

Unit 8

Lesson 3

Independent vs Dependent Events

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Lesson 3 → Independent & Dependent Events

Independent Events: Two events are independent when one event has *no effect* on the probability the other event occurring.

Dependent Events: Two events are dependent if the outcome or probability of the first event *affects* the outcome or probability of the second.

Suppose a die is rolled and then a coin is tossed.

- Explain why these events are independent:

b/c no effect on each other

	1	2	3	4	5	6
Head	H1	H2	H3	H4	H5	H6
Tail	T1	T2	T3	T4	T5	T6

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How can you find the total outcomes of the sample space **WITHOUT** writing it out? Remember the Fundamental Counting Principle.

- How many outcomes are there for rolling the die? 6
- How many outcomes are there for tossing the coin? 2
- How many outcomes are there in the sample space of rolling the die and tossing the coin? 12

Use the table above to find the following probabilities:

1. $P(\text{rolling a 3}) = \frac{2}{12} = \frac{1}{6}$

2. $P(\text{Tails}) = 50\%$

3. $P(\text{rolling a 3 AND getting tails}) = \frac{1}{12}$

4. $P(\text{rolling an even \#}) = \frac{1}{2}$

5. $P(\text{heads}) = 50\%$

6. $P(\text{rolling an even AND getting heads}) = \frac{3}{12}$

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MULTIPLICATION RULE of Probability for Independent Events

The probability of two independent events occurring can be found by the following formula:

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

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1. At City High School, 30% of students have part-time jobs and 25% of students are on the honor roll. What is the probability that a student chosen at random has a part-time job and is on the honor roll? Write your answer in context.

$$(.3)(.25) = .075 \quad 7.5\%$$

2. The following table represents data collected from a grade 12 class:

Plans after High School

Gender	University	Community College	Total
Males	28	56	84
Females	43	37	80
Total	71	93	164

- ✓ Suppose 1 student was chosen at **random** from the grade 12 class.

(a) What is the probability that the student is female? _____

$$\frac{80}{164} \approx 49\%$$

(b) What is the probability that the student is going to a university? _____

$$\frac{71}{164} \approx 43\%$$

(c) What is the probability that the student is female and going to a university? _____

$$\frac{43}{164}$$

- ✓ Now suppose 2 people each randomly chose 1 student from the grade 12 class. Assume that it's possible for them to choose the same student.

(c) What is the probability that the first person chooses a student who is female and the second person chooses a student who is going to university? _____

$$\left(\frac{80}{164}\right)\left(\frac{71}{164}\right) \approx 21\%$$

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3. Suppose a card is chosen at random from a deck of cards, **replaced**, and then a second card is chosen.

(a) Would these events be independent? How do we know? Yes, b/c replacement

(b) What is the probability that both cards are 7s? $(4/52)(4/52) \approx .5\%$

Recall Dependent Events: Two events are dependent if the outcome or probability of the first event affects the outcome or probability of the second.

Example 4: Determine whether the events are **independent** or **dependent**:

a.) Selecting a marble from a container and selecting a jack from a deck of cards. I

b.) Rolling a number less than 4 on a die and rolling a number that is even on a second die. I

c.) Choosing a jack from a deck of cards and choosing another jack, without replacement. D

d.) Winning a hockey game and scoring a goal. D

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MULTIPLICATION RULE of Probability for Dependent Events

The probability of two dependent events occurring can be found by the following formula:

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


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Example 5: A random sample of parts coming off a machine is done by an inspector. He found 5 out of 100 parts are bad on average. If the inspector were to do a new sample, what is the probability that he picks a bad part and then picks another bad part if he doesn't replace the first part?

$$\left(\frac{5}{100}\right)\left(\frac{4}{99}\right) \approx .2\%$$

Example 6: Independent vs. Dependent Probability

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Example 6: Independent vs. Dependent Probabilities

INDEPENDENT

A box contains 4 red marbles and 6 purple marbles.
You are going to choose 3 marbles with replacement.
What is the probability of drawing 2 purple marbles and 1 red marble in succession (aka in order)?

$$\left(\frac{6}{10}\right)\left(\frac{6}{10}\right)\left(\frac{4}{10}\right) \approx 14\%$$

DEPENDENT

A box contains 4 red marbles and 6 purple marbles.
You are going to choose 3 marbles without replacement. What is the probability of drawing 2 purple marbles and 1 red marble in succession (aka in order)?

$$\left(\frac{6}{10}\right)\left(\frac{5}{9}\right)\left(\frac{4}{8}\right) \approx 17\%$$

What is the probability of first drawing all 4 red marbles in succession and then drawing all 6 purple marbles in succession *without replacement*?

$$\left(\frac{4}{10}\right)\left(\frac{3}{9}\right)\left(\frac{2}{8}\right)\left(\frac{1}{7}\right)\left(\frac{6}{6}\right)\left(\frac{5}{5}\right)\left(\frac{4}{4}\right) \dots$$

$$\approx .5\%$$

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*** Two events (A & B) are independent if $P(A) = P(A/B)$ "read as the probability of A given that B has happened."

Example 7:

	Orders salad	Orders sandwich	Total
Drinks water	8	16	24
Drinks diet soda	6	12	18
Total	14	28	42

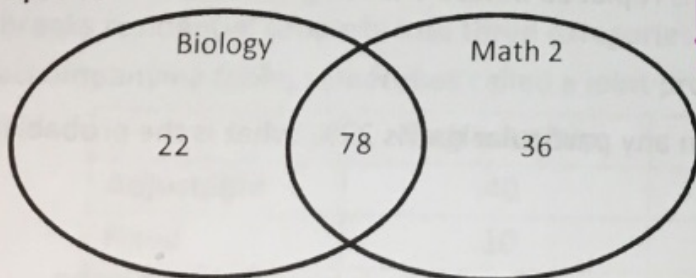
$$P(A) = \frac{24}{42} = .5714$$

$$P(A/B) = \frac{8}{14}$$

Are the events A: drinking water and B: ordering salad independent?

Yes

Example 8:



$$P(A) = \frac{100}{136}$$

$$P(A/B) = \frac{78}{114}$$

Dependent

Are taking A: Biology and taking B: Math 2 independent?

They are

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HW: 16-17

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