1.7 Conditional Probability

1. Joel surveyed his class and summarized responses to the question, "Do you like school?"

	Liked	Disliked	No Opinion	Total
Males	12	5	2	19
Females	10	3	1	14
Total	22	8	3	33

Find each of the following probabilities.

(a) P(likes school | student is male)

(b) P(student is female | student dislikes school)

2. A person is chosen at random from shoppers at a department store. If the person's probability of having blonde hair and glasses is $\frac{2}{25}$ and the probability of wearing glasses is $\frac{9}{25}$, determine P(blonde hair | wears glasses).

3. Tia and Jerry are tossing two coins. Tia wins when both coins turn up tails. The coins are tossed but roll under a chair. Jerry looks under the chair and, seeing both coins, says, "At least one of them is tails." What is the probability that Tia wins?

4. What is the probability of being dealt two clubs in a row from a well-shuffled deck of 52 playing cards without replacing the first card drawn?

5. **Knowledge and Understanding** From a medical study of 10 000 male patients, it was found that 2500 were smokers; 720 died from lung cancer and of these, 610 were smokers. Determine

(a) P(dying from lung cancer | smoker)

(b) P(dying from lung cancer | non-smoker)

6. A bag contains three red marbles and five white marbles. What is the probability of drawing two red marbles at random without replacing the first marble drawn?

7. A road has two stop lights at two consecutive intersections. The probability of getting a green light at the first intersection is 0.6, and the probability of getting a green light at the second intersection, given that you got a green light at the first intersection, is 0.8. What is the probability of getting a green light at both intersections?

8. A survey of 1000 people asked whether they wear eyeglasses while driving. These people were also tested to see whether they need to wear eyeglasses while driving. The results are displayed in the table below.

		Wear Eyeglasses While Driving	
		YES	NO
Need to Wear Eyeglasses While Driving	YES	440	140
	NO	20	400

If a person is selected at random from this group, determine the probability he or she

(a) should wear eyeglasses while driving
(b) wear eyeglasses while driving
(c) wear eyeglasses while driving even though he or she does not need to
(d) does not wear eyeglasses while driving even though he or she needs to

9. Suppose the two joker cards are left in a standard deck of cards. One of the jokers is red and the other is black. A single card is drawn from the deck of 54 cards but not returned to the deck, and then a second card is drawn. Determine the probability of drawing

(a) one of the jokers on the first draw and an ace on the second draw
(b) a numbered card of any suit on the first draw and the red joker on the second draw
(c) a queen on both draws
(d) any black card on both draws
(e) any numbered card below 10 on the first draw and the same number on a card on the second draw
(f) the red joker or a red ace on either draw

10. Helena Maksimovik, the human resources director for a company, is given the task of hiring two salespeople from four candidates. From their résumés, the candidates could be ranked as follows: 1. Noel; 2. Sara; 3. Emil; 4. Fran. It is two days before Helena's scheduled vacation and she does not want to take the time to go through a formal interview process. Instead, she decides to hire two of the candidates at random.

(a) List all the possible pairings that would make up the possible selections.

(b) Determine the probability the selection will include

(i) at least one of the top two candidates

(ii) both of the top two candidates

(iii) neither of the top two candidates

(iv) Emil, if you know Sara has been selected

(v) either Emil or Fran, if you know Sara has been selected

13. **Application** Gwen has recently purchased a cottage. She has arranged to have a well dug on the property. One in five wells that were dug recently in the vicinity were dry, and 30% of the others are contaminated. Find the probability of each of the following.

(a) Gwen's well will not be dry.

(b) Gwen's well will be uncontaminated, given that it is not dry.

(c) Gwen will have safe-drinking water from her well.

(d) Gwen will not have safe-drinking water from her well.

14. A survey of readers of *The News* indicated that 40% of them also read *The Chronicle*, 32% read *Info*, and 11% read both publications. Find the probability that a reader of *The News*

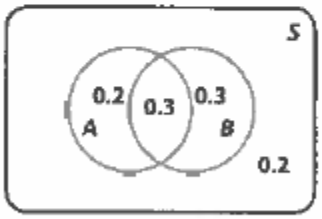
(a) also reads *Info*

(b) reads *Info*, but not *The Chronicle*

15. There are three cards in a hat. One card is black on both sides and the other two cards are black on one side and white on the other. If a card is drawn randomly from the hat and placed on a table so that the underside is not visible, determine the probability that the back of the card is black if the front is showing black.

Answers

1. (a) $\frac{12}{19}$ (b) $\frac{3}{8}$
2. $\frac{2}{9}$
3. $\frac{1}{2}$
4. $\frac{1}{17}$
5. (a) $\frac{61}{250}$ (b) $\frac{11}{750}$
6. $\frac{3}{28}$
7. 0.48
8. (a) $\frac{29}{50}$ (b) $\frac{23}{50}$ (c) $\frac{1}{50}$ (d) $\frac{7}{50}$
9. (a) $\frac{4}{1431}$ (b) $\frac{2}{159}$ (c) $\frac{2}{477}$
   (d) $\frac{13}{53}$ (e) $\frac{16}{477}$ (f) $\frac{52}{477}$
10. (a) 1, 2; 1, 3; 1, 4; 2, 3; 2, 4; 3, 4
    (b) (i) $\frac{5}{6}$ (ii) $\frac{1}{6}$ (iii) $\frac{1}{6}$ (iv) $\frac{1}{3}$ (v) $\frac{2}{3}$
11. (a) $\frac{1}{2}$ (b) $\frac{3}{5}$
12. (a) Region C satisfies both A and B conditions, so events are not mutually exclusive.



    (b) You get the same answers for the probabilities, so the condition has no influence.
13. (a) 0.8 (b) 0.7 (c) 0.56 (d) 0.44
14. (a) 0.32 (b) 0.21
15. $\frac{1}{2}$