11-4 Conditional Probability

Vocabulary

Review

1. **Multiple Choice** A basket has 7 plain, 8 wheat, 2 raisin, and 3 blueberry bagels. What is the *probability* of selecting a plain bagel without looking?

   (A) $\frac{3}{20}$ (B) $\frac{7}{20}$ (C) $\frac{1}{10}$ (D) $\frac{2}{5}$

2. A pencil machine contains 15 blue, 16 red, 18 green, and 26 purple pencils. The machine randomly dispenses a pencil when one is purchased. Keisha buys a pencil. Circle the *probability* that the pencil she buys is red.

   $\frac{1}{16}$ $\frac{4}{25}$ $\frac{16}{75}$ $\frac{59}{75}$ 16

Vocabulary Builder

conditional (adjective) **kun DISH un ul**

Related Words: conditions (adjective), conditionally (adjective), conditioned (adjective), conditioning (noun or adjective)

Definition: A **conditional** statement is a sentence stating that the probability of one event depends on the occurrence of another event.

Use Your Vocabulary

Complete each statement with the correct word from the list. Use each word only once.

conditioning conditions conditioned condition

3. The ? in the classroom made concentration difficult. _____
4. The track and field athletes were having spring ?. _____
5. Matthew had a heart ? that made participating in physical activities difficult. _____
6. The dog was ? to ring the bells on the door when he wanted to go outside. _____

Problem 1 Finding Conditional Probability

Got It? **The table shows the number of students of each gender at two-year and four-year colleges and graduate schools in 2005. What is *P*(four-year | male)?**

Student Genders

	Males (in thousands)	Females (in thousands)
Two-year colleges	1866	2462
Four-year colleges	4324	5517
Graduate schools	1349	1954

Source: U.S. Census Bureau

7. Find the total number of male students.

1866 + ____ + ____ = ____

8. Complete the steps to solve the problem. Round your answer to the nearest hundredth.

$$P(\text{four-year} \mid \text{male}) = \frac{\text{number of males attending four-year colleges}}{\text{total number of male students}}$$

$$= \frac{\quad}{\quad} \approx \quad$$

Got It? **Reasoning** **Without calculating, given a student is enrolled in a four-year college, is it more likely for the student to be male or female? Explain.**

9. There are ____ male students enrolled in four-year colleges.

10. There are ____ female students enrolled in four-year colleges.

11. Is it more likely for a four-year college student to be male or female? Explain.

_____

_____

Problem 2 Conditional Probability in Statistics

Got It? **Americans recycle increasing amounts through municipal waste collection. The table shows the collection data for 2007. What is the probability that a sample of recycled waste is plastic?**

Municipal Waste Collected (millions of tons)

Material	Recycled	Not Recycled
Paper	45.2	37.8
Metal	7.2	13.6
Glass	3.2	10.4
Plastic	2.1	28.6
Other	21.7	46.3

Source: U.S. Environmental Protection Agency

12. Find the total number of tons (in millions) of recycled waste.

____

13. Circle the amount of recycled waste that is plastic.

2.1 3.2 7.2 21.7 45.2

14. Complete.

$$P(\text{plastic} \mid \text{recycled}) = \frac{\text{plastic}}{\quad} = \frac{\quad}{\quad} \approx \quad$$

15. The probability that a sample of recycled waste is plastic is about _____%.

take note

Key Concept Conditional Probability

For any two events A and B, with $P(A) \neq 0$, $P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)}$.

Problem 3 Using the Conditional Probability Formula

Got It? Market Research **Researchers asked shampoo users whether they apply shampoo directly to the head, or indirectly using a hand. What is the probability that a respondent applies shampoo directly to the head, given that the respondent is female?**

Applying Shampoo

	Directly Onto Head	Into Hand First
Male	2	18
Female	6	24

16. Determine each probability.

$P(\text{female}) = \frac{30}{\quad}$ $P(\text{female and directly to head}) = \frac{\quad}{\quad}$

17. Circle the form the conditional probability formula will have.

$P(\text{directly} \mid \text{female}) = \frac{P(\text{female})}{P(\text{female and directly to head})}$ $P(\text{directly} \mid \text{female}) = \frac{P(\text{female and directly to head})}{P(\text{female})}$

18. Use your answers to Exercises 16 and 17 to find the probability that a female respondent applies shampoo directly onto her head.

19. The probability that a female respondent applies shampoo directly onto her head is _____.

Problem 4 Using a Tree Diagram

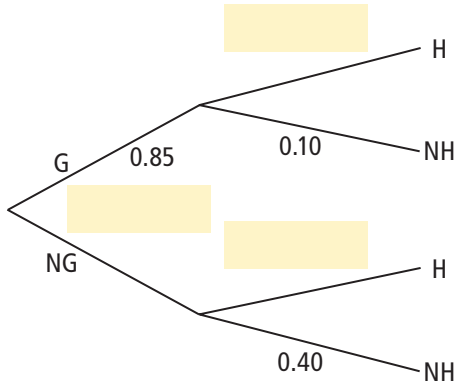
Got It? Education **A school system compiled the following information from a survey it sent to people who were juniors 10 years earlier.**

- **85% of the students graduated from high school.**
- **Of the students who graduated from high school, 90% are happy with their present jobs.**
- **Of the students who did not graduate from high school, 60% are happy with their present jobs.**

What is the probability that a student from the junior class 10 years ago did not graduate and is happy with his or her present job?

20. In the tree diagram at the right, G = graduated, NG = not graduated, H = happy with present job, and NH = not happy with present job. Use the numbers in the shaded box to complete the tree diagram below. Use each number once.

0.90
0.60
0.15



21. Highlight the path on the tree diagram that shows the probability that a person who did not graduate is happy with his or her present job.

22. Calculate the probability.

$P(\text{NG and H}) = P(\text{NG}) \cdot P(\text{H} \mid \text{NG}) =$ ____ · ____ = ____

Lesson Check • Do you know HOW?

The probability that a car has two doors, given that it is red, is 0.6. The probability that a car has two doors *and* is red is 0.2. What is the probability that a car is red?

23. Circle the equation you will use to solve this problem.

$0.6 = \frac{0.2}{P(\text{red})}$ $\quad 0.2 = \frac{0.6}{P(\text{red})}$ $\quad P(\text{red}) = 0.2 \cdot 0.6$

24. Solve the equation you circled in Exercise 23.

25. The probability that a car is red is ____ %.

Math Success

Check off the vocabulary words that you understand.

☐ conditional probability

Rate how well you can *determine conditional probability.*

Need to review 0 2 4 6 8 10 Now I get it!