the event F that both slips are marked with an even number.
 (d) Does $E \cup F = S$?
 (e) Give two events that are mutually exclusive.

3. A jar contains the following coins: 1 penny, 2 dimes, and 3 nickels. The experiment consists of drawing two coins without replacement and find the total value, in cents, of the coins drawn.

- (a) What is the sample space for this experiment?
 (b) Is the sample space equally likely? Justify your answer.

4. If the experiment is to flip a coin three times, give two events of the sample space that are mutually exclusive.

5. A box contains 4 white balls, 2 green balls, and 1 yellow ball. The experiment is to draw two balls from the box in succession without replacement.

- (a) What is the sample space of this experiment?
 (b) Give the event, G, that only one green ball is drawn.
 (c) Find an event, E, that will be mutually exclusive to G (from part b).

6. An experiment consists of selecting a letter at random from the letters in the word **REPRESENTATIVE** and observing the outcome.

- (a) Describe an appropriate sample space.
 (b) How many events does this sample space have?
 (c) Describe the event "the letter selected was a vowel".

Section 7.2 and 7.3

7. An experiment consists of tossing a fair coin and drawing a ball from a box that contains 3 red and 2 white balls.

- (a) Is the sample space equally likely? (explain)
 (b) Is the sample space uniform? (explain)

8. The sample space is $S = \{a, b, c, d\}$, where $P(a) = 0.15$, $P(b) = 0.25$, and $P(c) = 0.4$. Compute the following.

- (a) $P(d) =$
 (b) $P(\{a, b\}) =$

9. The sample space is $\{a, b, c\}$, where $P(a) + P(b) = .75$, $P(b) + P(c) = .45$. Find $P(a)$, $P(b)$, and $P(c)$.

10. The following is the sample space for an experiment with some of the probabilities given.

S	a	b	c	d	e
prob.	0.1	0.3			0.15

If the event $J = \{a, b, c\}$ and that $P(J^C) = 0.4$. Find the probabilities of the other outcomes.

11. The following is the sample space for an experiment with some of the probabilities given.

S	a	b	c	d	e
prob.				0.2	0.1

If the outcomes a and b are equally likely and that the event $J = \{b, c\}$ with $P(J^C) = 0.45$. Find the probabilities of the other outcomes.

12. An teacher looks back at a course that he has taught during the past years and has totaled up the different grades given. This information is given in the following table. Use it to answer the following questions.

Grades	A	B	C	D	F
frequency	7	20	25	17	21

- (a) If a student takes this class, what is the probability that the student makes an A or a B?
 (b) If a student takes this class, what is the probability that the student fails the class?

13. The table gives the results of a survey of students who were asked: How would you rate your math course? A= Awesome, B=Best class this semester, C= Cool, D= Dreadful, W= what's math.

Rating	A	B	C	D	W
Respondent	25	30	40	15	100

If a student, who completed the survey, is selected at random what is the probability that they gave an answer of A or B?

14. Ms Elliott invites 11 relatives to a party: her mother, 2 aunts, 3 uncles, 2 brothers, 1 male cousin and 2 female cousins. If the chance of any guest arriving first is equally likely, find the probability that the first guest to arrive is

- (a) a male.
- (b) a male or a cousin.

15. This table classifies the English, History, Math, and Poly Sci majors at State U according to their year. (There are no double majors.)

	Fresh.	Soph.	Jr.	Sr.	Totals
English(E)	64	35	31	41	171
History(H)	55	41	33	52	181
Math(M)	29	32	50	69	180
Poly Sci(PS)	70	33	41	37	181
Totals	218	141	155	199	713

If a student is selected at random, find the probability that

- (a) The student is a Poly Sci major and a Junior.
 - (b) The student is not a Junior and is an History major.
 - (c) The student is a English major or is a Senior.
 - (d) The student is Sophomore or a Senior.
16. A poll was conducted among 300 residents of a certain city regarding tougher gun-control laws. The results of the poll are shown in the accompanying table:

	Own only a handgun	Own only a rifle	own both	own neither	Total
F	15	12	5	138	170
O	58	5	25	4	92
N	12	9	5	12	38
Total	85	26	35	154	300

F = Favor tougher laws
 O = oppose tougher laws
 N = no opinion

If one of the participants in this poll is selected at random, what is the probability that he or she

- (a) owns a handgun?
 - (b) owns a handgun but not a rifle?
 - (c) opposes tougher gun-control laws and owns only a handgun?
 - (d) favors tougher gun-control laws or does not own a handgun?
17. A music store selected 1000 persons at random and surveyed them to determine a relationship between age of purchaser and monthly purchases of cds. The results are given in the table.

