Chapter 6 Normal Probability Distribution

6.6 Normal as Approximation to Binomial

This video clip is available at http://cfcc.edu/faculty/cmoore/nb1/nb1.htm

Technology available for this section

Normal as Approximation to Binomial – Excel program to calculate normal probabilities as approximation to binomial.
http://cfcc.edu/faculty/cmoore/S3.159a.6C.NormDist.xls

Animations and Videos in the Multimedia Library of Course Compass provide very valuable information and examples.

Quick Review – list the following conditions:
1. Two conditions for discrete probability distribution:
2. Four conditions for binomial probability distribution:
3. Two conditions for continuous probability distribution:
4. Two conditions for using normal to approximate binomial:
5. Continuity correction factor – what and why?

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Given discrete values as follow. Use continuity correction factor to state the normal probability. Probability of at least 12 adult males on an elevator in the Empire State Building.

\[ P(x \geq 12) \]

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Given discrete values as follow. Use continuity correction factor to state the normal probability. Probability that the number of working vending machines in the US is exactly 27.

\[ P(x = 27) \]
Given discrete values as follow. Use continuity correction factor to state the normal probability. Probability that the number of incorrect statistical procedures in Excel is between 15 and 20 inclusive. Binomial: \( P(15 \leq x \leq 20) \) is equivalent to Normal.

Given discrete values as follow. Use continuity correction factor to state the normal probability. Probability that the number of truly honest politicians is between 8 and 10 inclusive. Binomial: \( P(8 \leq x \leq 10) \) is equivalent to Normal.

\[ \text{Binomial: } P(x = 6) = 0.207 \]

\[ \text{Binomial: } P(x < 5) = 0.655 \]

Estimate the probability of passing a true/false test of 100 questions if 60% correct is the minimum passing grade and all responses are guesses. Is that probability high enough to risk passing by using random guesses instead of studying?
A multiple-choice test consists of 25 questions with possible answers of a, b, c, d, and e. Estimate the probability that with random guessing, the number of correct answers is between 3 and 10 inclusive.

\[
\text{Binomial: } P(3 \leq X \leq 10) = \frac{e^{-(25/2)} (25/2)^{10}}{10!} - \frac{e^{-(25/2)} (25/2)^{3}}{3!}
\]

\[
= 0.0962
\]

Assuming that boys and girls are equally likely, estimate the probability of getting at least 42 girls in 64 births. Is it unusual to get at least 42 girls in 64 births?

\[
\text{Binomial: } P(X \geq 42) = \sum_{k=42}^{64} \binom{64}{k} \left(\frac{1}{2}\right)^{64} \left(\frac{1}{2}\right)^{64-k}
\]

\[
= 0.0088 < 0.05 \\
\text{Yes, it is unusual to get at least 42 girls in 64 births.}
\]

CBS television show 60 Minutes had a rating of 7.8 (7.8% tuned to the show). Advertiser surveyed 100 households and found only 4 tuned to the show. Assuming that the 7.8 rating is correct, find the probability of surveying 100 randomly selected households and getting 4 or fewer tuned to 60 Minutes. Does the result suggest that the rating of 7.8 is too high? Does the advertiser have grounds to ask for refund?

\[
\text{Binomial: } P(X \leq 4) = \sum_{k=0}^{4} \binom{100}{k} \left(\frac{78}{100}\right)^{k} \left(\frac{22}{100}\right)^{100-k}
\]

\[
= 0.1089
\]

Since 0.1089 < 0.05, it is not unusual to expect 4 or fewer households to be watching the program.

The probability of flu symptoms for a person not receiving any treatment is 0.019. In a clinical trial of Lipitor, a common drug used to lower cholesterol, 863 patients were given a treatment of 10-mg atorvastatin tablets, and 19 of those patients experienced flu symptoms. Assuming that these tablets have no effect on flu symptoms, estimate the probability that at least 19 of 863 people experience flu symptoms. What do these results suggest about flu symptoms as an adverse reaction to the drug?

\[
P(X \geq 19) = \sum_{k=19}^{863} \binom{863}{k} (0.019)^{k} (0.981)^{863-k}
\]

\[
= 0.3
\]

Air America is considering a new policy of booking as many as 400 persons on an airplane that can seat only 350. (Past studies have revealed that only 85% of the booked passengers actually arrive for the flight.) Estimate the probability that if Air America books 400 persons, not enough seats will be available. Is that probability low enough to be workable, or should the policy be changed?

\[
P(X > 350) = 1 - P(X \leq 350) = 1 - \sum_{k=0}^{350} \binom{400}{k} (0.85)^{k} (0.15)^{400-k}
\]

\[
= 0.0707
\]
According to Mars, Inc., 20% of M&M plain candies are orange. A random sample of 100 M&Ms contained 25 orange. Assuming that the claimed 20% is correct, estimate the probability of randomly selecting 100 M&Ms and getting 25 or more that are orange. Based on the result, is it unusual to get 25 or more orange M&Ms when 100 are randomly selected?

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312/26. According to Mars, Inc., 20% of M&M plain candies are orange. A random sample of 100 M&Ms contained 25 orange. Assuming that the claimed 20% is correct, estimate the probability of randomly selecting 100 M&Ms and getting 25 or more that are orange. Based on the result, is it unusual to get 25 or more orange M&Ms when 100 are randomly selected?

There is a practice quiz at http://cfcc.edu/faculty/cmoore/155Norm-Bin-Quiz/index.html

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313/30. In Orange County, 12% of those eligible for jury duty are left-handed. Among 250 people selected for jury duty, 25 (or 10%) are lefties. Find the probability of getting at most 25 lefties assuming that they are chosen with a process designed to yield a 12% rate of lefties. Can we conclude that this process of selecting jurors discriminates against lefties?

There is a practice quiz at http://cfcc.edu/faculty/cmoore/155Norm-Bin-Quiz/index.html

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