Name: Key Date: ____________

Independent vs. Dependent Probabilities

1. A bag contains 5 red, 3 green, 4 blue, and 8 yellow marbles.

   Find the probability of randomly selecting a green marble, and then a yellow marble if the first marble is replaced. $3/50$

   $\left(\frac{3}{20}\right)\left(\frac{8}{20}\right) = \frac{3}{50}$

2. A sock drawer contains 5 rolled-up pairs of each color of socks, white, green, and blue.

   What is the probability of randomly selecting a pair of blue socks, replacing it, and then randomly selecting a pair of white socks? $1/9$

   $\left(\frac{5}{15}\right)\left(\frac{5}{15}\right) = \frac{1}{9}$

3. Two 1–6 number cubes are rolled—one is black and one is white.
   You want to know the probability of the sum of the rolls being greater than or equal to 6 and the black cube showing a 3.

   $P(\text{sum} \geq 6) \neq P(\text{sum} \geq 6 \mid \text{black shows } 3)$

   a. Are the events independent or dependent? Explain.

   Dependent - knowing that the black cube shows a 3 changes the probability of a sum greater than or equal to 6. $26/36$ or $13/18$ without the limiting condition.

   b. Find the probability. $2/3$

4. Randy has 4 pennies, 2 nickles, and 3 dimes in his pocket.

   If he randomly chooses 2 coins, what is the probability that they are both dimes if he doesn't replace the first one? $1/12$

   $\left(\frac{3}{9}\right)\left(\frac{2}{8}\right) = \frac{1}{12}$

Confirming Independence

$$P(A \cap B) = P(A) \bullet P(B)$$

This equation is known as necessary and sufficient. It works exactly like a biconditional statement: two events A and B are independent if and only if the equation is true. It is a must!

1. Based upon the definition of independence, determine if each set of events below are independent.

a. $P(A)=0.45$ $P(B)=0.30$ $P(A\cap B)=0.75$ $(0.4)(0.3)\neq 0.75$ No

b. $P(A)=0.12$ $P(B)=0.56$ $P(A\cap B)=0.0672$ $(0.12)(0.56)\neq 0.06722$ Yes

c. $P(A)=4/5$ $P(B)=3/8$ $P(A\cap B)=7/40$ $(4/5)(3/8)\neq 7/40$ No

d. $P(A)=7/9$ $P(B)=3/4$ $P(A\cap B)=7/12$ $(7/9)(3/4)=7/12$ Yes

2. Determine the missing values so that the events A and B will be independent.

a. $P(A)=0.55$ $P(B)=$ 0.25 $P(A\cap B)=0.1375$ $P(A\cap B)=P(A)P(B)$ $P(B)=\frac{P(A\cap B)}{P(A)}$

b. $P(A)=$ $10/21=0.476$ $P(B)=3/10$ $P(A\cap B)=1/7$ $P(A)=\frac{P(A\cap B)}{P(B)}$

Gender vs. Hair Color –

A random survey was conducted about gender and hair color. This table records the data.

Hair Color

	Brown	Blonde	Red	
Male	548	876	82	1506
Female	612	716	66	1394
	1160	1592	148	2900

3. Are having red hair and being female independent events?

$P(\text{red})=P(\text{red}/\text{female})$? $\frac{148}{2900}=\frac{66}{1394}$ $0.051\neq 0.047$ close, but not independent

Grade vs. Favorite Sport -

A survey was done of 90 junior and senior boys at Lincoln High School asking whether they liked basketball or football better. This table shows the data that was collected.

	Basketball	Football	
Junior	10	20	30
Senior	20	40	60
	30	60	90

4. Are liking basketball and being a junior independent events?

$P(B)=P(B/J)$

$\frac{30}{90}=10/30$ ✓

5. Are liking football and being a junior independent events?

$P(F)=P(F/J)$ $\frac{60}{90}=\frac{20}{30}$ ✓