

## 12-2 Populations and Samples

### Objective:

- I can find population percentages of a normal distribution (68-95-99.7 rule).
- Sampling Methods/Biases

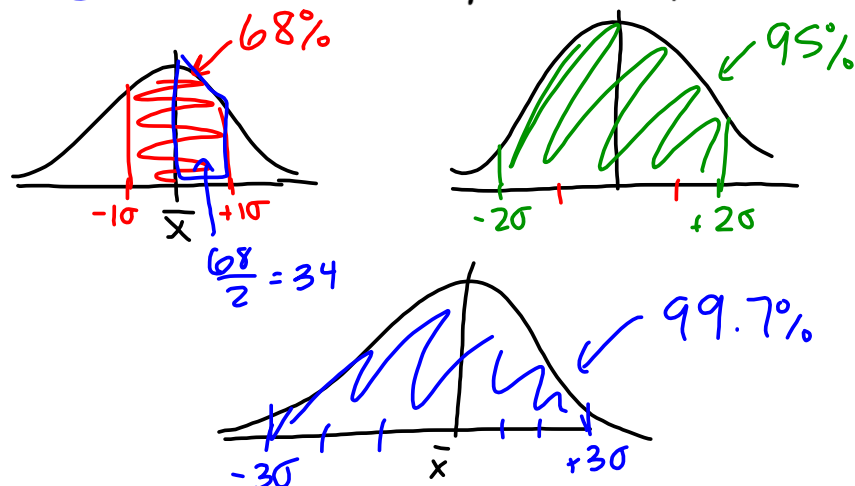
### 68-95-99.7 Rule

If the data for a population are normally distributed with mean  $\mu$  and standard deviation  $\sigma$  then,

68% of the data lie between  $\mu - 1\sigma$  and  $\mu + 1\sigma$

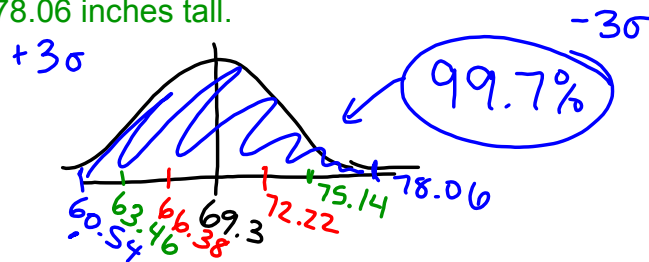
95% of the data lie between  $\mu - 2\sigma$  and  $\mu + 2\sigma$

99.7% of the data lie between  $\mu - 3\sigma$  and  $\mu + 3\sigma$

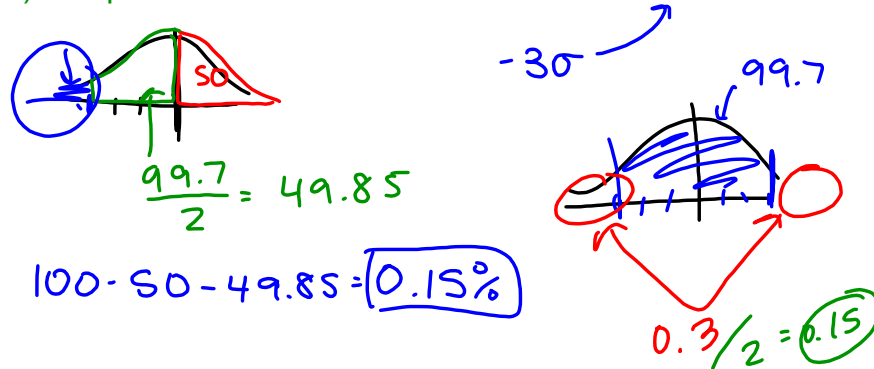


Suppose the heights (in inches) of men ages 20-29 in the United States are normally distributed with a mean of 69.3 inches and a standard deviation of 2.92 inches. Find the following:

- a) The percent of men who are between 60.54 inches and 78.06 inches tall.

