ELD STANDARD 3: The Language of Mathematics				MAISA Algebra 2, Unit 2, Univariate Data and Distributions		
CONNECTIONS: Michigan Academic State Standards for Mathematics						
EXAMPLE CONTEXT FOR LANGUAGE USAGE: Students will be given multiple sets of data, within the same context, of house prices in a specific area. The context will be read aloud. They will then decide and justify whether the mean and standard deviation are appropriate to use for the data sets. While only one context is read aloud, two different written examples of students' responses are provided based on data sets with and without outliers. **COGNITIVE FUNCTION:** Students at all levels of English language proficiency **SYNTHESIZE** a context read aloud in order to **JUSTIFY** the use or nonuse of the mean and standard deviation for different sets of data.						
	Level 1 Entering	**Level 2 Emerging**	**Level 3 Developing**	**Level 4 Expanding**	**Level 5 Bridging**	**Level 6 Reaching**
Listening & Writing	Synthesize a context read aloud multiple times with purposeful pauses and rephrasing as necessary, while pointing to supports, to justify in phrases or simples sentences the use or nonuse of the mean and standard deviation for different sets of data using a unit anchor chart, an illustrated reference sheet for contextual words, and sentence frames with answer choices while working with a partner at a higher level of English proficiency. Context to be read aloud: E.g., "Buying a home will likely [rephrase as 'probably'] be one of your biggest investments [pause, point to illustrated reference sheet, and rephrase as 'a way to make money']. The value of your home depends on many factors [pause and point to illustrated reference sheet], some examples are the market [pause and point to your neighborhood [pause and point	Synthesize a context read aloud multiple times with purposeful pauses and rephrasing as necessary, while pointing to supports, to justify in complete sentences the use or nonuse of the mean and standard deviation for different sets of data using a suggested word list (e.g., mean, standard deviation, set of data, outliers, normal/skew(ed)), a unit anchor chart, an illustrated reference sheet for contextual words, and sentence stems/frames with answer choices while working with a partner. Context to be read aloud: E.g., "Buying a home will likely [rephrase as 'probably'] be one of your biggest investments [pause, point to illustrated reference sheet, and rephrase as 'a way to make money']. The value of your home depends on many factors	Synthesize a context read aloud multiple times with purposeful pauses to justify in complete sentences the use or nonuse of the mean and standard deviation for different sets of data using a suggested word list (e.g., mean, standard deviation, set of data, outliers, normal/skew(ed)), a unit anchor chart, and an illustrated reference sheet for contextual words while working with a partner. Context to be read aloud: E.g., "Buying a home will likely be one of your biggest investments [pause]. The value of your home depends on many factors [pause], some examples are the market [pause], your neighborhood [pause], the size [pause], condition [pause], and similar house values [pause]. Home buyers often consider the average house value [pause] in deciding if they want to move to a certain area [pause]. Look at the following sets of house	Synthesize a context read aloud with purposeful pauses to justify in compound/complex sentences the use or nonuse of the mean and standard deviation for different sets of data using a suggested word list (e.g., mean, standard deviation, set of data, outliers, normal/skew(ed)) and a unit anchor chart while working with a partner. Context to be read aloud: E.g., "Buying a home will likely be one of your biggest investments [pause]. The value of your home depends on many factors [pause], some examples are the market [pause], your neighborhood [pause], the size [pause], condition [pause], and similar house values [pause]. Home buyers often consider the average house value	Synthesize a context read aloud with purposeful pauses to justify in compound/complex sentences the use or nonuse of the mean and standard deviation for different sets of data using a required word list (e.g., mean, standard deviation, set of data, outliers, normal/skew(ed)) and a unit anchor chart while working with a partner. Context to be read aloud: E.g., "Buying a home will likely be one of your biggest investments [pause]. The value of your home depends on many factors [pause], some examples are the market [pause], your neighborhood [pause], the size [pause], condition [pause], and similar house values [pause]. Home buyers often consider the average house value [pause] in deciding if they want to	

