HW 12-8

1. a-i) .58 a-ii) .522 b) No, P(fluorescent given long life) ≠ P(fluorescent)

2. a-i) .946 a-ii) .352 a-iii) .158

   b) P(B | R) = .158, P(B) = .054 The probability of bruised given ripe is more than the probability of bruised. This means an avocado is more likely to be bruised if it's ripe than avocados in general.

   c) No, the P(B | R) ≠ P(B). So the events ripe and bruised are not independent.

3. See table on work slide. P(B | not R) = .040

4. a) .29: I added the probability of fax access and no scanner with the probability of no fax access or no scanner.

   b) .53 c) No. The P(F) = .43 which is not equal to P(F | S) = .53.

Test Thursday. If you will be absent, reschedule the test with me if you haven't already.

Name *Key* Alg 2 HW 12-8

1. Of the light bulbs available at a store, 42% are fluorescent (F), 23% are labeled as "long life" (L), and 12% are fluorescent and "long life".

a. A light bulb will be selected at random from the light bulbs at this store. Rounding your answer to the nearest thousandth where necessary, find the probability that

i. the selected light bulb is not fluorescent.

$P(\text{not fluorescent}) = 1 - .42 = .58$

ii. the selected light bulb is fluorescent given that it is labeled as "long life".

$P(\text{fluorescent} \mid \text{long life}) = \dfrac{P(F \text{ and } L)}{P(L)} = \dfrac{.12}{.23} \approx .522$

b. ~~Are the~~ events *fluorescent* and *long life* independent? Explain.

No, $P(F \mid L) \neq P(F)$

$.522 \neq .42$

2. When an avocado is selected at random from those delivered to a food store, the probability that it is ripe is 0.12, the probability that it is bruised is 0.054, and the probability that it is ripe and bruised is 0.019. R = ripe, B = bruised

a. Rounding your answers to the nearest thousandth where necessary, find the probability that an avocado randomly selected from those delivered to the store is

i. not bruised.

$1 - .054 = .946$

ii. ripe given that it is bruised.

$P(R \mid B) = \dfrac{P(R \text{ and } B)}{P(B)} = \dfrac{.019}{.054} \approx .352$

iii. bruised given that it is ripe.

$P(B \mid R) = \dfrac{P(B \text{ and } R)}{P(R)} = \dfrac{.019}{.12} \approx .158$

b. Which is larger, the probability that a randomly selected avocado is bruised given that it is ripe or the probability that a randomly selected avocado is bruised? Explain what this tells you. $P(B \mid R) = .158$, $P(B) = .054$

The probability of bruised given ripe is more than the probability of bruised. This means an avocado is more likely to be bruised if it's ripe than avocados in general.

c. Are the events ripe and bruised independent? Explain.

No. $P(B \mid R) \neq P(B)$

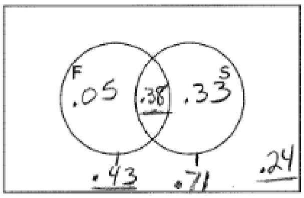
$.158 \neq .054$

3. Using the probability information given in ~~#3~~ #2, complete the hypothetical 1000 table given below, and use it to find the probability that a randomly selected avocado is bruised given that it is not ripe. Round your answer to the nearest thousandth.

	Ripe	Not Ripe	Total
Bruised	19	35	54
Not Bruised	101	845	946
Total	120	880	1000

$P(B \mid \text{not } R) = \frac{35}{880} \approx .040$

4. In a company 43% of the employees have access to a fax machine, 38% have access to a fax machine and a scanner, and 24% have access to neither a fax machine nor a scanner. Suppose that an employee will be selected at random.



a. Using a Venn diagram, calculate the probability that the randomly selected employee will not have access to a scanner. Explain how you used the Venn diagram to determine your answer.

$P(\sim S) = .05 + .24 = .29$

I added P(Fax no scanner) with P(No Fax or no Scanner)

b. Find the probability that a randomly selected employee who has access to a scanner (given) also has access to a fax machine.

$P(F \mid S) = \frac{P(F \cap S)}{P(S)} = \frac{.38}{.71} \approx .53$

c. Are the events fax machine access and scanner access independent? Explain your answer.

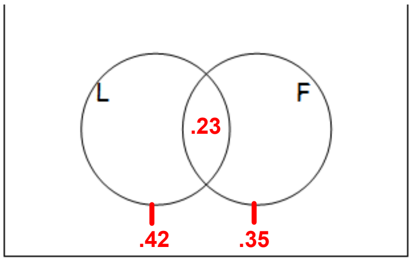
No. $P(F) = .43$ which is not equal to $P(F \mid S) = .53$

Day 9 Multiplication Rule

Recall yesterday's #5f: Venn Diagram included below.

