10.2 Independent and Dependent Events

Two events are independent events if one event **does not** affect the other event.

Two events are dependent events when one event **does** affect the other event.

Examples:

rolling dice and rolling two two's

Ind.

drawing cards from a deck without replacing them and getting a heart.

dep.

Practice: State whether the situation is independent or dependent.

a) You roll a 4 on a six-sided die and spin red on a spinner.

independent

b) Your teacher chooses a student to lead a group, chooses another student to lead a second group, and chooses a third student to lead a third group.

dependent

c) You have one red apple and three green apples in a bowl. You randomly select one apple to eat now and another apple for your lunch.

dependent

d) A vase contains four white roses and one red rose. You randomly select two roses to take home.

independent
same time

dependent
separately

10.2 Independent Dependent Events with answers

Core Concept

Probability of Independent Events

Words Two events A and B are independent events if and only if the probability that both events occur is the product of the probabilities of the events.

Symbols $\boxed{P(A \text{ and } B) = P(A) \cdot P(B)}$

USING PROBLEM-SOLVING STRATEGIES

One way that you can find $P(\text{girl second} \mid \text{girl first})$ is to list the 9 outcomes in which a girl is chosen first and then find the fraction of these outcomes in which a girl is chosen second:

G_1B	G_2B	G_3B
G_1G_2	G_2G_1	G_3G_1
G_1G_3	G_2G_3	G_3G_2

Core Concept

Probability of Dependent Events

Words If two events A and B are dependent events, then the probability that both events occur is the product of the probability of the first event and the conditional probability of the second event given the first event.

Symbols $\boxed{P(A \text{ and } B) = P(A) \cdot P(B \mid A)}$

Example Using the information in Example 2:

$$P(\text{girl first and girl second}) = P(\text{girl first}) \cdot P(\text{girl second} \mid \text{girl first})$$

$$= \frac{9}{12} \cdot \frac{6}{9} = \frac{1}{2}$$

Independent Event Examples

A bag contains six pieces of paper, numbered 1 through 6. A student randomly selects a piece of paper, replaces it, and randomly select another piece of paper. Use a sample space to determine whether randomly selecting an 5 first and randomly selecting an odd number second are independent events.

P(5) = $\frac{1}{6}$

$\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$ ✓

P(odd #) = $\frac{1}{2}$

P(5, odd #) = $\frac{1}{12}$

(correct on both out of total)

Pull

Yes the events are independent because they are both one twelfth a chance of occurring.

Independent Event Practice

A bag contains six pieces of paper, numbered 1 through 6. A student randomly selects a piece of paper, does not replace it, and randomly selects another piece of paper. Use a sample space to determine whether randomly selecting an even number first and randomly selecting a 4 second are independent events.

P (even #) = $\frac{1}{2}$

P(4) = $\frac{1}{6}$

P(even #, 4) = $\frac{1}{10}$

(correct on both out of total)

$\frac{1}{12} \neq \frac{1}{10}$

Pull

No, these events are not independent of each other. one twelfth does not equal one tenth.

Example:

Find the probability that you get an even number on your first spin and a number less than 3 on your second spin.

A

B

Pull

The probability is one eighth or 12.5%.

$P(A) = \frac{1}{2}$

$P(B) = \frac{1}{4}$

$P(A \cap B) = P(A) \cdot P(B) = \frac{1}{2} \cdot \frac{1}{4} = \boxed{\frac{1}{8}}$

Dependent Event EXAMPLES

Nine women and six men are on a committee. Two people are randomly chosen from the committee members to serve as a chairperson and a treasurer. Find the probability that both events A and B will occur.

A: the chairperson is a man.

B: The treasurer is a woman.

Pull

Dependent event: The probability that the chairperson is a man and the treasurer a woman is nine thirty-fifths, or about 25.7%.

$P(A) = \frac{6}{15} = \frac{2}{5}$

$P(B|A) = \frac{9}{14}$

$P(A \cap B) = P(A) \cdot P(B|A) = \frac{2}{5}\left(\frac{9}{14}\right) = \frac{18}{70} = \boxed{\frac{9}{35}}$

ALL MIXED UP

A bag contains 10 red marbles and 5 blue marbles. You randomly select 3 marbles from the bag. What is the probability that all 3 marbles are blue when (A) you replace each marble before selecting the next one and (B) you do not replace each marble before selecting the next one? Compare the probabilities.

Pull

$$P(A) = \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{27}$$

$$P(B) = \frac{1}{3} \cdot \frac{2}{7} \cdot \frac{3}{13} = \frac{2}{91}$$

Finding Conditional Probabilities

The probability that event B occurs given that event A has occurred is called the <u>conditional probability</u> of **B GIVEN THAT A** and is written as **P(B|A)**.

<u>Example:</u>

A quality control inspector checks for defective parts. The table shows the results of the inspector's work.

	Pass	Fail	T
Defective	5	24	29
Non-defective	208	9	217
T	213	33	246

a) Find the probability that a defective part "passes".

P(pass|defective) = $\frac{5}{29}$

$\frac{213}{246}$

b) Find the probability that a non-defective part "passes".

P(pass|non-defective) = $\frac{208}{217}$

Pull

a) P(pass| defective) ≈ 0.172 or 17.2%

b) P(pass|non-defective) ≈ 0.959 or 95.9%

Conditional Practice:

At a clothing store, 75% of the customers buy pants. Only 20% of the customers buy pants and a belt. What is the probability that a customer who buys pants also buys a belt?

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{.2}{.75} = .26\overline{7}$$

$$\boxed{26.7\%}$$

Pull

four fifteenth or about 26.7%

HW: pg. 550: 3 - 15 (o), 31 - 33