Normal Distribution as Approximation to Binomial Distribution

Criteria for a Binomial Probability Experiment

A probability experiment is a binomial experiment if all the following are true:

1.The experiment is performed n independent times. Each repetition is called a trial.

2.There are two mutually exclusive outcomes: success or failure

3.Probability of success, p, is the same for each trial

Note

For a fixed p, as the number of trials n in a binomial experiment increases, the probability distribution of the random variable X becomes more nearly symmetric and bell shaped. As a rule of thumb,

if np(1-p) $\geq$ 10, the probability distribution will be approximately symmetric and bell shaped.

Using a normal distribution to approximate a binomial distribution

1. Verify np(1-p) is greater than or equal to 10
2. Calculate μ = np and σ=$\sqrt{np(1-p)}$
3. x = # of successes, using x – 0.5 or x + 0.5, figure probability using the TI-83/84

Formulas

$$\mu = np$$

$$\sigma = \sqrt{np(1-p)}$$

Figuring Correction Factor (0.5)

1. Determine if your wording includes the number (yes or no question)
2. Draw the graph (adding or subtracting 0.5) such that:
   - Case 1: if the wording includes the number, your shading will include the number.
   - Case 2: If the wording doesn't include the number, then your shading won't include it.

By Hand Instructions

1. Verify binomial experiment and np(1-p)≥10
2. Change x value(s) (with 0.5 correction) to a z-score(s): $z = \frac{x-np}{\sqrt{np(1-p)}}$
3. Look it up in the table based upon shading to the a) left, b) right , or c) between

TI-83/84 Instructions

$normalcdf\,(lowerbound, upperbound, n \cdot p, \sqrt{np(1-p)})$

1. 80% of students procrastinate on their school work. Suppose 200 students are selected. Use the normal as an approximation to the binomial to:

Approximate the probability that exactly 150 procrastinate

2. 1.11% of citizens cheat on their taxes. Suppose 450 citizens are selected. Use the normal as an approximation to the binomial to:

Approximate the probability that at least 10 cheat on their taxes

3. 87% of American households have outdoor grills. Suppose 310 households are selected. Use the normal as an approximation to the binomial to:

Approximate the probability that fewer than 260 have outdoor grills

4. 40% of men have noticeable hair loss by age 35. Suppose 500 men (who are 35 years old) are selected. Use the normal as an approximation to the binomial to:

Approximate the probability that between 100 and 200 of them are having noticeable hair loss