LESSON 10-7 Practice A

Independent and Dependent Events

Tell whether each set of events is independent or dependent. Explain your answer.

1. You roll a number cube three times. independent; the outcome of one roll does not affect the other rolls.
2. Select a marble from a bag, do not replace it, then select another marble. dependent; a marble selected and not replaced reduces the number to choose from.
3. **A number cube is rolled two times.**
   a. Are the events independent or dependent? independent
   b. What is the probability of rolling a 5 both times? $\frac{1}{36}$
4. **The numbers 1 – 20 are written on pieces of paper and put in a box. Two pieces of paper are randomly selected and not replaced.**
   a. Are the events independent or dependent? dependent
   b. What is the probability of selecting a number less than 6 both times? $\frac{1}{19}$
5. **A bag contains 1 red, 7 black, and 2 yellow marbles. State whether the following events are independent or dependent. Then find the probabilities.**
   a. probability of selecting a black marble, replacing it, then selecting a red marble: independent; $\frac{7}{100} = 7\%$
   b. probability of selecting a yellow marble, not replacing it, then selecting another yellow marble: dependent; $\frac{1}{45} \approx 2.2\%$
   c. probability of selecting 1 yellow marble, not replacing it, then selecting a black marble: dependent; $\frac{7}{45} \approx 15.6\%$

The number of drama club members per grade is given. Two students will be chosen.

	Drama Club
9th	8
10th	2

6. What is the probability both students are 9th graders? $\frac{28}{45} \approx 62.2\%$
7. What is the probability both students are 10th graders? $\frac{1}{45} \approx 2.2\%$
8. What is the probability one student is a 9th grader and one student is a 10th grader? $\frac{8}{45} \approx 17.8\%$

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Practice B

Independent and Dependent Events

Tell whether each set of events is independent or dependent. Explain your answer.

1. You roll a die and flip a coin. independent; the result of the die does not affect the result of the coin.
2. You select one marble, do not replace it, then select another marble. dependent; selecting one marble without replacing it will change the number to choose from.
3. A number cube is rolled three times. What is the probability of rolling a 2 each time? $\frac{1}{216} \approx 0.5\%$
4. The numbers 1 – 40 are written on pieces of paper and put in a box. Two pieces of paper are randomly selected. What is the probability both numbers will be multiples of 4? $\frac{3}{52} \approx 5.8\%$
5. A coin is tossed 4 times. What is the probability of getting 4 tails? $\frac{1}{16} = 6.25\%$
6. **A bag contains 2 yellow, 12 red, and 6 green marbles.**
   a. What is the probability of selecting a red marble, replacing it, then selecting another red marble? $\frac{9}{25} = 36\%$
   b. What is the probability of selecting a red marble, not replacing it, then selecting another red marble? $\frac{33}{95} \approx 34.7\%$
   c. What is the probability of selecting 1 yellow marble, not replacing it, then selecting a green marble? $\frac{3}{95} \approx 3.2\%$
7. **There are 7 girls and 3 boys in a class. Two students are to be randomly chosen for a special project.**
   a. What is the probability both students will be girls? $\frac{7}{15} \approx 46.7\%$
   b. What is the probability both students will be boys? $\frac{1}{15} \approx 6.7\%$
   c. What is the probability of selecting a boy and a girl? $\frac{7}{30} \approx 23.3\%$

A music class consists of 9th and 10th graders as shown in the table. Two students will be selected at the same time.

Music Class	9th	10th
male	9	8
female	12	11

8. What is the probability both students are male? $\frac{34}{195} \approx 17.4\%$
9. What is the probability both students are 9th graders? $\frac{7}{26} \approx 26.9\%$
10. What is the probability one student is female and the second student is male? $\approx 25.1\%$

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Practice C

Independent and Dependent Events

Tell whether each set of events is independent or dependent. Explain your answer.

