

Name _____

Section _____

Instructor _____

NOTE: TO ANSWER THESE QUESTIONS YOU WILL NEED TO DO THE WORK ON A SEPARATE PIECE OF PAPER OR EXCEL. NUMBER EVERYTHING THE SAME AS IT IS NUMBERED HERE. SUBMIT THESE SHEETS. YOUR SIDEWORK, AND ANY EXCEL FILES

Question #1: Every morning James randomly chooses one shirt out of his wardrobe. He only owns shirts that are either red or green. Cecelia wants to find the total number of shirts and how many of each colour he owns. Instead of asking him she keeps a daily record of the color of James's shirts. (Assume that James does laundry every day, so the number of types of shirts remain the same.)

- A. Create a frequency distribution and relative frequency distribution of the observations.
- B. Give an estimate for the probability that James will wearing a red shirt that day, call this result \hat{p} .
 $\hat{p} = \underline{\hspace{2cm}}$
- C. One day Cecelia asked James for the number and color of shirts he owns. He claims that out of the 35 shirts he owns 14 of them are green. Should Cecelia believe his claim? Justify your answer.
- D. For the next 14 days James will keep to his pattern of choosing a shirt. Let X be a random variable defined as:

$X: \{\text{\# of days out of next 14 that James wears green shirt.}\}$

What distribution does X follow? Justify your answer by showing it follows ALL the criteria for your choice of distribution.

- E. Which is more likely:
 - a. James wears a green shirt 5 out of the next 14 days given Cecelia's estimate is true.
 - b. James wears a green shirt 5 out of the next 14 days given his claim is true.
- F. Let Y be defined as

$Y: \{\text{\# of times James wore a red shirt while being observed by Cecelia}\}$

Why is $P(Y = 90) = 0$?

Sampling Distribution of the Mean

Question 2: Suppose you have the following population: {24, 36, 48, 60, 72, 84, 96}

- A. What is this population's $\mu = \underline{\hspace{2cm}}$ $\sigma = \underline{\hspace{2cm}}$ $N = \underline{\hspace{2cm}}$
- B. Suppose you selected a sample of size $n=2$ from this population. What is the number of possible combinations of sample size $n= 2$.
- C. In the table below list all the possible combinations for samples of size $n=2$, and their sample means, \bar{x} :

Table 1

[illegible]

- D. What is the probability of selecting the combination of 24 and 36? _____
In fact, each of the sample combinations has what probability of being selected? _____
- E. What is the population mean and population standard deviation of the sample means in Table 1?

$$\mu_{\bar{x}} = \underline{\hspace{2cm}} \quad \sigma_{\bar{x}} = \underline{\hspace{2cm}}$$

- F. Using the Empirical Rule what interval, centred by the mean, will contain 68% of the observations of the sample mean? What about 95% of all observations?

- G. Generate a table that displays the probability distribution for the values of the sample mean (Hint: a relative frequency distribution can function the same way)
- H. Generate a probability histogram for the sample mean

Question 3: Suppose you have the same population: {24, 36, 48, 60, 72, 84, 96}

- A. Suppose you selected a sample of size $n=5$ from this population. What is the number of possible combinations of sample size $n=5$.
- B. In the table below list all the possible combinations for samples of size $n=5$, and their sample means, \bar{x} (Hint: The complement of each row in the first column of Table 1 will be a row in the first column of Table 2)

Table 2

[illegible]

- A. Each of these sample combinations has what probability of being selected? _____
- B. What is the population mean and population standard deviation of the sample means in Table 2?

$$\mu_{\bar{x}} = \underline{\hspace{2cm}} \quad \sigma_{\bar{x}} = \underline{\hspace{2cm}}$$

- C. Using the Empirical Rule what interval, centred by the mean, will contain 68% of the observations of the sample mean? What about 95% of all observations?
- D. Generate a table that displays the probability distribution for the values of the sample mean (Hint: a relative frequency distribution can function the same way)
- E. Generate a probability histogram for the sample mean:
- F. Comparing these results with the results of Question #2, which sample size has the higher risk of having a sample mean that is different from the population mean $n = 2$, or $n = 5$?

Question #4:

Benjamin Franklin once said, "in this world nothing can be said to be certain, except death and taxes." Write Benjamin Franklin's claim using the probability model.