17.c - Normal Approximation

Think - Show - Tell

1) Discussion of Binomial Assignment
2) Discussion of Calculator Usage - Notation
3) Ping Pong Balls
4) Notes 17.c: Normal Model Approximation
5) Assignment Time
17.c - Calculator Notation

**Geometric Models**
written in work as
\[ \text{Geom}(p) \]
probability of exactly \( x \) times waiting for first success
\[ \text{geometpdf}(p, x) \]
probability of success by the \( x \)" trial
\[ \text{geometcdf}(p, x) \]

**Binomial Models**
written in work as
\[ \text{Binom}(n, p) \]
probability of exactly \( x \) successes in \( n \) trials
\[ \text{binompdf}(n, p, x) \]
probability of up to \( x \) successes in \( n \) trails
\[ \text{binomcdf}(n, p, x) \]

17.c - Normal Approximation

-when the number of trials is "big enough", the distribution of a binomial model is approximately the same as the normal model
-this allows us to approximate large run binomial results with the normal model

**Process**
-find \( E(X) \) and \( \sigma \) of the binomial model
-convert your \( x \)-value to a \( z \)-score
-use a \( z \)-score table to convert to a probability
-draw a normal curve picture to make sure your answer is reasonable
17.c - "big enough"

-when the number of trials is "big enough"

Success/Failure Condition
-the Binomial model is approximately Normal if we expect
  at least 10 success and 10 failures

np ≥ 10 and nq ≥ 10

if this occurs, then

**Binom (n, p) is approximated by N(μ, σ)**

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**Normal Approximation of the Binomial Model**

An Olympic archer is able to hit the bull's-eye 80% of the time. Assume each shot is independent of the others. If she shoots 200 arrows...

\[ \text{SD}(X) = \sqrt{npq} = \sqrt{200 \times 0.8 \times 0.2} = 5.66 \]

\[ \text{E}(X) = np = 160(0.8) = 128 \]

a) is the Normal model appropriate here? Explain.

b) Use the 68-95-99.7 Rule to describe the distribution of the number of bull's-eyes she might get.

\[ N(160, 5.66) \]
Normal Approximation of the Binomial Model

An Olympic archer is able to hit the bull's-eye 80% of the time. Assume each shot is independent of the others. If she shoots 200 arrows...

\[ N(160, 5.66) \]

c) would you be surprised if she made only 140 bull's eyes?

\[ P(X \geq 180) = 0.0002 \]

d) what is the probability she would make more than 180 bull's-eyes

\[ Z = \frac{180 - 160}{5.66} \]

\[ Z = 3.533 \]

\[ P(Z \geq 3.533) = 0.0002 \]

Assignment (Due Monday, February 1)

1) Pg. 401c, #27-33 odd

2) Read Chapter 17, Pg. 397 - 399
   (make sure you are really still reading)