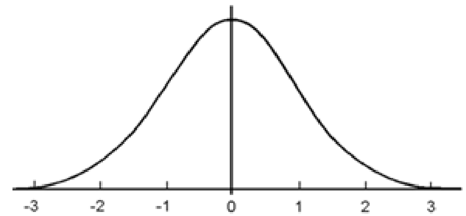
AP Stat Answers Ch 9: Sampling Distribution Review

1. A) **State:** What is the probability a randomly selected individual has a WAIS score of 105 or higher?

Plan: Randomness: The problem states the individuals were selected randomly.
Large Counts: The problem states the distribution of adult WAIS scores are normally distributed.

mean = 100 standard deviation = 15 N(100, 15)

P(X $\geq$ 105) =P(z $\geq \frac{105-100}{15}$) = P(z $\geq$ 0.33) = 0.3707



The probability that a randomly selected individual will have a WAIS score of 105 or higher is 37.1%.

B) **Independence:** pop $\geq$ 10(sample) all adults $\geq$ 10(60) all adults $\geq$ 600 Condition met for independence.

Large Counts: n = 60 60 $\geq$ 30 CLT states sample size large enough to use approximate normal distribution. Also problem states the population of adult WAIS scores are normally distributed.

$\mu_{\bar{x}} = \mu = 100$ $\sigma_{\bar{x}} = \frac{15}{\sqrt{60}}$ N(100, $\frac{15}{\sqrt{60}}$)

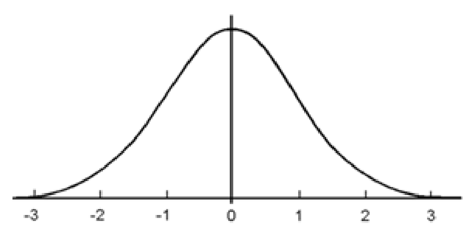
C) **State:** What is the probability that the average WAIS score of a SRS of 60 people is 105 of higher?

Plan:
Randomness: The problem states the 60 individuals were selected randomly.

Independence: pop $\geq$ 10(sample) all adults $\geq$ 10(60) all adults $\geq$ 600 Condition met for independence.

Large Counts: The problem states the distribution of adult WAIS scores are normally distributed. Also the CLT states a sample size of at least 30, in this case n = 60, a normal approximation is appropriate.

Do: P($\bar{X} \geq$ 105) = P(z $\geq \frac{105-100}{\frac{15}{\sqrt{60}}}$) = P(z $\geq$ 2.58) = 0.0049



The probability the means WAIS score of an SRA of 60 people is 105 or higher is 0.49%.

D) Since the sample size is only 1, part **A)** would not be able to be calculated if the population distribution were not normal.

Since the sample size is 60 for parts **B)** and **C)**, the results would be the same since this sample size meets the criteria for the CLT. Therefore the statements for the mean and standard deviation would be valid even if the population distribution were not normal.

2) Plan:

Randomness: The problem states the poll interviewed 1025 randomly chosen women.

Independence: pop $\geq$ 10(sample) all adult women $\geq$ 10(1025) all adult women $\geq$ 10,250

Condition met for independence.

Large Counts: np = 1025(.47) nq = 1025(53)

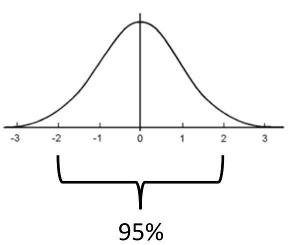
481.75 $\geq$ 10 543.25 $\geq$ 10

Number of successes and number of failures at least 10, so approximate normal distribution appropriate.

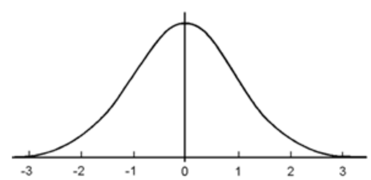
Do: $\boldsymbol{\mu_{\hat{p}} = 0.47}$ $\sigma_{\hat{p}} = \sqrt{\frac{(.47)(.53)}{1025}} = 0.01559$ N(0.47, 0.01559)

The sampling distribution of 1025 randomly selected women is approximately normal with mean = .47 and standard deviation = 0.01559.

B) p = 0.47 0.47 $\pm$ 2(0.01559) = (0.43883, 0.5012) The middle 95% of women who think they do not get enough time to themselves is between 43.883% and 50.12%.



C) P(z < $\frac{.45-.47}{0.1559}$) = P(z < -1.283) = 0.0997 = 9.97%



The probability that the poll of 1025 randomly selected adult women will say fewer than 45% say they do not get enough time for themselves is 9.97%.

3. A) $\mu = np = 25{,}000(0.202) = 5{,}050$ The mean number of high school dropouts who will receive the flyer is 5,050.

B) State: What is the probability at least 5,000 dropouts will receive the flyer>

Plan:

Randomness: The problem states the mailing lists is a random sample of the population.

Independence: pop $\geq$10(sample) all high school dropouts $\geq$ 10(25,000) Condition met for independence.

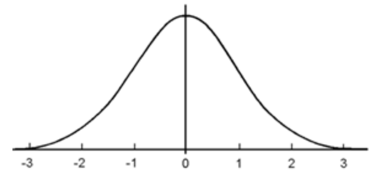
Large Counts: np = 25,000(0.202) = 5,050 nq = 25,000(0.798) = 19,950

5,050 $\geq$10 19,950 $\geq$10

Number of successes and number of failures at least 10, so approximate normal distribution appropriate.

Do: $\boldsymbol{\mu_{\hat{p}} = p = 0.202}$ $\sigma_{\hat{p}} = \sqrt{\frac{(.202)(.798)}{25000}} = 0.0025$ N(0.202, 0.0025)

$\hat{p} = \frac{5000}{25,000} = 0.2$ P(z $\geq \frac{.2-.202}{0.0025}$) = P(z $\geq$ -.8) = .7845 = 78.45%



The probability that at least 5,000 randomly selected dropouts will receive the flyer is 78.45%.

4) A) Independence: pop $\geq$ 10(sample) all college students $\geq$ 10(14,941) all college students $\geq$ 149,410

Condition met for independence.

Large Counts: *np* = 14,941(.5) *nq* = 14,941(.5)

7,470.5 $\geq$ 10 7,470.5 $\geq$ 10

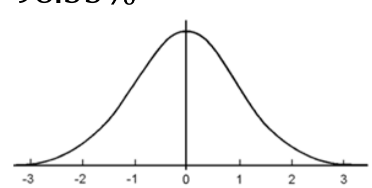
Number of successes and number of failures at least 10, so approximate normal distribution appropriate.

$\boldsymbol{\mu_{\hat{p}} = p = 0.5}$ $\sigma_{\hat{p}} = \sqrt{\frac{(.5)(.5)}{14941}} = 0.0041$ N(0.5, 0.0041)

The sampling distribution of 14,941 randomly selected college students is approximately normal with mean = .5 and standard deviation = 0.0041.

B) It is permissible to use the normal approximation to find the probability that $\hat{p}$ is within a certain range because the criteria for large counts was met in part **A).**

C) $P(\frac{0.49-0.5}{0.0041} < z < \frac{0.51-0.5}{0.0041}) = P(-2.439 < z < 2.439) = 0.9853 = 98.53\%$



There is a 98.53% probability that the proportion of 14,941 randomly selected college students who say they drink to get drunk at least once in a while is between 49% and 51%.