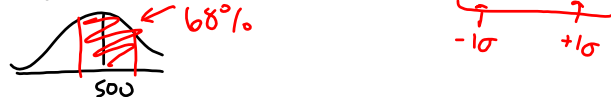


- b) The percent of men who are shorter than 60.54 inches.

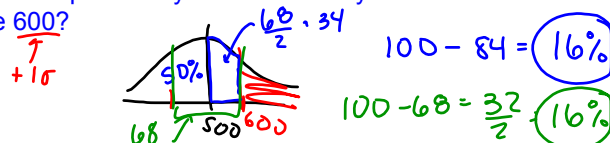


A college entrance exam is designed so that scores are normally distributed with a mean of 500 and a standard deviation of 100.

- a) What percent of exam scores are between 400 and 600?



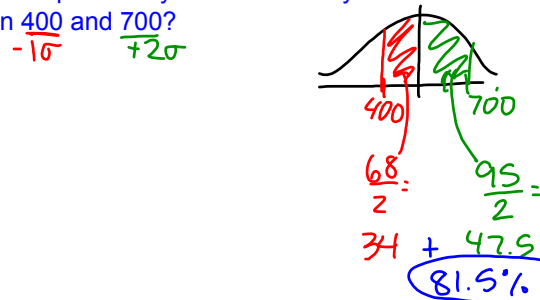
- b) What is the probability that a randomly chosen exam score is above 600?



- c) What is the probability that a randomly chosen exam score is less than 300?



- d) What is the probability that a randomly chosen exam score is between 400 and 700?



Would a loon chick weighing 95 grams be in the top 2.5%?

79.5 87.5 88.5 89.2 91.6 84.5 82.1 82.3 85.1 89.8  
84.0 84.8 88.2 88.2 82.9 89.8 89.2 94.1 88.0 91.1  
91.8 87.0 87.7 88.0 85.4 94.4 91.3 86.3 85.7 86.0

1-var Stats

$\sigma_x =$   
↗  
Standard deviation

## Sampling Methods

**Simple random:** each individual has an equal chance of being selected.

**Self-selected:** individuals volunteer to be in sample

**Convenience:** individuals are selected based on accessibility

**Systematic:** Members of the sample are chosen according to a rule, such as every nth individual

**Stratified:** population divided into groups and individuals from each group are selected *picked from every group*

**Cluster:** population is divided into groups (some groups randomly selected), and either all the individuals in the groups are selected or just some of the individuals in the groups are selected.  
*some groups picked, then people from those groups*

## Other sources of bias:

1. Nonresponse: subjects to not respond to the survey
2. Undercoverage: a portion of the population with some commonality is excluded from the survey
3. Voluntary response: the sample chooses itself by responding to a general appeal
4. Response bias: systematic difference between subject's response and the "truth" (i.e. lying)

Identify the population, classify the sampling methods, and decide whether the sampling method could result in a biased sample.

The officials of the NFL want to know how the players feel about some proposed changes to the NFL rules. They decide to ask a sample of 100 players.

Population: All NFL players

- a. The officials choose the first 100 players who volunteer their opinions.

Sampling Method: Self-Selected  
Bias: Voluntary

- b. The officials randomly choose 3 or 4 players from each of the 32 teams.

Method: Stratified  
Bias: Response?

- c. The officials have a computer randomly generate a list of 100 players from a database of all players.

Method: Simple Random  
Bias: None

Identify the population, classify the sampling methods, and decide whether the sampling method could result in a biased sample.

Administrators at your school want to know if students think that more vegetarian items should be added to the lunch menu.

Pop: Students @ school

a. The administrators survey every 25th student who enters the cafeteria during the lunch period.

Method: Systematic

Bias: Undercoverage (kids don't all go to cafeteria)

b. The administrators survey the first 50 students who get in the lunch line.

· convenience

· Response/undercoverage

c. The administrators use a randomly generated list of 50 students from a master list of all students.

Simple Random