Monthly Purchases of CDs

Age	0	1	2	3	4 or More	Totals
Under 12	50	60	30	20	10	170
12-18	30	100	90	30	40	290
19-25	70	110	100	30	20	330
Over 25	100	50	40	10	10	210
Totals	250	320	260	90	80	1000

A person from the survey is selected at random. What is the probability that

- (a) They bought more than 2 CDs per month and are older than 18?
 - (b) They bought exactly 3 cds per month or are between 12 to 18 years old.
 - (c) They did not buy more than 2 cds each month.
18. E and F are events of an experiment with sample space S. Suppose $P(E^C) = 0.4$, $P(F) = 0.35$, and $P(E \cap F) = 0.2$. Compute
- (a) $P(E) =$
 - (b) $P(F^C \cap E) =$
 - (c) $P(E^C \cup F^C) =$
19. E and F are events of an experiment with sample space S. Suppose $P(E^C) = 0.6$, $P(F) = 0.5$, and $P(E \cup F) = 0.8$. Compute
- (a) $P(E) =$
 - (b) $P(F \cap E) =$
 - (c) $P(E \cap F^C) =$
20. E and F are events of an experiment with sample space S. Suppose $P(E) = 0.7$, $P(F^C) = 0.45$, and $P(E \cap F^C) = 0.4$. Compute

- (a) $P(F) =$
- (b) $P(F \cap E) =$
- (c) $P(E^C \cup F) =$

21. The events E and F are mutually exclusive. If the $P(E) = .25$ and $P(F) = .35$, compute

- (a) $P(E \cup F) =$
- (b) $P(E \cup F^C) =$

22. For the following experiment, S is the sample space and A, B, and C are events.

$$S = \{s_1, s_2, s_3, s_4, s_5, s_6\}$$

$$A = \{s_1, s_2, s_4\}$$

$$B = \{s_3, s_5, s_6\}$$

$$C = \{s_2, s_3, s_5\}$$

$$D = \{s_1, s_6\}$$

outcome	s_1	s_2	s_3	s_4	s_5	s_6
prob.	1/6	1/8	1/3	1/8	1/6	1/12

Find the following probabilities.

- (a) $P(A) =$
 (b) $P(A^C \cap C) =$
 (c) $P(C^C \cup B^C) =$
 (d) How many events does S have?
 (e) Which pair of events, $A, B, C,$ and $D,$ are mutually exclusive?
23. Roll two 6-sided die, one red and the other green. Find the probability of getting
- (a) a 4 on either die and a sum of 5.
 (b) a 3 on either die or a sum of 4.
 (c) a 6 on the red die and a number less than 3 on the green.
24. Roll a 6-sided die and a 4-sided die. Compute the probability of getting a 4 on either die or a sum of 7.

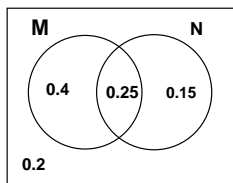
Section 7.4

25. Among 500 freshmen pursuing a business degree at a university, 320 are enrolled in an Economics course, 225 are enrolled in a mathematics course, and 140 are enrolled in both an Economic course and a mathematics course. If a freshman is selected at random from this group, what is the probability that they are enrolled in exactly one of these courses?
26. 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.
27. 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.
28. 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?
29. City Transit Authority is hiring 10 bus drivers. Twenty guys and 30 girls apply for the job. If it is stipulated that an 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?
30. 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?
31. 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?
32. 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.
33. 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?
34. 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?
35. 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.
36. 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.
37. 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?
38. 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.
39. 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?
40. 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.
41. 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.

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

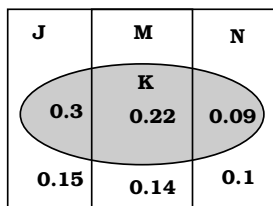
Section 7.5 and 7.6

43. Use the Venn diagram to answer the following.



- (a) $P(N|M) =$
 (b) $P(M|N) =$
44. The Venn diagram shows three mutually exclusive events J, M, and N and a event K that intersect all three of the other events. The numbers in the sections give the probability of each section. Use the Venn Diagram to answer these questions.

