HSCI 50 LAB 3: Binomial and Normal Distribution

INSTRUCTIONS

The data set that we will be using for the entire course is resampled data from the MIT COVID-19 Beliefs, Behaviors & Norms Survey (https://covidsurvey.mit.edu/api.html). This is a multi-country, online survey that examined different COVID-19 perceptions across time, from July 6, 2020 to March 28, 2021. We will be using data from the Philippines aged 20 to 60.

In this lab, you will practice calculating probabilities given a binomial distribution and a normal distribution.

You have many options to submit this worksheet. Either you work on this by hand and scan/take a clear photo of your submission and save as PDF, or type your responses in a Word processor or PowerPoint presentation. You do not have to copy the questions again, but please number them accordingly.

Part A. Binomial Distribution.

We will revisit the table from Lab 2 and recode the vaccine acceptance categories into a new variable, vaccine hesitancy. Those who do not accept the vaccine or are unsure about it will be considered vaccine hesitant, otherwise they are not vaccine hesitant. The table below summarizes that information.

Table 1: COVID-19 vaccine hesitancy in the Philippines, March 14-28, 2021

Vaccine hesitant	Count	Percent
No	612	53.4
Yes	533	46.6

1. Why was dichotomizing the vaccine acceptance outcome necessary to calculate probabilities based on the binomial distribution?

2. One of the other assumptions of the binomial distribution is that the outcomes are independent from one another. This assumption cannot be tested empirically (meaning, with whatever data you have). In the simplest of explanations, what does this mean in the context of this data?

3. Another assumption of the binomial distribution is that the probabilities of the outcomes of the trials remain the same across trials. In the context of this data, what does that mean exactly?

For questions 4-8, calculate this question by hand (you may use a calculator), and show your solutions. Approximate your answers to the nearest thousandth. Whenever appropriate, you may use the University of Iowa Binomial Distribution Applet (https://homepage.divms.uiowa.edu/~mbognar/applets/bin.html). Assume that three persons are randomly selected from this sample.

4. What is the probability that only the first person selected will be vaccine hesitant?

5. What is the probability that only one person selected will be vaccine hesitant?

6. What is the probability that the first two persons selected will be vaccine hesitant?

7. What is the probability that the exactly two persons selected will be vaccine hesitant?

8. Using what you have calculated so far, and calculating some more, complete the following table:

Number of vaccine hesitant (x)	P(X = x) = Probability of x vaccine hesitant
0	
1	
2	
3	

For questions 9 and 10, use the applet. Approximate to the nearest thousandths

9. Now let's assume we are randomly selecting 10. What is the probability that 5 of them are going to be vaccine hesitant?

10. Now let's assume we are randomly selecting 100. What is the probability that 50 of them are going to be vaccine hesitant? What do you notice about the binomial distribution as n becomes larger and larger?

PART B. Normal Distribution

In the same survey, individuals were asked about their perceptions of how other people will accept the COVID-19 vaccine, as a measurement of vaccine norms. They were asked, "Out of 100 people in your community, how many do you think would take a COVID-19 vaccine if it were made available?" We will call this variable **vaccine norms.** While this is technically a discrete variable, we will assume for the purposes of this class that this is a continuous variable.

In the latest survey wave, conducted March 14 to 28, 2021, the mean vaccine norm was 60.7 for the Philippines. We will assume that the population distribution is normal. We will also assume 60.7 is the true population distribution μ. We will also assume that the true population standard deviation σ is 12.5.

To answer the following questions, either calculate these by hand using a calculator or use the University of Iowa Normal Distribution Applet (https://homepage.divms.uiowa.edu/~mbognar/applets/normal.html). Approximate your answers to the nearest thousandth.

1. Approximately the middle 68% of Filipinos have vaccine norms of what range of values?

2. Approximately the middle 95% of Filipinos have vaccine norms of what range of values?

3. Approximately the middle 80% of Filipinos have vaccine norms of what range of values?

4. How many percent of Filipinos have vaccine norms above 50?

5. How many percent of Filipinos have vaccine norms between 35 and 55?

END OF LAB