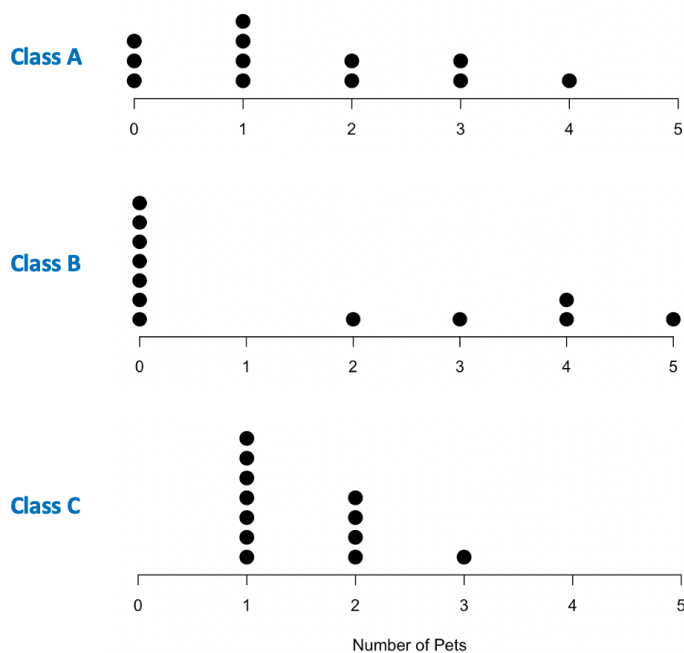


NAME:

1. Students from three different classes reported the number of pets in their household. The results are summarized graphically as dotplots and in a frequency table below.



Class A	Class B	Class C
1	0	1
0	0	1
4	0	1
3	4	1
2	4	2
1	3	1
1	0	2
3	5	2
0	0	3
2	0	2
1	0	1
0	2	1

(a) Compute the mean number of pets for each class.

(b) What is similar about the three dotplots?

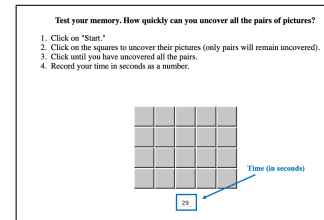
(c) What is different about the three dotplots?

NAME:

1. Test Your Memory!

Play the *Census at School Memory Game* where you will need to uncover and match 10 pairs of pictures. The time it takes you to complete the game will be tracked. Go to the following link to access the game:

<https://ww2.amstat.org/education/cas/1.cfm>



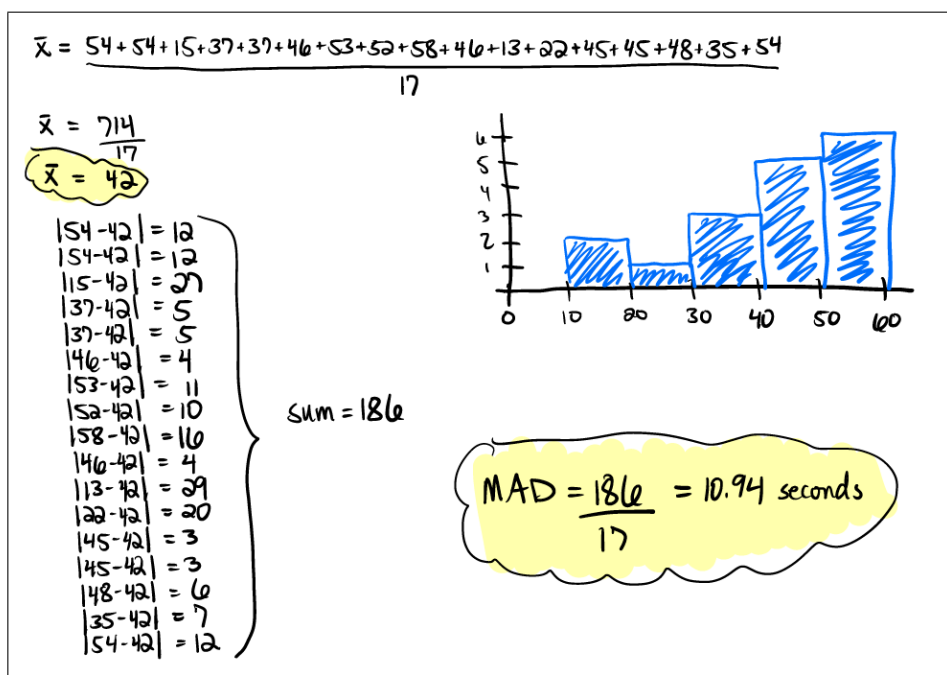
- (a) Play the game once and record your time (in seconds) as a number.
- (b) As a class, compile everyone's time in a dataset. What graphical summary would be appropriate to visualize the class's distribution of times on the memory game? Explain your reasoning.
- (c) As a class, create a graphical summary to visualize the class's distribution of times on the memory game and sketch it below.
- (d) Describe what you notice about the class's distribution of times on the memory game.

