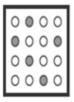
# 8-5 Sampling Distributions
## Extension: Confidence Intervals and Margins of Error

**Essential question:** *How do you calculate a confidence interval and a margin of error for a population proportion or mean?*

COMMON CORE **Standards for Mathematical Content**

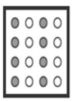
**CC.9-12.S.IC.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.*

**Types of Samples**



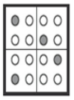
**Simple Random Sample**

Members are chosen using a method that gives everyone an equally likely chance of being selected.



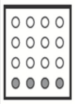
**Systematic Sample**

Members are chosen using a pattern, such as selecting every other person.



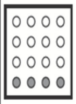
**Stratified Sample**

The population is first divided into groups. Then members are randomly chosen from each group.



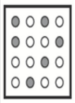
**Cluster Sample**

The population is first divided into groups. A sample of the groups is randomly chosen. All members of the chosen groups are surveyed.



**Convenience Sample**

Members are chosen because they are easily accessible.



**Self-Selected Sample**

Members volunteer to participate.

**The campaign staff for a state politician wants to know how voters in the state feel about a number of issues. Classify each sample.**

- They call every 50th person on a list of registered voters in the state.

  This is a systematic sample as members are chosen using a pattern.

- They randomly select 100 voters from each county to Call.

  This is a stratified sample as the county is chosen and then voters are selected at random.

- They ask every person who comes to the next campaign rally to fill out a survey.

  This is a convenience sample as the people at the rally are easily accessible.

**The editor of a snowboarding magazine wants to know the readers' favorite places to snowboard. The latest issue of the magazine included a survey, and 238 readers completed and returned the survey. Classify the sample.**

- This is a self-selected example as readers volunteered to participate.

A **probability sample** is a sample where every member of the population being sampled has a nonzero probability of being selected. Simple random samples, stratified samples, and cluster samples are all examples of probability sampling.

**A community organization has 56 teenage members, 103 adult members, and 31 senior members. The council wants to survey the members. Classify each sampling method. Which is most accurate? Which is least accurate? Explain your reasoning.**

| Method A | Method B | Method C |
|---|---|---|
| Randomly select 60 people from the complete membership list. | Choose every 5th person who arrives at the com-munity clean-up event. | Randomly select 20 teenagers, 20 adults, and 20 seniors from the complete roster. |

simple random → most accurate — every one has a equally likely chance

systematic → least accurate — because some have no chance of being selected

stratified

**A small-town newspaper wants to report on public opinion about the new City Hall building. Classify each sampling method. Which is most accurate? Which is least accurate? Explain your reasoning.**

| Method A | Method B | Method C |
|---|---|---|
| Ask readers to write in and give their opinion. | Survey 10 randomly selected female students and 10 randomly selected male students in the cafeteria during the lunch period. | Randomly choose 10 streets in the town and survey everyone who lives on each street. |

self-selected → least accurate

convenience

cluster → most accurate

| Most Accurate | Very Accurate | Not Very Accurate |
|---|---|---|
| census | simple random sample<br>stratified sample<br>cluster sample | convenience sample<br>self-selected sample |

The ***margin of error*** of a random sample defines an interval, centered on the sample percent, in which the population percent is most likely to lie

**A city is about to hold an election. According to a survey of a random sample of city voters, 42% of the voters plan to vote for Poe and 58% of the voters plan to vote for Nagel. The survey's margin of error is ±7%. Does the survey clearly project the outcome of the voting?**

Poe 35% to 49%

Nagel 51% to 65%

Between 35% and 49% of all voters plan to vote for Poe and between 51% and 65% of all voters plan to vote for Nagel. Because the intervals do not overlap, the survey does clearly project the outcome of the voting.

**A survey of a random sample of voters shows that 38% of voters plan to vote for Gonzalez, 31% of voters plan to vote for Chang, and 31% plan to vote for Harris. The survey has a margin of error of ±3%. Does the survey clearly project the outcome of the voting? Explain.**

Gonzalez 35% to 41%
Chang 28% to 34%
Harris 28% to 34%

Yes; while there is overlap between the intervals for Chang and Harris, their intervals, which are from 28% to 34%, do not overlap the interval for Gonzalez, which is 35% to 41%.