

Part 2: Free Response

Answer completely, but be concise. Write sequentially and show all steps.

A headache remedy is said to be 80% effective in curing headaches caused by simple nervous tension. An investigator tests this remedy on 100 randomly selected patients suffering from nervous tension.

6. Define the random variable being measured. $X =$ THE NUMBER OF SELECTED PATIENTS CURED OF THEIR HEADACHE.

What kind of distribution does X have? X IS BINOMIAL WITH $n = 100$, $p = 0.8$

7. Calculate the mean and standard deviation of X .

$$\mu_x = (100)(0.8) = 80 \text{ PEOPLE}$$

$$\sigma_x = \sqrt{(100)(0.8)(0.2)} = 4 \text{ PEOPLE}$$

8. Determine the probability that exactly 80 subjects experience headache relief with this remedy.

$$P(X=80) = \text{binompdf}(100, .8, 80) = 0.0993$$

9. What is the probability that between 75 and 90 (inclusive) of the patients will obtain relief? Justify your method of solution.

Method 1: $P(75 \leq X \leq 90) = \text{binomcdf}(100, .8, 90) - \text{binomcdf}(100, .8, 74) = 0.910$

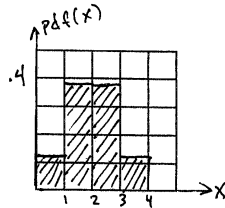
Method 2: Since $np = 80 > 10$, AND $nq = 20 > 10$, THEN X IS APPROXIMATELY NORMALLY DISTRIBUTED, WITH μ_x AND σ_x , SO

$$P(75 \leq X \leq 90) \approx \text{normalcdf}(75, 90, 80, 4) = 0.888.$$

10. Construct a pdf (probability distribution function) table for the variable X .

X	0	1	2	3
pdf(x)	.125	.375	.375	.125

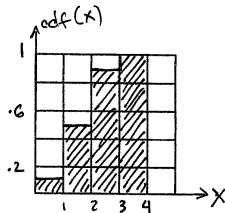
11. Construct a pdf histogram for X .



12. Construct a cdf (cumulative distribution function) table for X .

X	0	1	2	3
cdf(x)	.125	.5	.875	1

13. Construct a cdf histogram for X .



14. What is the probability that a family like the Ferrells would have three children who are all girls?

$$P(X=3) = .125$$

A survey conducted by the Harris polling organization discovered that 63% of all Americans are overweight. Suppose that a number of randomly selected Americans are weighed.

15. Find the probability that 18 or more of the 30 students in a particular adult Sunday School class are overweight. (NOTE THAT WE CALL THIS CALCULATION INTO QUESTION SINCE THIS SAMPLE IS NOT NECESSARILY AN SRS OF ALL AMERICANS.)

IF $X =$ NUMBER OF ADULTS IN THE 30-MEMBER CLASS WHO ARE OVERWEIGHT,
 $X \sim B(30, .63)$. $P(X \geq 18) = 1 - \text{binomcdf}(30, .63, 17) = 0.7055$

16. How many Americans would you expect to weigh before you encounter the first overweight individual? IF $X =$ NUMBER OF AMERICANS WEIGHED BEFORE WE FIND THE FIRST OVERWEIGHT PERSON, $X \sim G(.63)$,

THEN $E(X) = \frac{1}{.63} = 1.587$.

17. What is the probability that it takes more than 5 attempts before an overweight person is found?

$$P(X > 5) = 1 - \text{geometcdf}(.63, 5) = 0.0069$$

18. Construct the cumulative distribution table (stop at $n = 6$) for the number of Americans weighed before an overweight person was found.

X	1	2	3	4	5	6
cdf(x)	.63	.863	.949	.981	.993	.997

19. Sketch a cumulative distribution histogram (stop at $n = 6$) for the table you constructed in the previous problem. Don't forget to label the axes.