1. You select three marbles at the same time. dependent; selecting marbles at the same time is the same as selecting without replacement.
2. You guess the answers on a multiple choice test. independent; a guess on one question does not affect a guess on another question.
3. A music player has 10 songs. The songs are played on the player randomly. What is the probability your favorite song will be played twice in a row? $\frac{1}{100} = 1\%$
4. A coin is tossed 4 times. What is the probability of getting 4 tails? $\frac{1}{16} = 6.25\%$
5. What is the probability of randomly selecting 4 cards from a deck and getting all 4 aces? $\approx 0.0004\%$
6. **There are 10 pens in a desk. Two of the pens have no ink.**
   a. A pen is randomly selected and replaced. Then a pen is selected again. What is the probability both selections will be a pen with no ink? $\frac{1}{25} = 4\%$
   b. A pen is selected and not replaced. What is the probability both pens have no ink? $\frac{1}{45} \approx 2.2\%$
7. **A bag contains 5 yellow, 8 red, 2 green marbles.**
   a. What is the probability of selecting 1 yellow marble, replacing it, then selecting another yellow marble? $\frac{1}{9} \approx 11.1\%$
   b. What is the probability of selecting three red marbles without replacement? $\frac{8}{65} \approx 12.3\%$
   c. What is the probability of selecting a red and yellow marble without replacement? $\frac{4}{21} \approx 19.0\%$

The table shows the failure rates (in decimals) for three products. Assume all failures are independent. Find each probability as a percent.

Failure Rates	A	B	C
Assembly Errors	0.02	0.01	0.03
Manufacturing Defects	0.001	0.005	0.05
Design Errors	0.04	0.012	0.021
Misuse	0.001	0.07	0.002
Improper Material	0.06	0.001	0.023

8. A has an assembly error and a manufacturing defect. 0.002%
9. B has a design error and an assembly error. 0.012%
10. A and C have improper material. 0.138%

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Reteach

Independent and Dependent Events

Events are **independent** if the occurrence of one event does not affect the probability of the other.

If A and B are independent events, then $P(A \text{ and } B) = P(A) \cdot P(B)$.

In other words, if two or more events are independent, multiply their individual probabilities.

An experiment consists of rolling a number cube twice. What is the probability of rolling a 3 the first time and a 2 the second time?

Step 1: Determine if the two events are independent.

The first roll of a number cube will not affect the second roll. Therefore, the two rolls are independent events.

Step 2: Find the probability.

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

$P(3, 2) = P(3) \cdot P(2)$

$= \frac{1}{6} \cdot \frac{1}{6}$

$= \frac{1}{36}$

An experiment consists of randomly selecting a marble from a bag, replacing it, and then selecting another marble. The bag contains 2 red marbles, 1 white marble and 7 yellow marbles. What is the probability of selecting a white marble and then a yellow marble?

Step 1: Determine if the two events are independent.

Because the first marble is replaced, the probability of getting a certain color on the second selection is not affected by which color was selected first. The events are independent.

Step 2: Find the probability.

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

$P(\text{white, yellow}) = P(\text{white}) \cdot P(\text{yellow})$

$= \frac{1}{10} \cdot \frac{7}{10} = \frac{7}{100}$

1. Six cards are numbered 1 to 6 and placed in a box. One card is selected at random and replaced. Another card is selected at random. What is the probability of selecting a 1 and then a 6?

   $P(1) = \frac{1}{6}$ $P(6) = \frac{1}{6}$ $P(1 \text{ and } 6) = \frac{1}{36}$

2. A coin is tossed three times. What is the probability of the coin landing heads all three times? $\frac{1}{8}$
3. A bag contains 5 red marbles, 8 white marbles and 7 green marbles. What is the probability of randomly selecting a white marble, replacing it, then randomly selecting another white marble? $\frac{4}{25}$
4. Ten cards are numbered from 1 to 10 and placed in a box. One card is selected at random and replaced. Another card is selected at random. What is the probability of selecting a multiple of 3, then a multiple of 2? $\frac{3}{20}$

Copyright © by Holt, Rinehart and Winston. All rights reserved.

