12.2 HOMEWORK KEY

12.2 Exercises NAME____

1. Mr.Gilchrist never studies for his faculty meeting quizzes, when Ms. Shaw reminded him that we had a quiz the next morning Gil said he wasn't worried about it. Since it was a True/False quiz with only 10 questions on it, he boasted that he was a lucky guy and should easily get at least 8 out of the 10 correct since each question had a 50% chance of guessing the right answer. Ms. Shaw thinks Gil is full of hot air and decides to see how likely it would be for Gil to get at least 8 out of 10 right if he was just guessing on each question.

    a. Let's do a simulation where Heads = A correct answer and Tails = A wrong answer Since there are 10 questions on the quiz each trial will be made up of 10 coin flips. Either by hand or using the probability app on the TI-83 or TI-84.

	# Correct (Heads)	% Correct
Trial 1		
Trial 2		
Trial 3		
Trial 4		
Trial 5		

    b. Did you get 8 out of 10 correct (Heads) in any of your trials? How many times?

    c. What do you think are Gil's chances to get 8 out of 10 correct if he's just guessing?

    d. How would conducting more trials than just 5 affect our simulation results?
    By the Law of Large Numbers, our experimental probability would approach the actual probability.

    e. Do the simulation again but let's do 30 replications of the simulation instead just 5, record your results in the table below:

Trial #	Correct	%	Trial #	Correct	%	Trial #	Correct	%
1			11			21		
2			12			22		
3			13			23		
4			14			24		
5			15			25		
6			16			26		
7			17			27		
8			18			28		
9			19			29		
10			20			30		

    f. How did the probability of getting 8 or more correct out of 10 true/false questions change with the increased number of trials?

    g. Which of the two probabilities do you think is more accurate? Explain your answer.
    The one with more trials is likely to be more accurate.

    h. Based on what you've discovered in this example what is an important element of conducting simulations?
    Having enough trials to get experimental probability to resemble theoretical probability.

2. Sarah's favorite candy, Yummies, comes in a mix of 3 flavors, purple grape, red cherry and green apple. She often browses the web site of the company that makes Yummies to learn all she can about her favorite treat. She found out that in a pack of 10 random Yummies, about 30% should be purple grape, 30% should be red cherry and 40% should be green apple. Sarah secretly wishes that every time she opens her pack of 10 Yummies, she will get at least 5 purple grape candies. Conduct a simulation using the random number table below to determine the probability that Sarah's wish will come true. Do a simulation of 20 packs of 10 candies starting with the top row.

19223	95034	05756	28713	96409	12531	42544	82853
73676	47150	99400	01927	27754	42648	82425	36290
45467	71709	77558	00095	32863	29485	82226	90056
52711	38889	93074	60227	40011	85848	48767	52573
95592	94007	69971	91481	60779	53791	17297	59335
68417	35013	15529	72765	85089	57067	50211	47487
82739	57890	20807	47511	81676	55300	94383	14893

a. Let's use digits 0 – 2 to represent purple grape, and digits 3 – 9 to represent any candy other than grape. Record the number of purple grape candies in each of the 20 packs simulated.

	# of Grape		# of Grape		# of Grape		# of Grape
Pack 1	**4**	Pack 6	**5**	Pack 11	**2**	Pack 16	**1**
Pack 2	**3**	Pack 7	**2**	Pack 12	**5**	Pack 17	**3**
Pack 3	**4**	Pack 8	**4**	Pack 13	**3**	Pack 18	**3**
Pack 4	**2**	Pack 9	**2**	Pack 14	**4**	Pack 19	**2**
Pack 5	**2**	Pack 10	**3**	Pack 15	**4**	Pack 20	**2**

b. According to your simulation, what is the probability that Sarah's wish will come true and she will get 5 or more grape candies in her pack of Yummies?

$$\frac{\mathbf{2}}{\mathbf{20}} = \mathbf{10\%}$$

3. LET'S MAKE A DEAL!!!! In 1963, NBC started to host a game called *Let's Make a Deal!* Contestants were given three doors to choose from. Behind one door was a prize. After selecting one door, the contestant was shown what was behind one of the doors they did not select. The contestant is then asked if they would like to stick with the door they first selected, or switch to the remaining one.