	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reaching
Continued	illustrated reference sheet], your neighborhood [pause and point to illustrated reference sheet], the size [pause and point to illustrated reference sheet], condition [pause and point to illustrated reference sheet], and similar house values [pause and point to illustrated reference sheet]. Home buyers often consider [rephrase as 'think about'] the average house value [pause and point to illustrated reference sheet] in deciding if they want to move to a certain area [pause]. Look at the following sets of house values for a given area [pause]. For each set, determine [rephrase as 'think about'] if the mean [pause and point to anchor chart] and standard deviation [pause and point to anchor chart] are appropriate measures [pause, point to illustrated reference sheet, and rephrase as 'a good idea'] to use for analyzing house values [pause and point to illustrated reference sheet]. Justify your	factors [pause and point to illustrated reference sheet], some examples are the market [pause and point to illustrated reference sheet], your neighborhood [pause and point to illustrated reference sheet], the size [pause and point to illustrated reference sheet], condition [pause and point to illustrated reference sheet], and similar house values [pause and point to illustrated reference sheet]. Home buyers often consider [rephrase as 'think about'] the average house value [pause and point to illustrated reference sheet] in deciding if they want to move to a certain area [pause]. Look at the following sets of house values for a given area [pause]. For each set, determine [rephrase as 'think about'] if the mean [pause and point to anchor chart] and standard deviation [pause and point to anchor chart] are	values for a given area [pause]. For each set, determine if the mean [pause] and standard deviation [pause] are appropriate measures to use for analyzing house values [pause]. Justify your decision." E.g., [Student response for skewed data] “The mean and standard deviation should not be used for this set of data. The data set is skewed to the right because of the outliers. Two houses have very high values. The mean would not be a good measure for the average home value. The standard deviation should also not be used to study the spread. It is based on the mean.” E.g., [Student response for symmetric data] “The mean and standard deviation should be used for this set of data. The data set does not have outliers and looks normal. No houses have very high or very low values. The mean would be a good measure	[pause] in deciding if they want to move to a certain area [pause]. Look at the following sets of house values for a given area [pause]. For each set, determine if the mean [pause] and standard deviation [pause] are appropriate measures to use for analyzing house values [pause]. Justify your decision." E.g., [Student response for skewed data] “The mean and standard deviation should not be used for this set of data because the data set is skewed to the right due to the outliers. Since two of the houses have very high values, the mean would not be a good measure for the average home value. The standard deviation will also be impacted because it is calculated using the mean and therefore should not be used to analyze the spread.”	move to a certain area [pause]. Look at the following sets of house values for a given area [pause]. For each set, determine if the mean [pause] and standard deviation [pause] are appropriate measures to use for analyzing house values [pause]. Justify your decision." E.g., [Student response for skewed data] “The mean and standard deviation should not be used for this set of data because the data set is skewed to the right due to the outliers. Since two of the houses have very high values, the mean would not be a good measure for the average home value. The standard deviation will also be impacted because it is calculated using the mean and therefore should not be used to analyze the spread.”	

	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reaching
Continued	decision [pause and rephrase as 'tell me why']." _________(Use/do not use) the_______(mean/standard deviation). [Repeat for each measure.] The data set looks________(normal/skewed). I see______(outliers/no outliers).	appropriate measures [pause, point to illustrated reference sheet, and rephrase as 'a good idea'] to use for analyzing house values [pause and point to illustrated reference sheet]. Justify your decision [pause and rephrase as 'tell me why']." The ______(mean/standard deviation) _________ (should/should not) be used. [Repeat for each measure.] The data set looks________(normal/skewed) because....	for the average home value. The standard deviation should also be used to study the spread. It is based on the mean."	E.g., [Student response for symmetric data] "The mean and standard deviation should be used for this set of data because the data set does not contain outliers and is approximately normal. Since no houses have very high or very low values, the mean would be a good measure for the average home value. The standard deviation should also be used because it is calculated using the mean and will help analyze the spread of the data."	E.g., [Student response for symmetric data] "The mean and standard deviation should be used for this set of data because the data set does not contain outliers and is approximately normal. Since no houses have very high or very low values, the mean would be a good measure for the average home value. The standard deviation should also be used because it is calculated using the mean and will help analyze the spread of the data."	

EXAMPLE CONTEXT FOR LANGUAGE USAGE: The details of the activity can be found at https://www.illustrativemathematics.org/content-standards/HSS/ID/A/3/tasks/942 where students are asked to create a box plot from the data summaries of haircut costs for female and male college students and then describe the similarities and differences in shape, center, and spread of the two distributions. The strand of differentiation below corresponds to Part B of the activity, which provides an opportunity for students to produce language, in this case speaking. Either the students would have previously created box plots in Part A or teachers may provide the data summaries as box plots as well as in table form.

Oftentimes, students do not include the context when comparing distributions. However, students should be encouraged to provide the comparison in context. For example, in this task the comparison should be in terms of haircut costs for female and male college students. In addition, rather than describing each distribution separately, students should also be encouraged to actually compare the cost distributions. For example, students should be encouraged to say statements like "the mean haircut cost for female is $50 higher than the mean haircut cost of the male" rather than "one mean is 80 and the other mean is 30."

Note that the sentence stems/frames below include "context word". Teachers should replace "context word" with the corresponding context word(s) for the given problem prior to giving students the sentence stems/frames. This allows the sentence stems/frames to be generalized to additional problems within the unit and/or course. Alternatively, teachers could highlight "context word" in the sentence stems/frames and highlight the corresponding context word on the reference/illustrated reference sheet as well as on the language of each idividual problem (context).

To aid Level 1 students in justifying statistical measures such as why a sample is skewed, the teacher could ask follow up questions (e.g., "Why do you think it is skewed? Why do you think that happened?"). These questions prompt Level 1 students to point, gesture, or provide one word answers in English, or their first language. Level 1 students are able to justify their thinking and should be provided adequate scaffolds in order to do so.

