Name ______________________________ Class ____________ Date ____________

11-4 Reteaching

Conditional Probability

When events A and B are *dependent*, the probability of B occurring depends on whether A has already occurred. This kind of probability is called *conditional probability*. The probability of B given that A has occurred is written as $P(B \mid A)$.

Problem

A computer lab has 10 computers. Some have CD drives and some have DVD drives. Some are new and some are used. A student picks a computer at random. Use the table to find each probability.

	CD	DVD	Total
New	4	3	7
Used	2	1	3
Total	6	4	10

$P(\text{computer is new}) = \frac{7}{10}$ Out of 10 computers in the lab, 7 are new.

$P(\text{computer has a CD drive}) = \frac{6}{10} = \frac{3}{5}$ Out of 10 computers in the lab, 6 have CD drives.

$P(\text{computer is new } \underline{\text{and}} \text{ has a CD drive}) = \frac{4}{10} = \frac{2}{5}$ Out of 10 computers in the lab, 4 are new and have CD drives.

$P(\text{computer is new given it has a CD}) = \frac{4}{6} = \frac{2}{3}$ Out of 6 computers that have CD drives, 4 are new.

Note the difference between the last two probabilities. The conditional probability is based only on the number of computers that meet the condition, not on the total number of computers in the lab.

Exercises

A can holds 20 red balls with blue dots, 15 red balls without dots, 30 white balls with blue dots, and 25 white balls without dots. Find each probability.

1. $P(\text{red})$ $\frac{7}{18}$

2. $P(\text{with dots})$ $\frac{5}{9}$

3. $P(\text{red and with dots})$ $\frac{2}{9}$

4. $P(\text{red} \mid \text{with dots})$ $\frac{2}{5}$

5. $P(\text{white} \mid \text{no dots})$ $\frac{5}{8}$

6. $P(\text{no dots} \mid \text{white})$ $\frac{5}{11}$

11-4 Reteaching (continued)

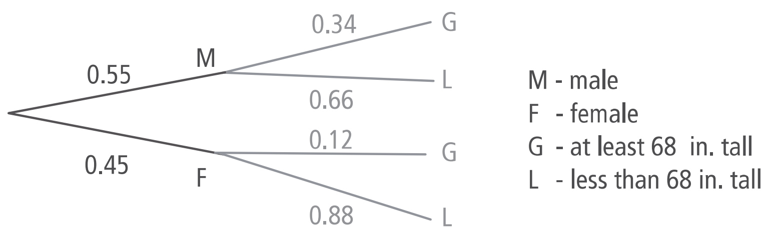
Conditional Probability

You can use a tree diagram to help you find the probabilities of dependent events.

Problem

Suppose a class is 55% male. Of the males, 34% are at least 68 in. tall. Of the females 12% are at least 68 in. tall. What is the probability that a randomly chosen student is a female at least 68 in. tall?

Step 1 Organize the information in a tree diagram.



Each of the two black branches of the tree represents a simple probability: $P(\text{M}) = 0.55$ and $P(\text{F}) = 0.45$.

Each of the four gray branches represents a conditional probability: $P(\text{G} \mid \text{M}) = 0.34$, $P(\text{L} \mid \text{M}) = 0.66$, $P(\text{G} \mid \text{F}) = 0.12$, and $P(\text{L} \mid \text{F}) = 0.88$.

Step 2 Determine the probability you want to find.
$P(\text{F and G})$, the probability that a student is female and at least 68 in. tall.

Step 3 Rewrite the conditional probability formula to find $P(\text{F and G})$.
$P(\text{F and G}) = P(\text{F}) \cdot P(\text{G} \mid \text{F})$

Step 4 Substitute information from the tree diagram.

$$\begin{aligned} P(\text{F and G}) &= P(\text{F}) \cdot P(\text{G} \mid \text{F}) \\ &= 0.45 \cdot 0.12 \\ &= 0.054 \end{aligned}$$

The probability that a randomly chosen student is a female at least 68 in. tall is 5.4%.

Exercises

Use the tree diagram above to find each probability.

7. $P(\text{L and M})$ **36.3%**   **8.** $P(\text{G and M})$ **18.7%**   **9.** $P(\text{L and F})$ **39.6%**