2. Quantifying Variability with Mean Absolute Deviation

Amaury is teaching a high school intermediate algebra class and his students are learning about different measures of variability. The students in his class played the *Census at School Memory Game* and recorded their times, in seconds:

54, 54, 15, 37, 37, 46, 53, 52, 58, 46, 13, 22, 45, 45, 48, 35, 54

Amaury asked his students to create a graphical summary of the data, compute the mean, and quantify the amount of variability present. One of his students, Jasmine, did the following:



Jasmine, recalling what they learned in middle school, quantified the amount of variability by computing the **mean absolute deviation (MAD)**. All of their calculations are correct. Describe mathematically what Jasmine did to compute the MAD.

3. Interpreting Mean Absolute Deviation

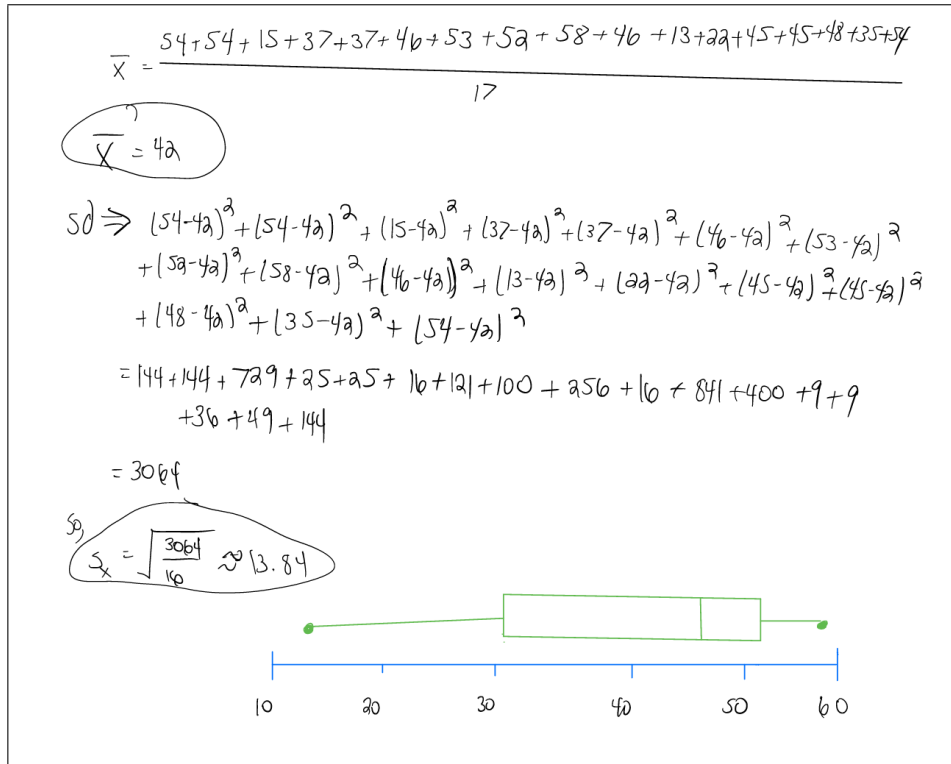
Two other students, Tarryn and Benny, also correctly computed the MAD. When Amaury asked his students to write a sentence interpreting their measure of variability in the context of the problem, Jasmine, Tarryn, and Benny wrote the following sentences:

Jasmine	The MAD is 10.94 seconds.
Tarryn	On average, the memory game times were 10.94 seconds away from the mean of 42 seconds.
Benny	A memory game time is 10.94 from the mean.