This strand addresses HSS-ID.A.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

COGNITIVE FUNCTION: Students at all levels of English language proficiency **DESCRIBE** the similarities and differences in shape, center, and spread of two distributions in the context of the data sets.

	Level 1 Entering	**Level 2 Emerging**	**Level 3 Developing**	**Level 4 Expanding**	**Level 5 Bridging**	**Level 6 Reaching**
Speaking	Describe in short phrases or sentences the similarities and differences in shape, center, and spread of two distributions using a unit anchor chart, a reference sheet, an illustrated reference sheet with context words, sentence frames with choices, and working with a partner of higher English language proficiency.	Describe in simple sentences the similarities and differences in shape, center, and spread of two distributions in context using a unit anchor chart, a reference sheet, an illustrated reference sheet with context words, sentence frames with choices, and working with a partner of higher English language proficiency.	Describe in multiple complete sentences the similarities and differences in shape, center, and spread of two distributions in context, using a unit anchor chart, reference sheet, sentence frames/stems with choices, and working with a partner.	Describe in compound and/or complex sentences the similarities and differences in shape, center, and spread of two distributions in context using a unit anchor chart, suggested word list (e.g., boxplot, distribution, symmetric, skewed, center, spread, median, mean, mode, range, interquartile range, outlier,	Describe in compound and/or complex sentences the similarities and differences in shape, center, and spread of two distributions in context using a unit anchor chart and suggested word list (e.g., boxplot, distribution, symmetric, skewed, center, spread, median, mean, mode, range, interquartile range, outlier,	

	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reaching
continued	E.g., [Students repeatedly use the frames/stems as necessary.] The boxplot for _______ (context word e.g., males/ females) is _________ (symmetric/skewed). The ________(minimum/ maximum) for _____(context word e.g., female haircut cost) is______(#). The range for __________ (context word) is _______(#). This is _______(smaller than/larger than/equal to) the range for ______ (context word). The median for______(context word e.g., males) is_____(#). This is _____# _____(more than/less than/times/of) the median for _______ (context word). The interquartile range for _______(context word) is______(#). The mean is _________(smaller/larger) than the median. Outliers _______(affect/do not affect) the ________(median/mean).	E.g., [Students repeatedly use the frames/stems as necessary.] The boxplot for _______(context word e.g., males/females) is _________(symmetric/skewed) because... The ________(minimum/maximum) for _____(context word e.g., female haircut cost) is... The range for __________(context word) is _______(smaller/larger) than the range for ______ (context word). The median for______(context word e.g., males) is_____(#) _____(more than/less than/times/of) the median for _______ (context word). The interquartile range for _______(context word) is ... The mean is _________(smaller/larger) than the median because... Outliers _______(affect/do not affect) the ________(median/mean) because…	E.g., [Students repeatedly use the frames/stems as necessary.] The boxplot for _______(context word e.g., males/females) is _________(symmetric/skewed) because... The ________(minimum/maximum) for _____(context word e.g., female haircut cost) is... The range for __________(context word) is _______(smaller/larger) than the range for ______ (context word). The median for______(context word e.g., males) is_____(#) _____(more than/less than/times/of) the median for _______ (context word). The interquartile range for _______(context word) is ... The mean is _________(smaller/larger) than the median because... Outliers _______(affect/do not affect) the ________(median/mean) because...	minimum, maximum), and reference sheet while working with a partner. E.g., "Both boxplots show distributions that are skewed to the right. It makes sense that most haircuts will not cost too much, but a few students will spend a large amount. Since the cost will always be a positive number, the minimum cannot be less than 0, and there is a long right tail. The centers and spreads are quite different. The median cost for females is about twice that of males, and there is much more variability in the haircut costs for women. The interquartile range (IQR) for women is $55, while for men it is $10.75. The mean is larger than the median because the distribution appears to be skewed to the right. The mean averages all the values in the data, so the mean is “pulled” toward the high ones. The median is in the middle of the data set and is not affected by outliers." (adapted from Illustrative Mathematics)	minimum, maximum) while working with a partner. E.g., "Both boxplots show distributions that are skewed to the right. It makes sense that most haircuts will not cost too much, but a few students will spend a large amount. Since the cost will always be a positive number, the minimum cannot be less than 0, and there is a long right tail. The centers and spreads are quite different. The median cost for females is about twice that of males, and there is much more variability in the haircut costs for women. The interquartile range (IQR) for women is $55, while for men it is $10.75. The mean is larger than the median because the distribution appears to be skewed to the right. The mean averages all the values in the data, so the mean is “pulled” toward the high ones. The median is in the middle of the data set and is not affected by outliers." (adapted from Illustrative Mathematics)	

ELD STANDARD 3: The Language of Mathematics — **MAISA Algebra 2, Unit 2, Univariate Data and Distributions**

