Name: ______________________ Hour: _____ Date: ______

Which way will the Hershey Kiss land?

When you toss a Hershey Kiss, it sometimes lands flat and sometimes lands on its side. What proportion of tosses will land flat?

Each group of four selects a random sample of 50 Hershey's Kisses to bring back to their desks. Toss the 50 Kisses and then calculate the proportion that land flat. Let $\hat{p}$ = the proportion of the Kisses that land flat.

1. What is your **point estimate** for the true proportion that land flat? $\hat{p} = \frac{21}{50} = .42$

2. Identify the population, parameter, sample and statistic.

   Population: All Hershey's Kisses　　Parameter: $p \Rightarrow$ true proportion that land flat

   Sample: 50 Hershey's Kisses　　Statistic: $\hat{p} = 0.42$

condition #1

3. Was the sample a random sample? Why is this important?

   Yes, we randomly sampled 50 Hershey's Kisses so we can generalize to the population.

4. What is the formula for calculating the standard deviation of the sampling distribution of $\hat{p}$?

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

condition #2

5. What condition must be met to use this formula? Has it been met?

   10% Condition: $50 < \frac{1}{10}$(All Hershey's Kisses) ✓

   10% condition is met.

6. We don't know the value of *p* (that's the whole point of a confidence interval) so we will use $\hat{p}$ instead. Calculate the standard deviation.

   Standard Error of $\hat{p}$ $SE_{\hat{p}}$

   $$\sigma_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{\frac{.42(.58)}{50}} = 0.0698$$

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

condition #3

7. Would it be appropriate to use a normal distribution to model the sampling distribution of $\hat{p}$? Justify your answer.

   Large Counts

   $n \cdot \hat{p} \geq 10$　　$50(.42) = 21 \geq 10$ ✓

   $n(1-\hat{p}) \geq 10$　　$50(.58) = 29 \geq 10$ ✓

   Yes it's appropriate.

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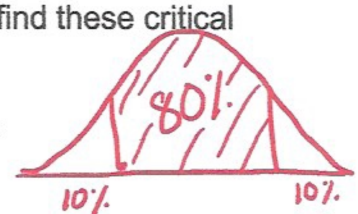
8. In a normal distribution, 95% of the data lies within __2__ standard deviations of the mean. This value is called the **critical value.** Use table A or InverseNorm to find these critical values:

80% of the data lies within __1.282__ standard deviations of the mean



InvNorm (tail)

90% of the data lies within __1.645__ standard deviations of the mean

95% of the data lies within __1.960__ standard deviations of the mean

99% of the data lies within __2.576__ standard deviations of the mean

9. Calculate the **margin of error** for a 95% interval by multiplying the critical value and standard deviation you found. Show your work.

$1.960 \times 0.0698 = 0.137$

Margin of Error = critical value × standard Error

$z^* (SE_{\hat{p}})$

10. Find the 95% confidence interval using **point estimate +/- margin of error**.

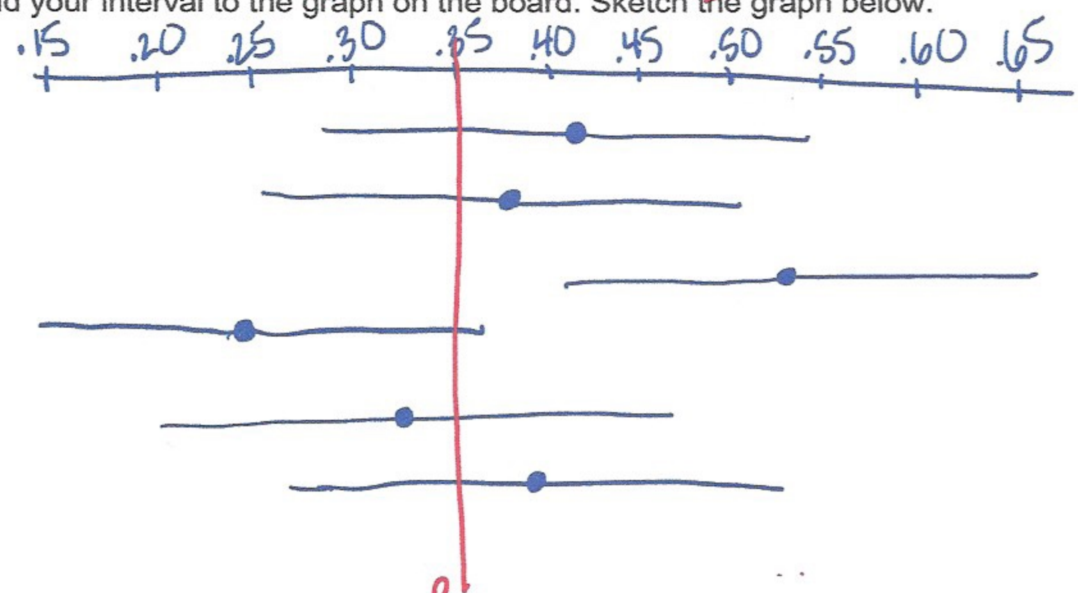
$0.42 \pm 0.137 = (0.283, 0.557)$

Point Estimate ± margin of Error

$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

confidence Interval for a proportion

11. Add your interval to the graph on the board. Sketch the graph below.



12. What do you think is the true proportion of kisses that land flat is?

$p = 0.35$

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Constructing a Confidence Interval for *p*

Important ideas: LT#1 Conditions	LT#2 Critical Values	Formulas for CI for p
Pop $\geq 10 \cdot n$ → OK to use formula for s.d. $n \cdot \hat{p}$ and $n(1-\hat{p}) \geq 10$ → samp dist of $\hat{p}$ is ≈ Normal	90% $z^* = 1.645$ 95% $z^* = 1.960$ 99% $z^* = 2.576$ about 2 s.d.s Do not need to memorize	Estimate ± margin of Error $\hat{p} \pm z^* \underbrace{\left[\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right]}_{SE_{\hat{p}}}$

Check Your Understanding

What do you want to be when you grow up? According a nationwide survey of a random sample of 1000 kids under the age of 12, some kids want to be a ninja, a dragon keeper, a dancing unicorn, and even an octopus. Fifty-five of the 1000 kids want to be a doctor. We would like to use this study to find a 98% confidence interval for the true proportion of kids who want to be a doctor.

a. Identify the parameter of interest.

p → true proportion of kids who want to be a doctor.

b. Check if the conditions for constructing a confidence interval for *p* are met.

Random: "Random Sample of 1000 kids" ✓

10%: $1000 < \frac{1}{10}$(All kids nationwide) ✓

Normal: Large Counts

$1000(.055) = 55 \geq 10$ ✓

$1000(.945) = 945 \geq 10$ ✓

c. Find the critical value for a 98% confidence interval. Then calculate the interval.

InvNorm(.01) = 2.33

Point Estimate ± margin of Error

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$.055 \pm 2.33 \sqrt{\frac{.055 \times .945}{1000}} = (.038, .072)$$

d. Interpret the interval in context.

We are 98% confident that the interval from .038 to .072 captures the true proportion of kids who want to be a doctor.

Assignment #8.2a

(28) ✓

(30) We do not know about sampling method so resots may not generalize to the population of interest.

$n \cdot \hat{p}$ is not at least 10 so the sampling distribution of $\hat{p}$ may not be normal and our calculations may not be accurate

(32) $z^* = 1.81$