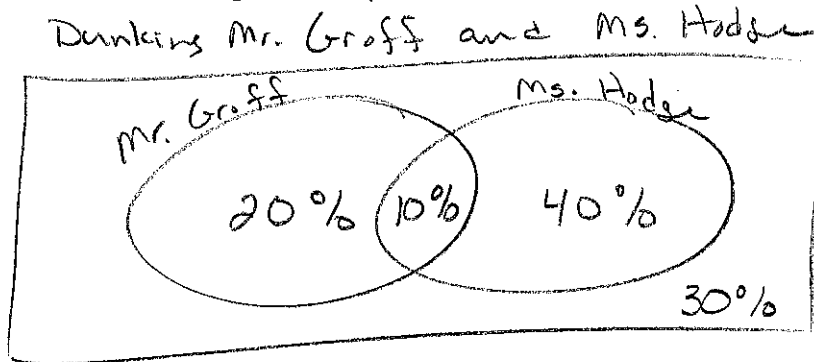


AMDM  
Unit 2 Test Review

Name Ans Key 04/08/2019  
Per. \_\_\_\_\_

A large group of high school students participated in a dunking booth where Mr. Groff and Ms. Hodge were the targets. Students were given 2 balls and one attempt at each target. There is a 30% chance that Groff gets dunked, a 50% chance that Ms. Hodge gets dunked, and a 10% chance that both Mr. Groff and Ms. Hodge get dunked.

- 1) Construct a Venn diagram to represent this scenario.



- 2) What portion of the Venn diagram represents the probability of both Groff and Hodge being dunked? What is the vocabulary word for this occurrence?

The overlap area which is the intersection

- 3) What is the probability of either Groff or Hodge being dunked?

$$P(\text{Groff or Hodge}) = P(\text{Groff}) + P(\text{Hodge}) - P(\text{Groff and Hodge})$$

$$= 30\% + 50\% - 10\% = 70\%$$

- 4) What is the probability of only Hodge being dunked?

$$P(\text{Hodge}) = 50\%$$

- 5) What is the probability that neither Hodge nor Groff is dunked?

$$P(\overline{\text{Hodge or Groff}}) = 1 - P(\text{Hodge or Groff})$$

$$= 100\% - 70\% = 30\%$$

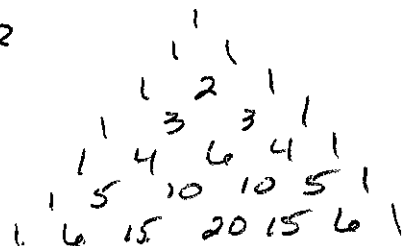
## Binomial Probability

As a special promotion for its 20 oz. bottles of soda, a soft drink company printed a message on the inside of each cap. Some of the caps said "Please try again," while other's said "You're a winner!" The company advertised that "1 in 6 wins a prize."

Suppose Vinny and his five friends: Angelina, Snookie, J-Wow, Ronnie and Paulie each buy one 20 oz. bottle.

$$p = \frac{1}{6} = 0.167 \quad n = 5 + 1 = 6$$

$$q = \frac{5}{6} = 0.833$$



6) What is the probability none of them wins a prize?

$$P(k) = \binom{n}{k} (p)^k (q)^{n-k}$$

$$P(0) = \binom{6}{0} (0.167)^0 (0.833)^{6-0}$$

$$= (1)(1)(0.833)^6 = 0.3349$$

7) What is the probability that exactly one of the six is a winner?

$$P(1) = \binom{6}{1} (0.167)^1 (0.833)^{6-1}$$

$$= (6)(0.167)(0.833)^5 = 0.4019$$

8) What is the chance that exactly 3 of the six are winners?

$$P(3) = \binom{6}{3} (0.167)^3 (0.833)^{6-3}$$

$$= (20)(0.167)^3 (0.833)^3 = 0.0538$$

According to the Mars candy company, 20% of its plain M&M candies are orange. Assume that the company's claims are true and you randomly select 8 eight candies from a large bag of M&M's without looking. (M&M's come in brown, yellow, blue, green, orange and red) Calculate an appropriate probability to justify your answers.

$p = 20\% = 0.20$ ;  $q = 80\% = 0.80$ ;  $n = 8$

9) Would you be surprised if none of the candies are orange?

$$P(k) = \binom{n}{k} (p)^k (q)^{n-k}$$

$$P(0) = \binom{8}{0} (0.20)^0 (0.80)^{8-0}$$

$$= (1)(1)(0.8)^8 = 0.1677$$

Just calc probability, u

10) Would you be surprised if exactly 2 of the candies you pulled are orange?