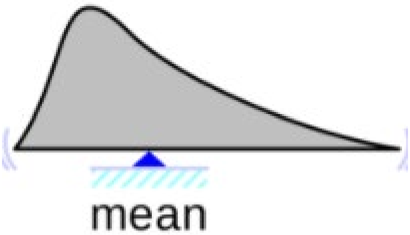
EXAMPLE CONTEXT FOR LANGUAGE USAGE: The strand below addresses the mathematics standard HSS-IC.B.3a: Recognize the purposes of and differences among sample surveys, experiments and observational studies. Students will read multiple scenarios and categorize them as best investigated through an experiment, a simulation, or an observational study. Prior to this lesson, students would have had experiences making sense of these different types of studies and sampling methods. During these experiences, students added illustrations or additional notes on the reference sheet as part of sense making. Students at Levels 1 and 2 would benefit from working in a small group with a paraprofessional or teacher to support making sense of the highly technical language. Throughout this lesson, students have access to this reference sheet and will use it as they analyze and categorize scenarios. (A reference sheet with space provided for student note taking is provided in the supports.)

The strand below provides supports to aid comprehensibility in reading. Students will need additional supports for speaking and/or writing as they are asked to explain their answers.

COGNITIVE FUNCTION: Students at all levels of English language proficiency will **ANALYZE** linguistically complex scenarios in order to **APPLY** an understanding of statistical terminology to categorize the scenarios according to appropriate sampling methods.

	Level 1 Entering	**Level 2 Emerging**	**Level 3 Developing**	**Level 4 Expanding**	**Level 5 Bridging**	**Level 6 Reaching**
Reading	Analyze simplified, illustrated versions of various scenarios in order to apply an understanding of statistical terminology to categorize the scenarios, using a reference sheet while working with a partner. E.g., [See supports for the complete illustrated version of the simplified scenarios below.] Decide whether each each of the following research topics is best studied by an experiment, a simulation, or an observational study. Explain your answer. WHO WANTS TO KNOW a) A pizza restaurant Which pizza sauce do people like best? b) An energy drink company Does their new drink give people more energy?	Analyze glossed versions of linguistically complex scenarios in order to apply an understanding of statistical terminology to categorize the scenarios, using a reference sheet and an illustrated word list for contextual words, while working with a partner. E.g., Determine [gloss: decide] whether each of the following research topics is best investigated [gloss: studied] through an experiment, a simulation, or an observational study. Explain your answer. a) A pizza restaurant is trying to determine [gloss: decide] which pizza sauce recipe is preferred [gloss: liked] by its guests [gloss: people eating]. b) An energy drink	Analyze glossed versions of linguistically complex scenarios in order to apply an understanding of statistical terminology to categorize the scenarios, using a reference sheet while working with a partner. E.g., Determine [gloss: decide] whether each of the following research topics is best investigated [gloss: studied] through an experiment, a simulation, or an observational study. Explain your answer. a) A pizza restaurant is trying to determine [gloss: decide] which pizza sauce recipe is preferred [gloss: liked] by its guests [gloss: people eating]. b) An energy drink manufacturer [gloss: maker/company] is trying to determine [gloss: decide] whether a certain new	Analyze linguistically complex scenarios in order to apply an understanding of statistical terminology to categorize the scenarios, using a reference sheet and comparing work with a partner. E.g., Determine whether each of the following research topics is best investigated through an experiment, a simulation, or an observational study. Explain your answer. a) A pizza restaurant is trying to determine which pizza sauce recipe is preferred by its guests. b) An energy drink manufacturer is trying to determine whether a certain new ingredient improves the energy level	Analyze linguistically complex scenarios in order to apply an understanding of statistical terminology to categorize the scenarios, using a reference sheet and comparing work with a partner. E.g., Determine whether each of the following research topics is best investigated through an experiment, a simulation, or an observational study. Explain your answer. a) A pizza restaurant is trying to determine which pizza sauce recipe is preferred by its guests. b) An energy drink manufacturer is trying to determine whether a certain new ingredient improves the energy level	

	Level 1 Entering	Level 2 Emerging	Level 3 Developing	Level 4 Expanding	Level 5 Bridging	Level 6 Reaching
continued	c) A doctor Do smokers and non-smokers have different average blood pressures? d) A town Will adding a traffic light increase or decrease the number of car accidents (crashes) at that intersection?	manufacturer [gloss: maker/company] is trying to determine [gloss: decide] whether a certain new ingredient [gloss: something in the drink] improves [gloss: makes better] the energy level of consumers [gloss: people who drink it]. c) A doctor wants to compare [gloss: find differences] the average blood pressures of smokers [gloss: people who smoke] and non-smokers [gloss: people who do not smoke]. d) A town [gloss: small city] is trying to determine whether [gloss: decide if] installing [gloss: putting up] a traffic light will increase [gloss: make more] or decrease [gloss: make less] the number of car accidents [gloss: crashes] at that intersection [gloss with a picture of two roads crossing/intersecting lines].	ingredient [gloss: something in the drink] improves [gloss: makes better] the energy level of consumers [gloss: people who drink it]. c) A doctor wants to compare [gloss: find differences] the average blood pressures of smokers [gloss: people who smoke] and non-smokers [gloss: people who do not smoke]. d) A town [gloss: small city] is trying to determine whether [gloss: decide if] installing [gloss: putting up] a traffic light will increase [gloss: make more] or decrease [gloss: make less] the number of car accidents [gloss: crashes] at that intersection [gloss with a picture of two roads crossing/intersecting lines].	of consumers. c) A doctor wants to compare the average blood pressures of smokers and non-smokers. d) A town is trying to determine whether installing a traffic light will increase or decrease the number of car accidents at that intersection.	of consumers. c) A doctor wants to compare the average blood pressures of smokers and non-smokers. d) A town is trying to determine whether installing a traffic light will increase or decrease the number of car accidents at that intersection.	