If the events A and B are independent then we know:	P(A given B) = P(A) $P(A\|B) = P(A)$
Use the formula for conditional probability to replace P(A given B): $P(A)\ \cancel{P(A\|B)} = \frac{P(A\cap B)}{P(B)}$	$P(A) = \frac{P(A\cap B)}{P(B)}$
Now isolate P(A and B) and conclude that:	$P(A\cap B) = P(A) * P(B)$
Multiplication Rule for Independent Events If two events are independent, then:	$P(A\cap B) = P(A) * P(B)$ (only true for indep. events)

Yesterday in #5f, we determined that F and L were not independent because their conditional probabilities were not equal. Justify this now with the multiplication rule.



$$P(A\cap B) \stackrel{?}{=} P(A) * P(B)$$
$$P(L\cap F) \stackrel{?}{=} P(L) * P(F)$$
$$.23 \stackrel{?}{=} (.42) * (.35)$$
$$.23 \neq .147 \quad \therefore \text{Not indep.}$$

<u>Use the Multiplication Rule for Independent Events</u>

1. A number cube has faces numbered 1 through 6, and a coin has two sides, heads and tails. Find the probability that the cube shows a 4, and the coin lands heads.
   Are the events independent? Yes. The #cube cannot affect the result for the coin and the reverse is true. So, they are independent.

   The P(4 and a head) = $P(4 \cap H) = P(4) * P(H)$
   $= \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$

2. If you toss the coin five times, what is the probability you will see a head on all five tosses?
   $P(H,H,H,H,H) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \left(\frac{1}{2}\right)^5 = \frac{1}{32} = .03125$
   $\sim 3\%$

If you tossed the coin five times and got five heads, would you think that this coin is a fair coin? Explain.

Answers may vary. Always getting a heads five times out of five tosses is possible about 3% of the time. So it is very unlikely. If this happened, there would be reason to suspect the coin is **not** fair.

3. If you roll the number cube three times, what is the probability that it will show 4 on all three rolls?

$$P(4 \cap 4 \cap 4) = \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} = \frac{1}{216} \approx .005$$

If you rolled the number cube three times and got a 4 on all three rolls, would you think that this number cube is fair? Explain.

No, I would think the #cube is not fair because the probability of three 4s is so small at .5%.

4. Suppose that the credit card company introduced in ~~#3~~ #5 states that when a customer is selected at random, the probability that the customer pays his or her bill in full each month is 0.35, the probability that the customer makes regular online purchases is 0.83, and these two events are independent. What is the probability that a randomly selected customer pays his or her bill in full each month and makes regular online purchases?

$$P(F \text{ and } O) = P(F) * P(O)$$

(b/c they are indep.)

$$= .35 * .83$$

$$= .2905$$

5. A spinner has a pointer, and when the pointer is spun, the probability that it stops in the red section of the spinner is 0.25.

a. If the pointer is spun twice, are the 2 events independent? Explain.

Yes. One spin will not affect another spin.

b. If the pointer is spun twice, what is the probability that it will stop in the red section on both occasions?

$P(R \text{ and } R) = .25 \times .25 = \frac{1}{16}$ $(.0625)$

c. If the pointer is spun four times, what is the probability that it will stop in the red section on all four occasions? (Round your answer to the nearest thousandth)

$P(R, R, R, R) = (.25)^4 \approx .004$

d. If the pointer is spun five times, what is the probability that it never stops on red? (Round your answer to the nearest thousandth) $P(\text{Not } R) = .75$

$P(\text{Not } R \text{ 5 times}) = (.75)^5 = .237$

e. Explain what your answer from part (d) represents in terms of the context of the question. Does your result make sense? Explain.

Yes. The probability of never stopping on red for 5 spins in a row is 23.7%. This makes sense because the probability of red in one spin is 25% (1 in 4 spins is predicted to be red). So, the probability of no red after 5 spins should be less than 25%.

Remember:

Probability of the complement of an event: For any event A, P(not A) = P(A^c) = P(A') = $1 - P(A)$.

Conditional Probability of A given B:

For any two events A and B, P(A given B) = $\frac{P(A \text{ and } B)}{P(B)}$ or P(A | B) = $\frac{P(A \cap B)}{P(B)}$.

Multiplication Rule for Independent Events: (or Product Rule)

Events A and B are independent if and only if P(A and B) = $P(A) * P(B)$ (only if indep)

Add: (Test for Independence)

$$P(A) = P(A|B)$$