9.2 Sample Proportions

$$\hat{p} = \frac{\text{success within the sample}}{\text{sample size}} = \frac{X}{n}$$

Ch.8 $\mu_X = np \quad \sigma_X = \sqrt{np(1-p)}$

Ch.7 If $Y = a + bX$, then $\mu_Y = a + b\mu_X$
and $\sigma_Y = b\sigma_X$
($a \Rightarrow$ recenter $\quad b \Rightarrow$ rescale)

Ch.9 $\hat{p} = 0 + \frac{1}{n}(X)$ $\qquad \hat{p} = \frac{X}{n} \Rightarrow X = n\hat{p}$

$\mu_{\hat{p}} = \frac{1}{n}(np) = p$

$\sigma_{\hat{p}} = \frac{1}{n}\sqrt{np(1-p)}$

$= \sqrt{\frac{np(1-p)}{n^2}}$

$$\boxed{\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}} \qquad \boxed{\mu_{\hat{p}} = p}$$

* Use formula for σ_X only when the population is at least 10 times as large as the sample
$N \geq 10n$

* Use normal approximation to the sampling distribution of $\hat{p}$ for values of n and p that satisfy $np \geq 10$ and $n(1-p) \geq 10$

Example 9.7 An SRS of 1500 first-year college students is questioned regarding whether they applied for admission to schools other than the one they currently attend. Of the 1.7 million first-year college students 35% did apply to other schools. ($p = .35$) What is the probability the SRS of 1500 students will be within 2% of the parameter.

Can we use $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$ to determine σ?

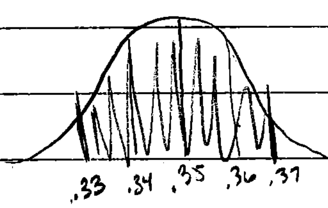
$$10 \times 1500 = 15{,}000 < 1.7 \text{ million} \quad \text{yes}$$

$$\sigma_{\hat{p}} = \sqrt{\frac{(.35)(.65)}{1500}} = \boxed{.0123}$$

Can we use normal distribution to approximate the distribution of $\hat{p}$?

$$1500(.35) = 525 > 10 \qquad 1500(.65) = 975 > 10$$

yes



$$z = \frac{x - \mu}{\sigma} = \frac{\hat{p} - .35}{.0123}$$

$\hat{p}(.33)$: $z = \frac{.33 - .35}{.0123} = -1.63$

$\hat{p}(.37)$: $z = \frac{.37 - .35}{.0123}$ 1.63

$$P(-1.63 < z < 1.63) = .9484 - .0516 = .8968$$

89.68% of the samples will give a result within 2% points of the parameter

9.2 cont'd

Example 9.8 Proof of underrepresentation
UHS statistics? Representative of p?

UHS Statistics	KS	National