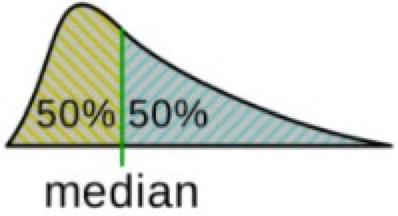
average, balancing point

$$\frac{\text{sum of numbers}}{\text{how many numbers}}$$

EX set:
10,12,12,12,13,14,14,18,21

(10+12+12+12+13+14+14+18+21)/9 = 14

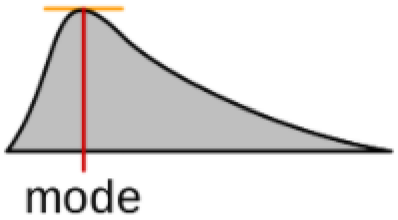
Mean = 14



middle

EX set:
10,12,12,12,13,14,14,18,21

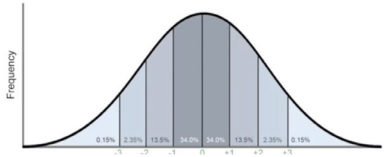
Median = 13



repeated most often

EX set:
10,12,12,12,13,14,14,18,21

Mode = 12



standard deviation

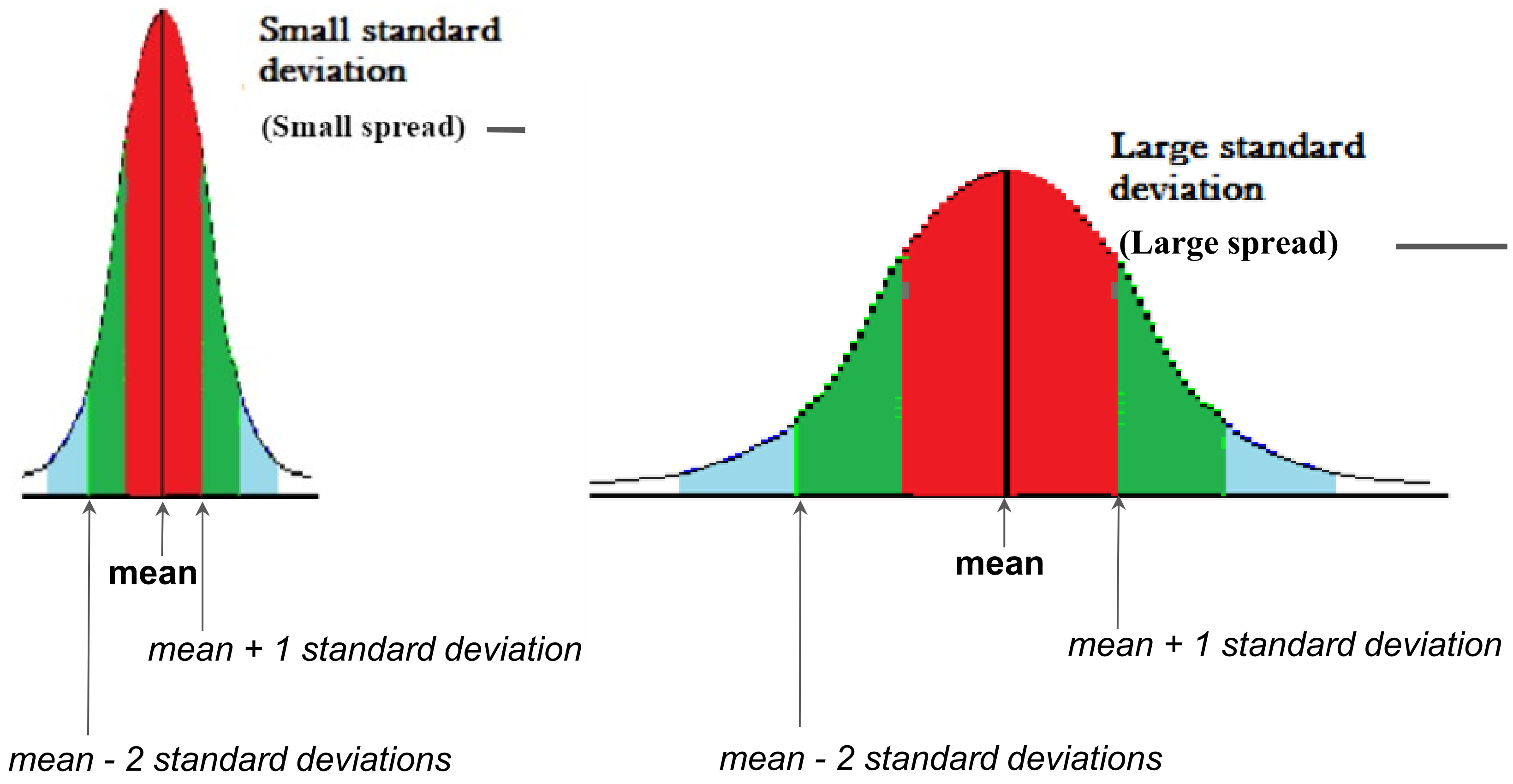
measure of spread from mean:
how far mean