$$P(2) = \binom{8}{2} (0.2)^2 (0.8)^{8-2}$$

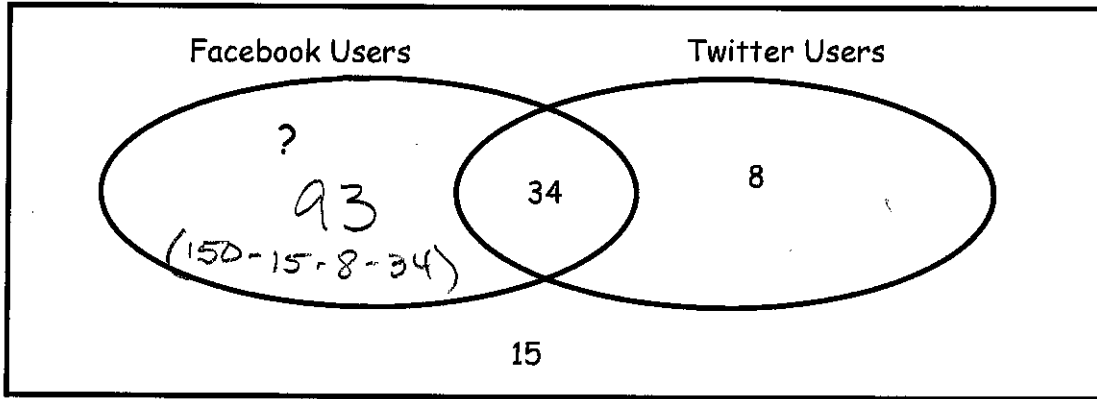
$$= (28)(0.2)^2 (0.8)^6 = 0.2936$$

11) How many orange M&M's would you expect to have in total if Vinny and each of his 6 friends from the previous problem pulled 9 M&M's each?

$$\text{Total M+M's drawn} = (1+6)(9) = (7)(9) = 63$$

$$\# \text{ of orange M+M's} = (63)(0.20) = 12.6 \approx 13$$

Isabella gave a survey to 150 seniors at her school. In this survey she asked the seniors if they used Facebook, Twitter both or neither. Here is a Venn diagram that models the results.



12) How many students use Facebook and Twitter?

$$n(\text{Facebook and Twitter}) = 34$$

13) What is the probability that a student is not a Facebook user?

$$P(\overline{\text{Facebook}}) = \frac{8 + 15}{150} = 0.1533$$

$$P(\text{Facebook}) = \frac{n(\text{Facebook})}{n(S)} = \frac{93 + 34}{150} = 0.8467$$

$$P(\overline{\text{Facebook}}) = 1 - P(\text{Facebook})$$

14) How many students are Facebook users but not Twitter? =  $1 - 0.8467 = 0.1533$

$$n(\text{Facebook and } \overline{\text{Twitter}}) = 93$$

15) What is the probability that a student is neither a Facebook user or Twitter user?

$$P(\overline{\text{Facebook or Twitter}}) = \frac{15}{150} = 0.1000$$

16) What is the probability that a student is a Twitter user given that he/she is a Facebook user?

$$P(\text{Twitter} | \text{Facebook}) = \frac{n(\text{Facebook and Twitter})}{n(\text{Facebook})}$$

$$= \frac{34}{93 + 34}$$

$$= \frac{34}{127} = 0.2677$$

17) Consider a well shuffled standard deck of 52 cards.

a. What is the probability of drawing a heart as the first card?

$$P(\text{Heart}) = \frac{n(\text{Heart})}{n(S)} = \frac{13}{52} = 0.2500$$

b. If the first card is not replaced, what is the probability of drawing a face card?

poorly written problem, don't bother (value)

c. If neither of the two previously drawn cards is replaced, what is the probability of drawing an 8 or an Ace on the third draw?

poorly written problem, don't bother

d. If the previously drawn cards are replaced and the deck is reshuffled, what is the probability of drawing a Royal Flush (Ace, King, Queen, Jack, 10, all of the same suit...i.e. all hearts or all spades, or all diamonds, or all clubs)?

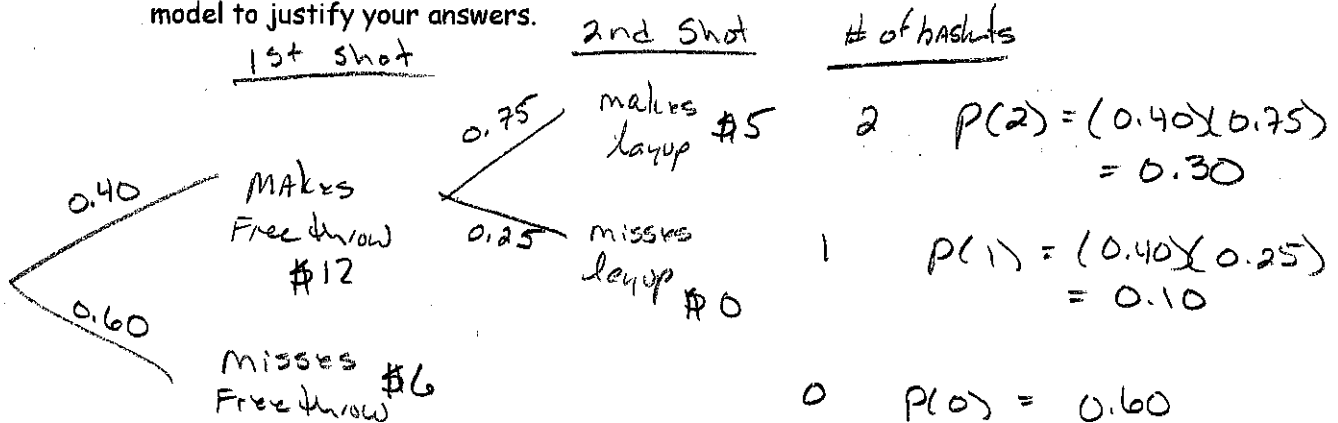
$$\begin{aligned}
 P(\text{Royal Flush}) &= (4) \left( \frac{1}{52} \right) \left( \frac{1}{51} \right) \left( \frac{1}{50} \right) \left( \frac{1}{49} \right) \left( \frac{1}{48} \right) \\
 &\quad \uparrow \\
 &\quad \text{four different} \\
 &\quad \text{ways to do so} \\
 &= \frac{4}{31,875,200} \\
 &= 1.2826 \times 10^{-8} \\
 &= 0.00000012826
 \end{aligned}$$

