9 CHAPTER
Samples and Sampling Distributions

Sampling Distribution of the Sample Proportion

If the population is infinite and the sample is sufficiently large, the distribution of $\hat{p}$ has the following characteristics:

1. An approximately normal distribution.
2. $\mu_{\hat{p}} = E(\hat{p}) = p$. (The mean of the sample proportions equals the population proportion.)
3. $\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}}$

Suppose a sample of 400 persons is used to perform a taste test. If the true fraction in the population that prefers Pepsi is really 0.5, what is the probability that less than 0.44 of the persons in the sample will prefer Pepsi?

$\mu = .5 = p \qquad n = 400$

$\sigma = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{.5(1-.5)}{400}} = 0.025$

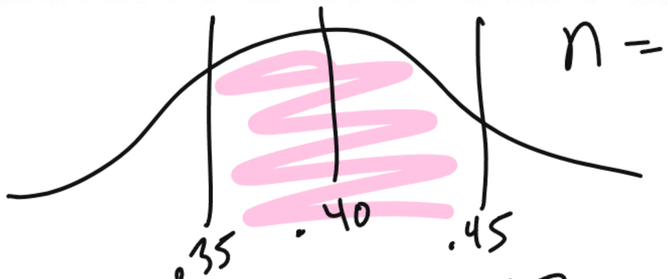
$z = \frac{x-\mu}{\sigma} = \frac{0.44-.50}{0.025} = -2.4$

$.0082$

Suppose a sample of 500 is used to estimate the fraction of voters that favor a particular candidate. If the population proportion that favors the candidate is really 0.4, what is the probability that the error of estimation will be less than 0.05?

$\mu = 0.4$

$\sigma = 0.022$



$n = 500$

$z = \frac{.35 - .40}{0.022} = -2.27$

2.27

$.0116 - .9884 = .9768$

$p = 0.4$ $\quad x = .37$ $\quad x = .43$

$n = 1000$

$\sigma = 0.015$

$z = -2 \leftrightarrow 2$

$.95$

Eighty percent of the flights arriving in Atlanta for a large US airline are on time. If the FAA randomly selects 50 of the airline's flights, find the probability that:

a. at least 85% of the sampled flights will be on time.

b. at most 70% of the sampled flights will be on time.

c. between 75% and 85% of the sampled flights will be on time.

$n = 50 \qquad p = .80 = \mu$

$\sigma = \sqrt{\frac{.8(1-.8)}{50}} = 0.057$

$x = .85$

$z = \frac{.85 - .80}{0.057}$

$z = 0.87$

$1 - .8079$

$.1921$

9.5 Other Forms of Sampling

Judgment Sample

A sample in which the observations are selected by an expert in the field and not picked at random.

DEFINITION

Convenience Sample

A sample of observations that are easily obtained and not random.

DEFINITION

Systematic Sample

A sample in which you choose a starting point and then every k^{th} member of the population is included in the sample.

DEFINITION

Cluster Sampling

Cluster sampling involves dividing the population into clusters, and randomly selecting a sample of clusters to represent the population. Cluster sampling is used when "natural" groupings are evident in the population.

DEFINITION

Stratified Sampling

In **stratified sampling,** the population is divided into **strata**, which are sub-populations. A **strata** can be any identifiable characteristic that can be used to classify the population. If the population consists of people, then strata could be sex, income, political party, religion, education, race, or location.

DEFINITION

A social researcher in Florida wants to determine the average number of children per family in the state.

a. What is the population of interest?

b. What variable will be measured?

c. What level of measurement is the variable of interest?

d. Discuss the steps that would be necessary for each of the following sampling methods.

- **i.** Simple random sampling
- **ii.** Cluster sampling
- **iii.** Stratified sampling

e. What sampling method do you believe would be the most cost-effective? Justify your answer.

A news reporter in Orlando, Florida wants to conduct a survey to determine how local residents feel about the institution of a state income tax. Since there will be a lot of people from which to choose, he goes to Disney World and randomly selects individuals entering the complex. He asks the selected people whether or not they favor a state income tax in Florida. The responses to the survey are as follows.

Survey Responses	
Category	**% of Responses**
Favor a Florida State Income Tax	50
Do Not Favor a Florida State Income Tax	50

a. What sampling technique was used for this survey?

b. What biases may be present in the responses?

c. Is 50% a reasonable point estimate of the proportion of Orlando residents who favor the state income tax? Explain.