EX set:
13,13,13,13,14,14,16,18,21

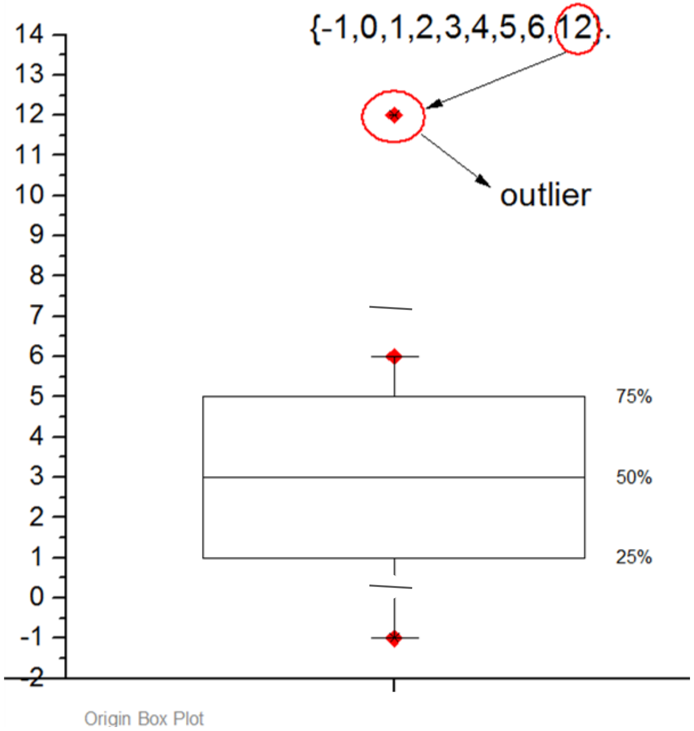
$[(10-14)^2+(12-14)^2+(12-14)^2+(12-14)^2+(13-14)^2+(14-14)^2+(14-14)^2+(18-14)^2+(21-14)^2]$ / 9 = 10.4 = **variance**

standard deviation =
square root of **variance** =
$\sqrt{(10.4)}$ = 3.2

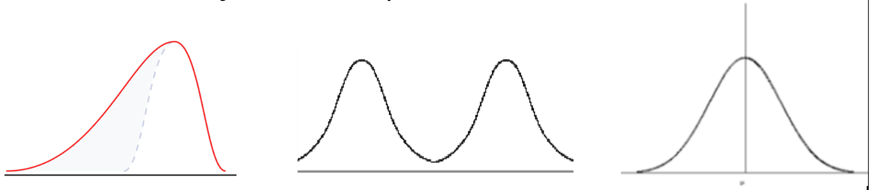
Standard Deviation = 3.2


Small standard deviation
(Small spread)
mean
mean + 1 standard deviation
mean - 2 standard deviations
Large standard deviation
(Large spread)
mean
mean + 1 standard deviation
mean - 2 standard deviations

Outlier - a data point that is dramatically different than other data points.



Shape (Distribution):
Skewed vs Symmetric (normal or not normal)