a. Which strategy do you think would result in the best chance of selecting the winning door, sticking with the door they chose first or switching doors?

b. Go to http://www.shodor.org/interactivate/activities/SimpleMontyHall/ and play the game 20 times sticking with your first choice. Then play it 20 more times switching doors. Record your wins and losses for each method in the table below: **sample data**

	Sticking	Switching	Total
Win	**5**	**11**	**16**
Lose	**15**	**9**	**24**
Total	**20**	**20**	**40**

c. Based on the simulation, what is $P(winning|sticking) = \frac{\mathbf{5}}{\mathbf{20}} = \mathbf{25\%}$

d. Based on the simulation, what is $P(winning|switching) = \frac{\mathbf{11}}{\mathbf{20}} = \mathbf{55\%}$

e. Does there appear to be a strategy that seems to win more often? Why do you think that method is seems to be more successful than the other?

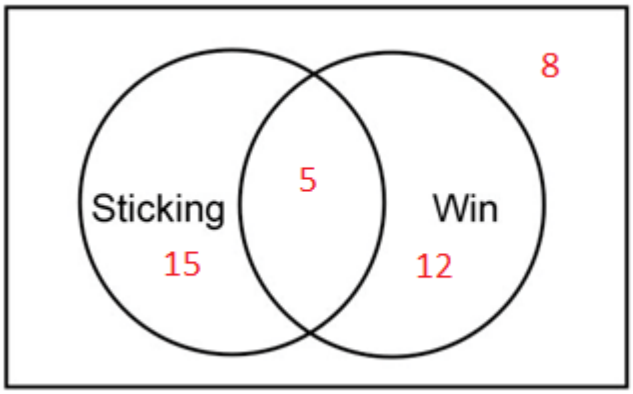
Switching seems to win more often. Picking 1 of 2 has better probability than picking 1 of 3.

4. PROBABILITY REVIEW

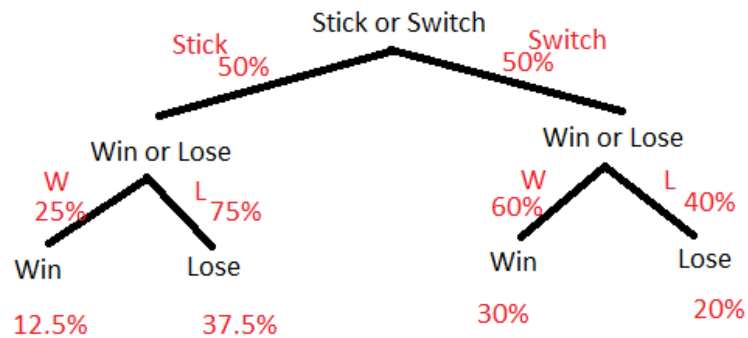
a. Use the following table of Gil's wins and losses in his Let's Make a Deal simulation from #3 to answer the following questions

	Sticking	Switching	Total
Win	**5**	**12**	**17**
Lose	**15**	**8**	**23**
Total	**20**	**20**	**40**

b. Draw a Venn Diagram of the table data and include the probability for each area:



c. Draw a tree diagram with the probabilities of choosing a winning or losing door included.



d. $P(winning) = \mathbf{\frac{17}{40} = 42.5\%}$

e. $P(winning \cap sticking) = \mathbf{\frac{5}{40} = 12.5\%}$

f. $P(winning \cap switching) = \mathbf{\frac{12}{40} = 30\%}$

g. $P(losing|sticking) = \mathbf{\frac{15}{20} = 75\%}$

h. $P(winning\ or\ losing) = \mathbf{\frac{40}{40} = 100\%}$

i. Are the events winning and sticking independent of each other? Justify your answer using probabilities.

Events A (winning) and B (switching) are independent if $\boldsymbol{P(A\ and\ B) = P(A) \cdot P(B)}$.

$$\boldsymbol{P(A\ and\ B) = 12.5\%}$$

$$\boldsymbol{P(A) = 42.5\%, P(B) = 50\%;\ P(A) \cdot P(B) = 21.25\%}$$

$$\boldsymbol{12.5\% \neq 21.25\%}$$

The events are not independent of each other.