- (a) One student correctly (and completely) interpreted the MAD in the context of the problem. Identify who it was, and describe what components of their interpretation make it correct and complete.
- (b) The other two students gave incomplete interpretations of the MAD. Based on their interpretations, describe what each
- may understand about interpreting the MAD, and
 - may not yet understand about interpreting the MAD.
- (c) In a general context, describe what MAD measures.

4. Quantifying Variability with Standard Deviation and Interpreting Standard Deviation

Josief, another student in Amaury's class, did something different, as shown below:



- (a) Josief quantified the amount of variability by computing the **standard deviation (SD)**. All of his calculations are correct. Describe mathematically what he did to compute the SD.

- (b) When asked to write a sentence to interpret the SD in the context of the problem, Josief wrote the following:

The memory game times varied by 13.84 seconds.

Describe why Josief's interpretation is not completely correct.

- (c) Consider the following questions that one might ask Josief to help him with his interpretation of the standard deviation (in the context of the memory game times).

- i. Explain how the following question might help Josief to advance in his understanding of interpreting standard deviation in the context of a problem:

Can you say more about how the memory game times varied?

- ii. Explain how the following question might help you assess what Josief understands about interpreting the standard deviation in the context of a problem:

What does standard deviation measure?

- iii. Explain why the following question might not help Josief:

Why is your interpretation incorrect?

- (d) In a general context, describe what SD measures.

5. Return to the class dataset from Problem 1.

(a) Compute the mean absolute deviation of your class's data of memory game times and write a sentence interpreting the mean absolute deviation in the context of the problem.

(b) Compute the standard deviation of your class's data of memory game times and write a sentence interpreting the standard deviation in the context of the problem.

NAME:

HOMEWORK PROBLEMS: VARIABILITY: MAD AND SD (page 1 of 2)

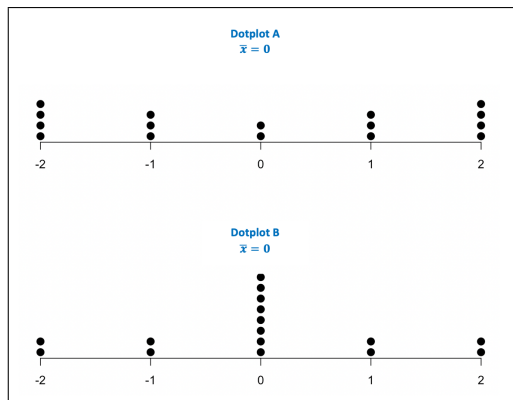
1. Ten movies were randomly selected and the length of each movie (in minutes) is given below.

152, 156, 98, 173, 68, 122, 92, 105, 138, 126

- (a) Compute the mean absolute deviation (MAD) and write a sentence that interprets the MAD in the context of the problem.
- (b) Compute the standard deviation (SD) and write a sentence that interprets the SD in the context of the problem.
2. In this problem, you will *visually* compare the mean absolute deviation (MAD) between pairs of dotplots.

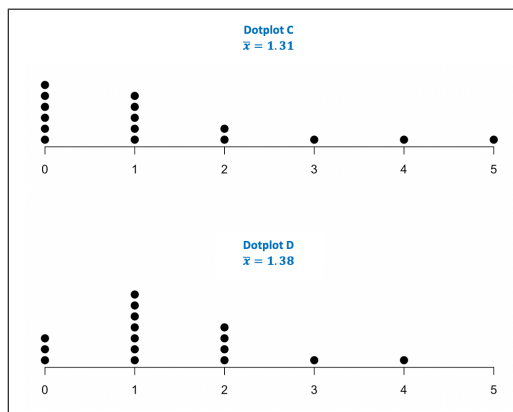
- (a) **Dotplots A and B.**

Without doing any calculations, identify which dotplot (A or B) has the *larger* MAD. Explain your reasoning.



- (b) **Dotplots C and D.**

Without doing any calculations, identify which dotplot (C or D) has the *larger* MAD. Explain your reasoning.



- (c) Draw two different dotplots that have the same MAD. Describe your thought process when creating these two different dotplots.

3. Consider the mean absolute deviation (MAD) and the standard deviation (SD). Typically, MAD is first taught in middle school and SD is taught in high school. Describe why it is helpful for school students to learn MAD before SD.
4. Four students (Daveed, Monica, Juliana, and Bryant) are working on the following problem together, but they all pick a different answer.

