Stastics Lab Ch. 3 M&M's

Names:

Student Learning Outcome

- The student will calculate theoretical and experimental probabilities.
- The student will appraise the differences between sampling with and without replacement.
- The student will demonstrate an understanding of long-term relative frequencies.

Directions:

1. Randomly pick out 40 (or 30) mixed-color M&M's® from a small bag of M&M's (some distance learning classes that are using the virtual lab should count out 25). Record the number of each color below.

Color	Quantity
Yellow Y	
Green G	
Blue BL	
Brown B	
Orange O	
Red R	

2. Construct two tree diagrams (1 for with replacement and 1 for without replacement) using the information in the table in #1 to complete the theoretical probability questions below. Attach the trees to your lab when you turn the lab in. **Leave your answers in unreduced fractional form.**

	With Replacement	**Without Replacement**
$P(R_1$ and $R_2)$:		
$P(R_1$ and B_2 or B_1 and $R_2)$:		
$P(R_1$ and $G_2)$:		
$P(G_2 \mid R_1)$:		
P(no yellows on either draw):		
P(doubles):		
P(no doubles):		

Note: G_2 = green on second pick; R_1 = red on first pick; R_2 = red on second pick; doubles = both picks are the same color. B_1= brown on first pick; B_2 = brown on second pick.

2. Put the M&M's in a cup and conduct the experiment of picking 2 M&M's, one at a time, **with replacement**. Do NOT look at them as you pick them. Repeat this experiment 23 more times. Remember, each experiment starts with 40 (or 30) M&M's in the cup. Record the result of each experiment below.

With Replacement

(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)

3. Use the table in #2 to answer the following probability questions. **Leave your answers in unreduced fractional form. All answers MUST include both the numerator and the denominator.**

Experimental Probabilities

With Replacement

$P(R_1 \text{ and } R_2)$: _____

$P(R_1 \text{ and } B_2 \text{ or } B_1 \text{ and } R_2)$: _____

$P(R_1 \text{ and } G_2)$: _____

$P(G_2 | R_1)$: _____

P(no yellows on either draw): _____

P(doubles): _____

P(no doubles): _____

4. Repeat the experiment in #3, **without replacement**. Do NOT look at them as you pick them. Repeat this experiment 23 more times. Remember, each experiments starts with 40 (or 30) M&M's in the cup. Record the result of each experiment below.

Without Replacement

(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)
(,) (,)	(,) (,)

5. Use the table in #4 to answer the following probability questions. **Leave your answers in unreduced fractional form. All answers MUST include both the numerator and the denominator.**

Experimental Probabilities

Without Replacement

$P(R_1 \text{ and } R_2)$:

$P(R_1 \text{ and } B_2 \text{ or } B_1 \text{ and } R_2)$: _____

$P(R_1 \text{ and } G_2)$: _____

$P(G_2 | R_1)$: _____

P(no yellows on either draw): _____

P(doubles): _____

P(no doubles): _____

_____

Questions (answer in complete sentences): (If there is not enough room to answer in the space provided, then use an additional page.)

1. Why are the "With Replacement" and "Without Replacement" probabilities different?

2. Convert **P(no yellows on either draw)** to decimal format for both Theoretical "With Replacement" and for Experimental "With Replacement". Round to 4 decimal places.
   a. Theoretical "With Replacement": **P(no yellows) =** _____
   b. Experimental "With Replacement": **P(no yellows) =** _____
   c. Are the decimal values "close"? _____ (yes or no)
   d. Did you expect them to be closer together or farther apart? _____ Why?

3. If you were to repeat this experiment another 24 times, would experimental probability values change, and if so, why?

4. Would increasing the number of times the experiment is conducted cause the empirical probabilities and theoretical probabilities to be closer together or farther apart? How do you know?

5. Explain the differences in what $P(R_1 \text{ and } G_2)$ and $P(G_2 \mid R_1)$ represent. Hint: Think about the sample space for each probability.