

Unit 3 Lesson 3 Guided Notes

The Normal Approximation to the Binomial Distribution

- A normal distribution is often used to solve problems that involve the binomial distribution since when n is large, the calculations are too difficult to do by hand using the binomial distributions.
- Remember the four criteria for binomial distributions:
 1. There must be a fixed number of outcomes.
 2. The outcome of each trial must be independent.
 3. Each experiment can have only two outcomes or outcomes that can be reduced to two outcomes.
 4. The probability of a success must remain the same for each trial.

Similarities between binomial and normal distribution

- Binomial distributions are determined by the number of trials (n) and the probability of success (p). When n is large, and p is close to 0.5, the shape of the binomial distribution becomes similar to that of the normal distribution.
- However, when n is small and p is close to 0 or 1, a normal approximation would be inaccurate.
 - Statisticians agree that the normal approximation should only be used when nxp and nxq are both greater than or equal to 5.

Correction for Continuity

- In addition to the previous condition that nxp and nxq are both greater than or equal to 5, a correction for continuity may be used in the normal approximation.
- A **correction for continuity** is a correction employed when a continuous distribution is used to approximate a discrete distribution.
 - This is similar to when we found the class boundaries for frequency distributions – when we extended the boundaries by 0.5 to account for the continuity and get rid of any gaps in the distribution.

Summary of the Normal Approximation to the Binomial Distribution	
Binomial	Normal
When finding...	Use...
1. $P(X = a)$	$P(a - 0.5 < X < a + 0.5)$
2. $P(X \geq a)$	$P(X > a - 0.5)$
3. $P(X > a)$	$P(X > a + 0.5)$
4. $P(X \leq a)$	$P(X < a + 0.5)$
5. $P(X < a)$	$P(X < a - 0.5)$
For all cases, $\mu = nxp$, $\sigma = \sqrt{nxp \times q}$, $nxp \geq 5$, and $nxq \geq 5$	

Procedure Table	
Procedure for the Normal Approximation to the Binomial Distribution	
Step 1	Check to see whether the normal approximation can be used.
Step 2	Find the mean and the standard deviation.
Step 3	Write the problem in probability notation using X .
Step 4	Rewrite the problem by using the continuity correction factor, and show the corresponding area under the normal distribution.
Step 5	Find the corresponding z values.
Step 6	Find the solution.

Examples

1. A magazine reported that 6% of American drivers read the newspaper while driving. If 300 drivers are selected at random, find the probability that exactly 25 say they read the newspaper while driving.
2. Of the members of a bowling league, 10% are widowed. If 200 bowling league members are selected at random, find the probability that 10 or more will be widowed.

3. If a baseball player's batting average is 0.320 (32%), find the probability that the player will get at most 26 hits in 100 times at bat.

4. When $n = 10$ and $p = 0.5$, use the binomial distribution table to find the probability that $X = 6$. Then use the normal approximation to find the probability that $X = 6$.