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Reteach

Independent and Dependent Events (continued)

Events are **dependent** if the occurrence of one event does affect the probability of the other.

If A and B are dependent events, then $P(A \text{ and } B) = P(A) \cdot P(B \text{ after } A)$

In other words, the second probability depends on the first outcome.

A class has 18 boys and 12 girls. Two students are chosen at random. What is the probability that the students chosen will be a boy and a girl?

Step 1: Determine if the two events are dependent.

Selecting the first person reduces the total number of outcomes by 1. Therefore, the events are dependent.

Step 2: Find the probability.

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

$P(\text{boy and girl}) = P(\text{boy}) \cdot P(\text{girl after boy has been selected})$

$= \frac{18}{30} \cdot \frac{12}{29} = \frac{216}{870} \approx 24.8\%$

Total outcome is reduced by 1.

What is the probability of selecting two boys?

$P(\text{boy and girl}) = P(\text{boy}) \cdot P(\text{boy after boy has been selected})$

There is 1 less boy to select from.

$= \frac{18}{30} \cdot \frac{17}{29} = \frac{306}{870} \approx 35.2\%$

Total outcome is reduced by 1.

5. A bag contains 3 red marbles, 5 green marbles and 2 blue marbles. What is the probability of selecting a blue marble, setting it aside, then selecting a red marble?

$P(\text{blue}) = \frac{1}{5}$ $P(\text{red after blue has been selected}) = \frac{1}{3}$

$P(\text{blue and red}) = \frac{1}{15}$

6. Twenty-six cards with all the letters of the alphabet are placed in a box. What is the probability of selecting a vowel (A, E, I, O, U), setting it aside, then selecting another vowel? $\frac{2}{65}$

7. A bag contains 8 orange marbles, 5 blue marbles and 7 yellow marbles. What is the probability of randomly selecting an orange marble, setting it aside, then randomly selecting another orange marble? $\frac{14}{95}$

8. Ten cards are numbered from 1 to 10 and placed in a box. What is the probability of selecting one even card, setting it aside, and then selecting one odd card? $\frac{5}{18}$

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Challenge

Drawing without Replacement

It is dark when you stumble out of bed and you are not ready to turn on the light. You pick socks out of the sock drawer at random. The wash has just been done, so you know that there are 8 blue, 4 tan, and 12 white socks in the drawer.

1. What is the probability that the first sock that you pick is blue? $\frac{1}{3}$

2. If the first sock that you picked was blue, and you hold onto it, what is the probability that the second sock that you pick will also be blue? $\frac{7}{23}$

3. What is the probability that you picked 2 blue socks? $\frac{7}{69}$

4. Using the same process that you used for Exercises 1–3 and starting over with a full drawer of socks, what is the probability of picking 2 socks, without replacement, that both are white? $\frac{11}{46}$

Suppose that there are n socks in another drawer and that 6 of them are brown. (Assume that there are more than 6 socks in the drawer.)

5. What is the probability of picking 1 brown sock? $\frac{6}{n}$

6. If the first sock that you picked was brown, and you hold onto it, what is the probability that the second sock that you picked will also be brown? $\frac{5}{n-1}$

7. What is the probability of picking 2 brown socks if the first one is not replaced? $\frac{30}{n(n-1)}$

There are tryouts for seating positions in band. To determine the order of the n students trying out, slips of paper numbered 1 through n are placed in the bag, and each student draws a number.

8. What is the probability that the first number drawn is 8? (Assume that there are at least 8 students.) $\frac{1}{n}$

9. If the first student draws position 8, what is the probability that the next student will draw 5. $\frac{1}{n-1}$

10. If the slips with 8 and 5 have been drawn, what is the probability that the number 4 will be drawn next? $\frac{1}{n-2}$

11. Find the probability that the slips with 8, 5, and 4 are selected in this order. $\frac{1}{n(n-1)(n-2)}$

12. Suppose you want to draw the number 1 so that you can play first. As other students draw other numbers, what happens to your chances of getting the 1? Use math to explain.

