

Application exercise 8.1: Bayesian vs. frequentist inference

Team name: _____

Lab section: 8:30 10:05 11:45 1:25 3:05 4:40

Write your responses in the spaces provided below. WRITE LEGIBLY and SHOW ALL WORK! Only one submission per team is required. One team will be randomly selected and their responses will be discussed and graded. Concise and coherent are best!

Hypotheses 10% yellow M&Ms vs. 20% yellow M&Ms

Decision Table

Decision	True state of the population	
	% yellow = 10%	% yellow = 20%
% yellow = 10%	<i>Your boss gives you a bonus, and I bring you candy on Monday</i>	<i>You lose your job, and no candy for you</i>
% yellow = 20%	<i>You lose your job, and no candy for you</i>	<i>Your boss gives you a bonus, and I bring you candy on Monday</i>

Set up

1. How many M&Ms would you buy? Decide as a team and vote.

(a) 5

(b) 10

(c) 15

(d) 20

2. Then, discuss at what significance level you will reject the null hypothesis.

$\alpha =$ _____

Data RGYBO BBGOY YRBRR GORBY

Frequentist inference

- Number of yellows in the first n draws = _____ = k
- Calculate the p-value:
 $P(k \text{ or more yellows} \mid n, \% \text{yellow is } 10\%) = \text{_____}$

- Do you reject the null hypothesis? _____

Bayesian inference

Using the same data, use Bayes' theorem to calculate the probability the percentage of yellow is 10% and 20%.

$$P(10\%yellow|data) = \frac{P(data|10\%yellow) \times P(10\%yellow)}{P(data)}$$

$$P(20\%yellow|data) = \frac{P(data|20\%yellow) \times P(20\%yellow)}{P(data)}$$

Bayesian vs. Frequentist inference

Regardless of the choices you made earlier about n , fill out the table below for all possible choices of n and the resulting k

	Frequentist: p-value		Bayesian: Posterior	
Number of yellow M&Ms in first	$P(K \geq k \mid 10\% \text{ yellow})$	Decision	$P(10\% \text{ yellow} \mid n, k)$	$P(20\% \text{ yellow} \mid n, k)$
$n = 5 : k = 1$				
$n = 10 : k = 2$				
$n = 15 : k = 3$				
$n = 20 : k = 4$				