Not Symmetric Symmetric
Skewed

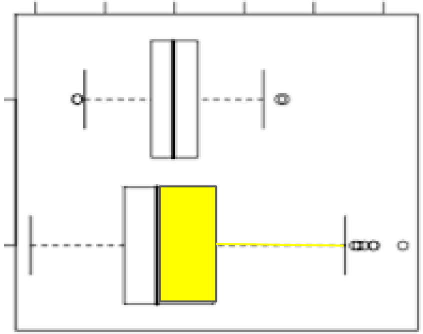
Symmetric

Not Normal

Normal

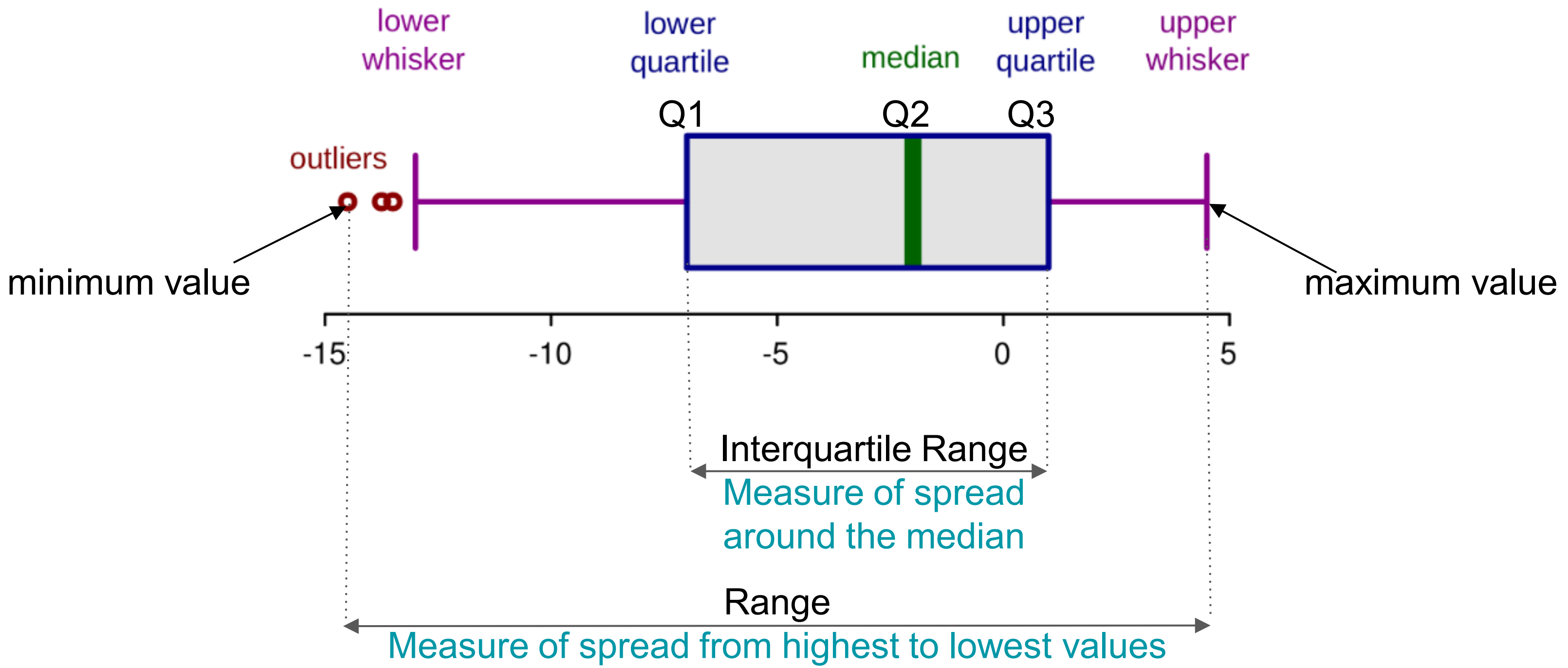
Normal / Symmetric

Skewed



Notice this section is wider than the other section and the right whisker is longer than the left, so it is skewed.

Example Box Plots



Box plot : visual display of 5 number summary

For an even number of values, add the two middle numbers & divide by 2.

Minimum: the smallest number in data set

Lower Quartile (Q1): the middle number to the left of the median in the data set, when data is in numerical order.

Median (Q2): the middle number when data set is in numerical order

Upper Quartile (Q3): the middle number to the right of the median in the data set, when data is in numerical order

Maximum: the largest number in data set

Range: Maximum - Minimum	**Interquartile Range:** Q3 - Q1	**Mean:** Mathematical average of the data

Measures of Center: Mean, Median, or Mode of a data set (depends on distribution)

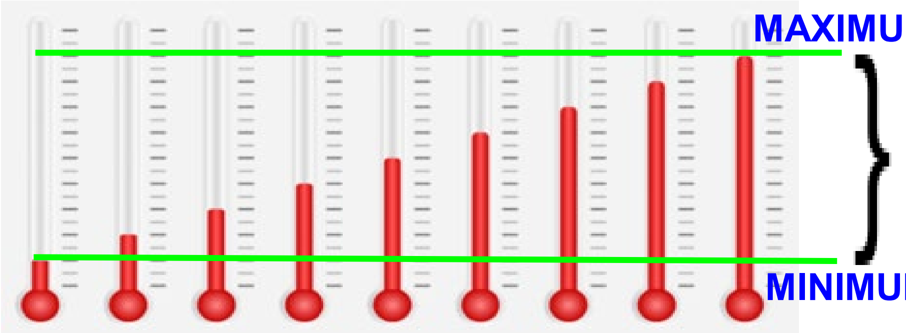
Measures of Spread: Range, Interquartile Range, or Standard Deviation of data (depends on distribution)

Shape: Describes the graph. Is it symmetric? How many peaks does it have? Is it skewed to the left or right? Is it uniform?