Your chances of drawing a 1 get better until the 1 is drawn. This happens because the number in the denominator of the probability fraction keeps getting lesser, and the value of the fraction gets closer to 1.

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Problem Solving

Independent and Dependent Events

Janeesa's backpack has 4 pens and 6 pencils in the front pocket. She reaches in, grabs one, and removes it. Then she reaches in again, grabs another, and removes it. Write the correct answer.

1. Are these two events independent or dependent? Explain.

dependent; the item removed first affects the sample space for the second item.

2. What is the probability that Janeesa removes two pens? $\frac{2}{15}$

3. What is the probability that Janeesa removes two pencils? $\frac{1}{3}$

4. What is the probability that Janessa removes a pencil and then a pen? $\frac{4}{15}$

5. What is the probability that she removes a pen and then a pencil? $\frac{4}{15}$

6. Your answers to questions 4 and 5 should be numerically identical. Does that mean that the events are identical? Explain.

no; the events are different because the order in which the items are removed is different.

On a game show, a contestant tries to win a car by randomly picking tiles from a bag. Some of the tiles are printed with the digits in the price of the car and some are printed with strikes (red X's). Select the best answer.

7. When the prices of cars only had four digits, the game was played with 7 tiles—4 digits and 3 strikes. Whenever you picked a strike, it was removed from the bag. In this old version of the game, what was the probability of picking three strikes in a row?

A $\frac{1}{343}$ C $\frac{6}{343}$ (D) $\frac{1}{35}$ B $\frac{1}{210}$

8. When the prices of cars began to have five digits, the game was modified to use 6 tiles—5 digits and 1 strike. Whenever you picked a strike, it was put back in the bag. In this new version of the game, what is the probability of picking three strikes in a row?

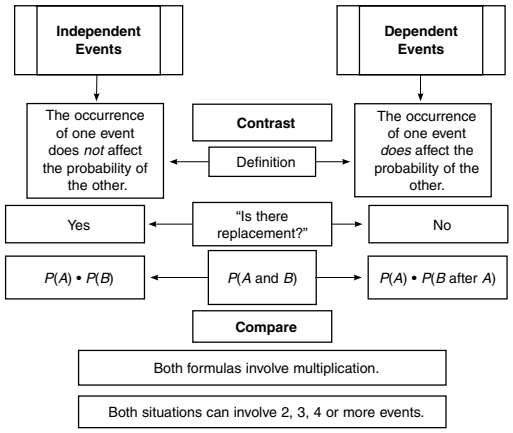
(F) $\frac{1}{216}$ H $\frac{1}{36}$ G $\frac{1}{120}$ J $\frac{1}{20}$

Copyright © by Holt, Rinehart and Winston. All rights reserved.

LESSON 10-7 Reading Strategies

Compare and Contrast

The chart below shows the similarities and differences between independent and dependent events.



Identify the following as independent or dependent events.

1. Ben rolls a 3 on a number cube. Then he rolls a 4. independent

2. May chooses a prize out of a bag and keeps it. Then Grace chooses a prize. dependent

3. Greg picks a red crayon out of a box, uses it, and then puts it back. Then Jo picks a red crayon. independent

A bag contains 5 blue marbles, 3 red marbles, and 2 green marbles. Find the probability of each event.

4. P(blue, blue) with replacement $\frac{1}{4}$

5. P(blue, blue) without replacement $\frac{2}{9}$

6. P(blue, red, green) with replacement $\frac{3}{100}$

Copyright © by Holt, Rinehart and Winston. All rights reserved.

Copyright © by Holt, Rinehart and Winston. All rights reserved.