Lesson 7.1.3

7-20. a. The properties of the binomial setting are: 1) There is a fixed number of trials—in this case, 25 "trials." 2) There are two possible outcomes for each trial—in this case, "Erica" or "other." 3) The outcome of each trial is independent. 4) The probability of a "yes" remains constant for every trial. The first two are definitely satisfied. The third one is less obvious; it is satisfied if Erica is drawing with replacement OR is close enough to satisfied if the population she is drawing from is large relative to her sample size.

b. Because the class is large compared to the samples, the probability of a voter voting for Erica is about the same for each trial. If the senior class were small relative to the sample size, then the probabilities would change for subsequent "trials" and so the binomial setting would no longer be appropriate.

c. $np = 25 \cdot 0.56 = 14$ students

d. ≈ 2.5 people

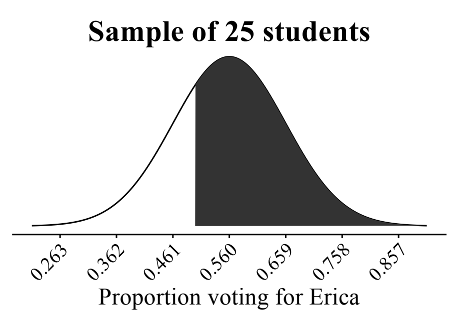
e. Since $np = 14$ and $n(1 - p) = 11$, both > 10, it is reasonable to assume that V is approximately normal in shape.

7-21. a. P will represent the proportion of people voting for Erica in each sample.

b. Since P is a linear transformation of V, the linear transformation rules from Lesson 1.3.3 apply. The shape will stay identical to the shape of V—symmetric, unimodal. The mean will divide by 25, resulting in a mean of 0.56. The standard deviation will also divide by 25, resulting in a standard deviation of about 0.10.

7-22. $\mu_{\hat{p}} = \frac{np}{n} = p,\ \sigma_{\hat{p}} = \frac{\sqrt{np(1-p)}}{n} = \sqrt{\frac{p(1-p)}{n}}$

7-23. Using the normalcdf or a normal probability table with $\mu = 0.56$, $\sigma = 0.0993$, the probability of a sample having 50% or higher votes for Erica is 72.7%. This is quite close to the value in problem 7-9, which estimates the same probability. See diagram at right.



7-24. 2 standard deviations around 0.56 would be 95%, here that would be the range between 0.36 and 0.76.

7-25. $\frac{18}{25}$ is 0.72, which is in the 95% range found from problem 7-24. Therefore this should not be considered an outlier.

7-26. a. 0.014

b. 0.384

c. Using normal approximations, $P(\text{Whig } \hat{p} > 0.4) \approx 0.103$ and $P(\text{Tory } \hat{p} > 0.4) \approx 0.995$, so $P(\text{both}) = 0.103 \cdot 0.995 = 0.102$. This assumes that both events are independent.

7-27. a. The independent trials condition.

b. This is the large counts condition; it makes the normal approximation reasonable.

c. When the sample is drawn without replacement and the population is smaller than then 10 times the sample size.

d. It comes from the binomial setting.

7-28. a. The number of cards on the field is $768 \times 1029 = 790{,}272$ cards. The probability is $\frac{1}{790272}$ or 0.000001265.

b. $\frac{790{,}272 \text{ cards}}{\frac{52 \text{ cards}}{1 \text{ pack}}} = 15{,}198$ packs of cards. The maximum loss is if the first player chooses a card and wins: –\$1,000,000[prize] – (\$0.99)(15,198)[cost of packs] + \$5[from the player] = –\$1,015,041.02. (If nobody plays, then the million dollars is not paid out, and the boosters do not have the maximum possible loss.)

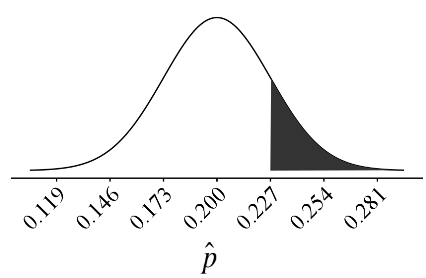
c. If all of the chances were purchased, –\$1,000,000[prize] – (\$0.99)(15,198)[cost of packs] + (\$5)(790,272)[from players] = \$2,936,313.98

d. On average half the cards would be sold before there was a winner, –\$1,000,000[prize] – (\$0.99)(15,198)[cost of packs] + (\$5)(397,136)[from players] = \$960,633.98

e. $\frac{176{,}000{,}000}{790{,}272} \approx 223$ football fields would have to be covered to give the same odds as winning the state lottery!

7-29. a. Random, to avoid bias: met by the statement of random sample in the question. Independent trials, for an accurate σ: the population of all Tisklets is extremely large! Much larger than 2200 Tisklets. Large counts, sampling distribution ≈ normal: the expected number of orange Tisklets is 0.20(220) = 44, and the expected number of non-orange Tisklets is 176.

$P(X \geq 50)$ Orange Tisklets



b. $\mu_{\hat{p}} = p = 0.20$ candies and

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.2(0.8)}{220}} = \sqrt{\frac{0.16}{220}} \approx 0.027 \text{ candies}$$

c. probability ≈ 0.156. See graph above right for an example curve.

7-30. See diagrams below. Using an inverse normal probability density function or table: $z_1 = -1.1264$, $z_2 = 0.80642$. 10.199 = mean + (–1.1264)stDev; 11.282 = mean + (0.80642)stDev. Solving the system of equations gives mean = 10.83 pH and standard deviation = 0.56 pH