- (a) $P(J|K) =$
 (b) $P(M|K^C) =$
 (c) $P(M|N) =$



45. A mathematics professor assigns two problems for homework and knows that the probability of a student solving the first problem is 0.75, the probability of solving the second is 0.45, and the probability of solving both is 0.20.
- (a) Edna has solved the first problem, what is the probability that she solves the second problem?
 (b) Edna has solved the second problem, what is the probability that she does not solve the first problem?
46. The Science Club at the junior college (all freshmen and sophomores) has 42 students, 18 of whom are women. Seven of the students are freshmen and 1 of those is a woman. If a student is chosen at random from the club, find the probability that the student is a sophomore given the student is a man.
47. Refer to the chart in problem 16. One of the participants in this poll is selected at random.

- (a) What is the probability that he or she opposes tougher gun-control laws if the person only owns a rifle?

- (b) Knowing that the person selected owns a handgun, what is the probability that person opposes tougher gun-control laws?
 (c) What is the probability that a person that owns a rifle will favor tougher gun-control laws?

48. Refer to the chart in problem 17. A person from the survey is selected at random.

- (a) What is the probability that the person, who is over 25, purchases 2 cds monthly?
 (b) What is the probability that a person who purchases less than 2 cds each month will be in the age group 19-25?

49. Two freshmen, 5 sophomores and 12 juniors all apply to attend a national conference. If five of these students are selected to attend the conference, what is the probability that exactly three of the students are juniors if you know that David and Susan, who are both juniors, are two of the students picked to attend the conference.

50. An exam will be constructed by picking 10 questions from two different category of questions. There are 12 questions in the easy category and 8 questions in the difficult category. What is the probability that the exam will have exactly four questions from the difficult category if the prof has told you three of the questions that will be on the exam: two rated difficult and 1 rated easy.

51. E and F are events of an experiment with sample space S. Suppose $P(E^C) = 0.4$, $P(F) = 0.3$, and $P(E \cap F) = 0.2$. Compute

- (a) $P(F^C|E) =$
 (b) $P(E^C|F^C) =$
 (c) $P(F|E^C) =$

52. For the following experiment, S is the sample space and A, B, and C are events.

$$S = \{s_1, s_2, s_3, s_4, s_5, s_6\}$$

$$A = \{s_1, s_2, s_4\}$$

$$B = \{s_3, s_5, s_6\}$$

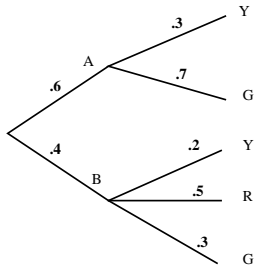
$$C = \{s_2, s_3, s_5\}$$

outcome	s_1	s_2	s_3	s_4	s_5	s_6
prob.	1/6	1/8	1/3	1/8	1/6	1/12

Find the following probabilities.

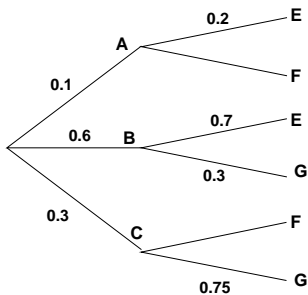
- (a) $P(A^C|C) =$
 (b) $P(C|B) =$

53. Use the tree to calculate the following probabilities.



- $P(Y) =$
- $P(B \cap (R \cup Y)) =$
- $P(G) =$
- $P(B \cap R) =$
- $P(A \cup G) =$
- $P(R|B) =$
- $P(G|A) =$
- $P(A|G) =$
- $P(B|R) =$
- $P(A|Y) =$
- $P(A|R) =$

54. Use the tree to compute the following.



- $P(E) =$
- $P(C \cap F) =$
- $P(F|A) =$
- $P(C|G) =$
- Are the events E and C independent?
- Are the events E and C mutually exclusive?
- Are the events E and B independent?
- Are the events E and B mutually exclusive?

55. A beautician's school is 75% female. After one month of school, 80% of the females and 45% of the males have mastered the 5 basic hair cuts. A student is selected at random.