MALE

FEMALE

MAXIMUM (larger)

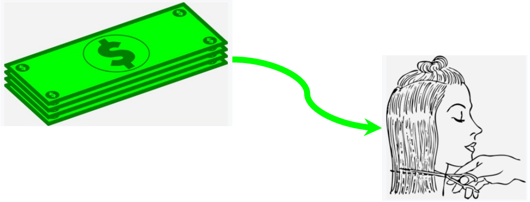


RANGE

MINIMUM (smaller)

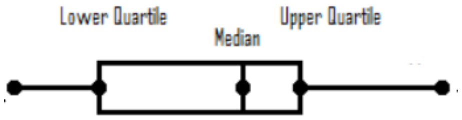
HAIRCUT

COST



INTERQUARTILE RANGE

Q3 - Q1



Q1 Q2 Q3

Population - set of all data or individuals the researcher is interested in studying Example: The school principal wants to know the most popular month for 10th grade student birthdays. The population is the birthdates of all tenth graders in the school	**Sample** - a subset of the population. Example: The birthdates of 40 tenth graders selected from a school with 500 tenth graders.
Bias - an error or influence that causes a misrepresentation of a population.	**Unbiased** - accurately represents the population.
Survey - an investigation in which every member of a sample is asked one or more questions.	**Experiment** - an investigation that imposes a treatment on individuals in order to collect information on their response to the treatment.
Observational Study - an investigation that observes individuals and measures variables without controlling the individuals or their environment. A survey is one example of an observational study.	**Simulation** - uses a model to reproduce the conditions of a situation using random probabilities so that the outcomes closely match the real-world outcomes

Random Sampling- each member of the population has an equal probability of being selected.	**Self-selected Sampling** - members of the population can choose whether to be part of the sample.
Systematic Sampling - a rule is used to select members of the population to be part of the sample. Example: Every tenth person is chosen.	**Cluster Sampling** - a population is divided into smaller naturally occurring groups (clusters) and all the members of one group or a few groups are selected (geographical grouping).
Stratified Sampling - a population is divided into smaller groups (strata) that share a similar characteristic (age, income, race, religion, etc.). A sample is then randomly selected from each group.	**Convenience Sampling** - only members of a population who are easy or convenient to study are selected for the sample.

Population - set of all data or individuals being studied. Example: The birthdates of all tenth graders in a school.	Additional notes/examples/diagrams:
Sample - a subset of the population. Example: The birthdates of 40 tenth graders selected from a school with 500 tenth graders.	
Bias - an error or influence that causes a misrepresentation of a population.	
Unbiased - accurately represents the population (no bias in the study).	

Survey - an investigation in which every member of a sample is asked one or more questions.	Additional notes/examples/diagrams:
Experiment - an investigation that imposes a treatment on individuals in order to collect information on their response to the treatment.	
Observational Study - an investigation that observes individuals and measures variables without controlling the individuals or their environment. A survey is one example of an observational study.	
Simulation - uses a model to reproduce the conditions of a situation using random probabilities so that the outcomes closely match the real-world outcomes	

Random Sampling - each member of the population has an equal probability of being selected.	Additional notes/examples/diagrams:
Self-selected Sampling - members of the population can choose whether to be part of the sample.	
Systematic Sampling - a rule is used to select members of the population to be part of the sample. Example: Every tenth person is chosen.	

Cluster Sampling - a population is divided into smaller naturally occurring groups (clusters) and all the members of one group or a few groups are selected.	Additional notes/examples/diagrams:
Stratified Sampling - a population is divided into smaller groups (strata) that share a similar characteristic. A sample is then randomly selected from each group.	
Convenience Sampling - only members of a population who are easy or convenient to study are selected for the sample.	

Pizza Restaurant

Guests/people eating

Pizza Sauce

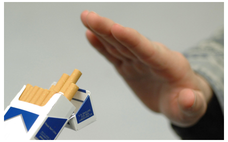
Energy Drink

Ingredient/something in drink

Consumers/people who drink it

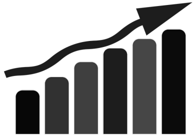
Blood Pressure

Non-Smoker



Smoker

Increase /make more



Decrease/make less

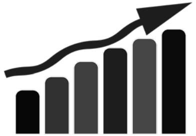
Traffic Light

Car Accident/car crashes

Intersection

Who?	Wants to know what?
a) A pizza restaurant  	a) Which pizza sauce do people like best?   
b) An energy drink company  	b) Does the new drink give people more energy? 

Who?	Wants to know what?
c) A doctor 	c) Do smokers and nonsmokers have different average blood pressures?   

Who?	Wants to know what?
d) A town 	d) Will adding a traffic light increase or decrease    the number of car accidents (crashes) at that intersection (place)?