The director of the City Transportation System is interested in the amount of time required for a bus to make the trip from Downtown Station to City Mall. After collecting data for several months by recording the time it takes to make the trip, she finds that the distribution of times has a standard deviation of 3 minutes.

Which of the following is the best interpretation of the standard deviation?

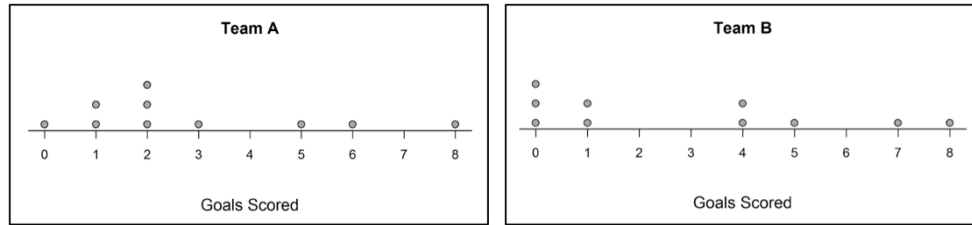
- A. A bus that leaves from Downtown Station typically arrives at City Mall 3 minutes later than the scheduled time.
- B. A bus typically takes about 3 minutes to get from Downtown Station to City Mall.
- C. The time a bus takes to get from Downtown Station to City Mall never varies more than 3 minutes from the mean trip time.
- D. The difference between the actual time a bus takes to get from Downtown Station to City Mall and the mean trip time is, on average, about 3 minutes.

Daveed selects option A, Monica selects option D, Juliana selects option C, and Bryant selects option B.

- (a) Who selected the correct answer?
- (b) For *each* student who selected an incorrect answer, examine the choice they selected and describe a statistical concept they do understand.
- (c) For *each* student who selected an incorrect answer, examine the choice they selected and describe a statistical concept they might not yet fully understand.
- (d) For *each* student who selected an incorrect answer, write a question you could ask them to help guide their understanding of interpreting a standard deviation in the context of the problem. Briefly explain how your question may help guide their statistical understanding.

NAME:

1. Two soccer teams will be meeting in the city championship game. Each team played 10 games and averaged 3 goals scored per game for the season. The two dotplots below show the number of goals scored by each team per game for the season.

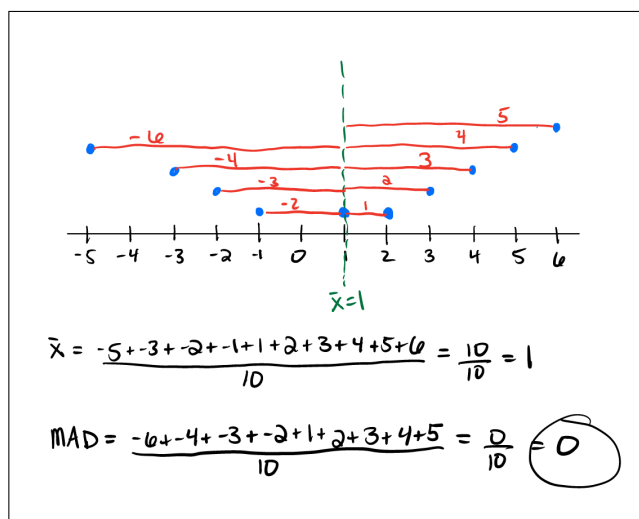


- (a) Describe what one dot in the dotplot for Team A represents.
- (b) Compute the standard deviation (SD) for Team A.
- (c) Write a sentence that interprets the SD for Team A in the context of the problem.
- (d) Based on the dotplots (and without computing the SD for Team B), does Team A or Team B have more variability in the number of goals scored per game over the course of the season? Explain your reasoning.

2. Delia was given the following dataset and asked to compute the MAD.

1, 5, 2, 6, -2, 3, 4, -1, -3, -5

She incorrectly computed the MAD, as shown in her work below.



- (a) Draw a dotplot to graphically display the data. Explain how the dotplot shows that the MAD cannot equal 0.

- (b) Examine Delia's work and describe what she understands about MAD.

- (c) Identify the error(s) Delia made in her work.
- (d) Write one question you could ask Delia to help her correct her work. Briefly explain how your question might help guide Delia's statistical understanding of MAD.