- If the student picked has mastered the 5 basic hair cuts, what is the probability that the student is male?

(b) What is the probability that the student is female or has mastered the 5 basic hair cuts?

56. A box with 80 squirt guns, of which 20 leak. A small group of children come up and buy 6 squirt guns. What is the probability that the second child has a leaky gun given the third child doesn't have a leaky gun?

57. Sixty percent of the toasters in a warehouse come from the Hot-Slice Co., and of those toasters, 3% are defective; 40% come from the Warm Morning Co., and of those 5% are defective. What percentage of the toasters in the warehouse are not defective?

58. In a major city, 70% of the drivers are older than 25 years, and 12% of them will have a traffic violation during the next year. Of the drivers 25 years and younger, 28% of them will have a traffic violation during the next year.

(a) A driver is charged with a traffic violation. Find the probability that the driver is older than 25.

(b) Find the probability that a driver will be charged with a traffic violation during the next year.

59. It is known from past experience that the probability that a new worker who has attended the company's training program will meet the production quota is 90%; whereas, a new worker who has not attended the company's training program will meet the production quota is 45%. Seventy-five percent of all new workers attend the training program.

(a) A new worker is selected at random and is meeting the production quota, what is the probability that the worker attended the training program?

(b) A new worker is selected at random, What is the probability that a the worker is not meeting the production quota and did not attend the training program.

60. There are three urns: urn A has 3 red marbles and 4 yellow marbles, urn B has 1 red marble and 3 white marbles, and urn C has 2 red marbles and 3 white marbles. A die is rolled; if a 1 occurs, then a marble is selected from urn A; if a 2 or 3 occurs, then a marble is selected from urn B; otherwise a marble is selected from urn C.

(a) Find the probability that the marble is white and is from urn C.

(b) Find the probability that a red marble was drawn from urn B.

61. You draw 5 cards from a standard deck of cards. What is the probability that the 5th card is a heart if the first card was a diamond and the third card was a club?

62. A standard deck of cards is shuffled and 10 cards are placed on the table in a row. Your pest of a younger brother turns up these cards before you could stop him:

2nd card—Ace of clubs; 4th card—3 of diamonds, 5th card—3 of clubs, 7th card—king of hearts; 9th card—queen of spades; and 10th card—nine of clubs. Knowing the cards that Pest turned over,

- (a) What is the probability that the first card is a heart?
- (b) What is the probability that the third card is an Ace?
- (c) What is the probability that the seventh card is a Jack?
63. Students are randomly selected from a class one at a time and sent out of the room. This process is continued until a freshman is sent out of the room. The class has 3 freshman, 3 sophomores and 2 juniors. Compute the probability that two students are sent out of the room.
64. A box has 2 red balls, 5 green balls and 2 yellow balls. Balls are drawn from the box, one at a time without replacement, until a green ball is drawn.
- (a) What is the probability that three balls were drawn?
- (b) What is the probability that 6 balls were drawn?
65. A company manufactures integrated chips on silicon chips at two different plants: X and Y. 70% of the chips produced for this company come from plant X. It has been determined that plant X has a defect rate of 2% and plant Y has a defective rate of 10%.
- (a) A chip is selected at random, what is the probability that it is not defective.
- (b) What is the probability that a defective chip came from plant Y?
- (c) what is the probability that the chip selected was defective and came from plant Y?
66. An automobile manufacturer obtains the computer chips used to regulate fuel consumption in its automobiles from three different firms: A, B, and C. The quality-control department of the company has determined that 2% of the chips produced by firm A are defective, 6% of those produced by firm B are defective, and 9% of those produced by firm C are defective. Firms A, B, and C supply 30%, 20% and 50%, respectively, of the chips used by the company. A chip is selected at random,
- (a) What is the probability that the chip will have come from Firm C or Firm B and not be defective?
- (b) What is the probability that a chip from company C will not be defective?
- (c) What is the probability that the defective chip will come from Firm A?
67. Roll a 6-sided die and a 4-sided die. Find the probability of
- (a) Getting a 3 or a 4 on the six sided die if the sum was greater than 5.
- (b) Getting an odd sum greater than 6 if a 4 is on either of the dice.
- (c) Getting a sum of 4 given that the sum is at most 6.
- (d) Getting a sum of 4 given that the roll was a “double” (two identical numbers).
68. You have two bags. The first bag (Bag #1) has 3 red marbles and 5 black marbles. The second bag (Bag #2) has 4 red marbles and 7 black marbles. Draw one marble from the first bag, put into the second bag, and then draw 1 marble from the second bag.
- (a) Draw a probability tree for this problem.
- (b) Find the probability a black marble is drawn in the second draw.
- (c) Find the probability of a red marble from the second bag if a black marble was drawn from the first bag.
- (d) Find the probability of the transferred marble was red if the second marble drawn was black.
- (e) Find the probability of a red marble from the first bag if a red marble was drawn from the second bag.
69. You have two bags. The first bag (Bag #1) has 3 red marbles and 5 black marbles. The second bag (Bag #2) has 4 red marbles and 7 black marbles. Draw two marbles from the first bag, put them into the second bag, and then draw 1 marble from the second bag.
- Find the following.
- (a) Draw a probability tree for this problem.
- (b) Find the probability that of the three balls drawn that exactly two were black.
- (c) Find the probability of drawing a black marble from the second bag and two red marbles from the first bag.
- (d) Find the probability of drawing a red marble from the second bag provided that 1 red and 1 black are drawn from the first bag.
- (e) Find the probability that 1 red and 1 black are drawn from the first bag provided that a red marble was drawn from the second bag.
- (f) Find the probability that at least one red ball was transferred if a red ball was drawn from the second bag.
70. In a group of college students, 60 males and 75 females, 35% of the males and 40% of the females are from out of state. A student is randomly selected.
- (a) Find the probability that the guy is not from out of state.