e. What is the probability of not drawing a royal flush?

$$\begin{aligned}
 P(\overline{\text{Royal Flush}}) &= 1 - P(\text{Royal Flush}) \\
 &= 1 - 1.2826 \times 10^{-8} \\
 &= 0.999999987
 \end{aligned}$$

After Yvonne starts her allowance deal with her dad, she tells her cousin CJ. CJ's dad agrees that he wants to offer a similar allowance to his son. Since CJ is only 8 years old, he takes his first shot from behind the free throw line, and the second shot is a layup. If his son misses the first shot, he only gets \$6. If he makes the first shot, he gets \$12 and a chance to shoot again for \$5 more. CJ makes 40% of his shots from the free throw line and 75% of his layups.

18) Find the probability of CJ making 0 baskets, 1 basket and 2 baskets. Draw an appropriate model to justify your answers.



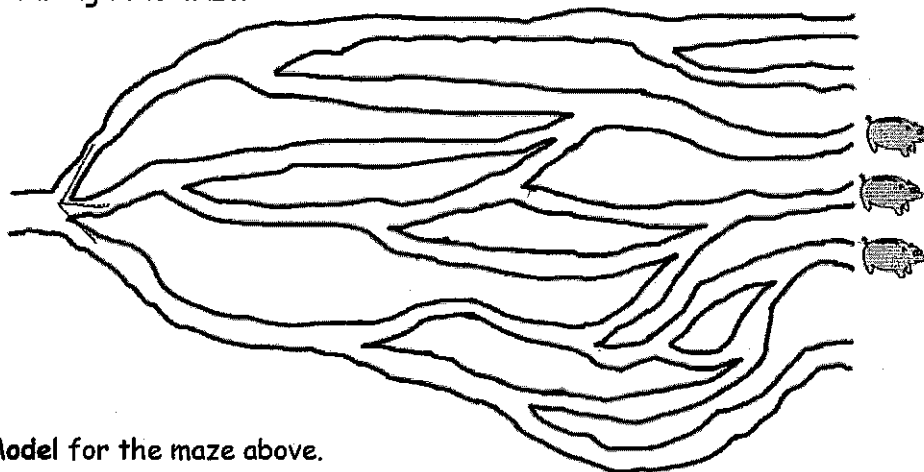
19) How many times in a year (52 weeks) would you expect CJ to get \$6?

poorly written problem  
you are not told how many times a week  
CJ gets this offer

20) How much allowance should CJ expect to receive in a year?

See above

The company you work for is sending you to a Professional Learning Seminar that lasts all weekend. One of the activities at the seminar is a maze that costs 10\$ to enter, however if you come out at an exit with a piggy bank you win \$500. You may only play the maze once and you can only move forward through the maze.



21) Create an Area Model for the maze above.

$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{4}$	piggy bank		$\frac{1}{2}$
$\frac{1}{3}$	piggy bank $\frac{1}{2}$		p.b. $\frac{1}{8}$	p.b. $\frac{1}{8}$	piggy bank $\frac{1}{4}$
$\frac{1}{3}$	piggy bank $\frac{1}{4}$	p.b. $\frac{1}{8}$	p.b. $\frac{1}{8}$	piggy bank $\frac{1}{4}$	$\frac{1}{4}$

22) What is probability that you will win the \$500 prize? Based on this answer, would you play or keep your money?

$$P(\text{piggy bank} - \$500) = \frac{1}{3} \left( \frac{1}{2} \right) + \frac{1}{3} \left( \frac{1}{2} + \frac{1}{8} + \frac{1}{8} + \frac{1}{4} \right) + \frac{1}{3} \left( \frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{4} \right)$$

$$= \frac{1}{3} \left( \frac{1}{2} + 1 + \frac{3}{4} \right) = \frac{1}{3} \left( \frac{9}{4} \right) = \frac{3}{4} = 0.75$$

Yes!! play!

23) If you and 5 of your friends decide to all play and split the winnings evenly amongst yourselves, how much should each person expect to win?

Hint: (think in terms of expected profit)

one person expected value =  $(\$500)(0.75) = \$375$

single profit =  $\$375 - \$10 = \$365$