- (b) Find the probability that the out of state student is a female.
- (c) Are the events $F = \{\text{a female is selected}\}$ and $O = \{\text{out of state student}\}$ independent from each other? Justify your answer.

71. Based on data obtained from the National Institute of Dental Research, it has been determined that 46% of 12-year-olds have never had a cavity, 26% of 13-year-olds have never had a cavity, and 14% of 14-year-olds have never had a cavity. A child is selected at random from a group of 24 junior high school students comprising six 12-year-olds, eight 13-year-olds, and ten 14-year-olds.

- (a) If this child does not have a cavity, what is the probability that this child is 14-years old?
- (b) Let B be the event a 13-year-old is selected and C be the event the kid had a cavity. Are these events independent.

72. E and F are independent events of an experiment with sample space S . Suppose $P(E^C) = 0.4$ and $P(F) = 0.3$. Compute

- (a) $P(E \cap F) =$
- (b) $P(E \cup F) =$

73. Bob has two boxes with the contents of the boxes listed in the table. If he draws one ball from each box, what is the probability that they are both the same color.

Box A	Box B
3 red	7 red
4 green	5 green
	1 purple

74. Acme, Inc., has two photocopy machines A and B. The probability that a given machine will break down on a particular day is $P(A) = .02$ and $P(B) = .03$. Assuming independence, what is the probability on a particular day that

- (a) Exactly one machine will break down.
- (b) Both machines will not break down.

75. A jewel box contains four rings:
 one has a diamond and an emerald
 one has a diamond and a ruby
 one has a ruby and an emerald
 one has pearls

A ring is selected at random from the box. Let the event E be “a ring has a diamond” and let the event F be “a ring has a ruby”. Show that these events are or are not independent.

76. A kennel raises purebred dogs. Several litters from one dog produced 16 puppies with the following markings:

Five had a white mark only on the head.
 three had a white mark only on the forelegs.
 three had a white mark on both head and forelegs
 The rest had neither mark.

Determine whether the events “white mark on the head” and “white mark on the forelegs” are independent or not.

77. A retailer receives a shipment of TV sets from two different, independent companies. The first shipment, from company A, is known historically to be 7.5% defective. The second, from company B, is known to be 13% defective. If one item is selected from each shipment, what is the probability of selecting one good TV and one defective TV?

78. Copykwik has two photocopy machines A, B, and C. The probability that a given machine will break down on a particular day is $P(A) = 1/10$ $P(B) = 3/20$ $P(C) = 8/15$

Assuming independence, what is the probability on a particular day that:

- (a) None of the machines break down?
- (b) Only one of the machines breaks down.