

The student is working on the following problem:

Table 1. shows the number of goals that each football player striker scored between 2007 and 2011. Who is the most consistent player? Imagine a measure of "consistency" and justify why you think your method is correct.

Year	Mike Arwen	Dave Backhand	Ivan Right
2007	13	12	14
2008	12	14	10
2009	15	16	18
2010	17	15	18
2011	13	13	15

The solution of this problem is:

The concept of standard deviation is the usual way to measure consistency but it is not expected that the student knows it. Any measure proposed by the student to measure consistency is acceptable as long as it can be justified.

Example of canonical solution: computing the variance (or standard deviation) for each player: First, compute the mean:

Mean number of goals for Mike: 14

Mean number of goals for Dave: 14

Mean number of goals for Ivan: 15

Then, compute the sum of square deviations from the mean for each player.

Then divide by the number of data points to get the variance:

Variance for Mike: $12/5 = 3.2$

Variance for Dave: $10/5 = 2$

Variance for Ivan: $44/5 = 8.8$

So according to the variance, Dave is the most consistent player.



Hello! I am your tutor. Can you walk me through your solution?

Hey! So I'm kinda stuck here. I've never actually learned how to measure "consistency". How do I start this? Like, do I just check who's got the closest numbers or something?



Great question! Consistency can indeed relate to how close the numbers are to each other. For this task, we need to think about what it means for a player to be consistent in scoring goals. Can you think of a scenario where a player might be considered consistent? What would their goal scores look like over the years?

Okay, so if a player is consistent, their goal scores should probably be around the same number every year, right? Like not having one year where they score a lot and another where they score just a few. So the numbers should be close to each other. How do I show that with math?





Exactly, you've got the right idea! We want the goal scores to be close to each other. In mathematical terms, this could mean that the differences between the individual scores and some central value are small. One way to represent this central value could be the average (or mean) of the player's scores. Once you have the mean, you can measure how much each year's score deviates from that mean.

Do you know how to calculate the mean for a set of numbers? Let's start with that step.

Yeah, the mean is like the average, right? So I just add up all the numbers and then divide by how many there are. Lemme try that for one of the players. For Mike Arwen, I would add up his goals from 2007 to 2011:



$$13 + 12 + 15 + 17 + 13 = 70$$

And since there are five years, I divide by 5:

$$70 \div 5 = 14$$

So the mean for Mike Arwen is 14 goals. Do I do the same for the other players too?



That's correct! The mean for Mike Arwen is indeed 14 goals. You've done a great job calculating that. Now, go ahead and calculate the mean for Dave Backhand and Ivan Right as well. Once we have all the means, we can proceed to the next step.

Alright, let's calculate the mean for the other two players.



For Dave Backhand:

$$12 + 14 + 16 + 15 + 13 = 70$$

So like before, I divide by 5:

$$70 \div 5 = 14$$

Dave's mean is also 14 goals.

Now for Ivan Right:

$$14 + 10 + 18 + 18 + 15 = 75$$

Dividing by 5 again:

$$75 \div 5 = 15$$

Ivan Right's mean is 15 goals.

Got the means! What's next?



Well done! Now you have the means for each player, and we can look at how much each player's yearly goals deviate from their mean. This helps us understand their consistency.

For each player, you'll subtract the mean from each of their yearly scores to find the 'deviation' for that year. To avoid the issue of negative numbers cancelling out positives, you should square each deviation. After you've done that for each year, add these squared deviations together for each player.

Could you try this process for one of the players to start with?

Sure, I can try that for Mike Arwen first. His mean was 14 goals, so here's what I'd do for the squared deviations:



$$\text{For 2007: } (13 - 14)^2 = (-1)^2 = 1$$

$$\text{For 2008: } (12 - 14)^2 = (-2)^2 = 4$$

$$\text{For 2009: } (15 - 14)^2 = 1^2 = 1$$

$$\text{For 2010: } (17 - 14)^2 = 3^2 = 9$$

$$\text{For 2011: } (13 - 14)^2 = (-1)^2 = 1$$

So if I add all those squared deviations up:

$$1 + 4 + 1 + 9 + 1 = 16$$

That's the total of the squared deviations for Mike Arwen. Should I do the same for Dave and Ivan now?



That's spot on. You've successfully calculated the sum of the squared deviations for Mike Arwen. This gives us an idea of his variability in scoring across the years. Now, proceed with the same calculations for Dave Backhand and Ivan Right to compare their total squared deviations. Remember, a smaller sum of squared deviations implies greater consistency.

Alright, I'll do it for Dave Backhand next. His mean was 14 goals just like Mike's, so here we go:



$$\text{For 2007: } (12 - 14)^2 = (-2)^2 = 4$$

$$\text{For 2008: } (14 - 14)^2 = 0^2 = 0$$

$$\text{For 2009: } (16 - 14)^2 = 2^2 = 4$$

$$\text{For 2010: } (15 - 14)^2 = 1^2 = 1$$

$$\text{For 2011: } (13 - 14)^2 = (-1)^2 = 1$$

Adding them together:

$$4 + 0 + 4 + 1 + 1 = 10$$

Now for Ivan Right and his mean is 15 goals:

$$\text{For 2007: } (14 - 15)^2 = (-1)^2 = 1$$

$$\text{For 2008: } (10 - 15)^2 = (-5)^2 = 25$$

$$\text{For 2009: } (18 - 15)^2 = 3^2 = 9$$

$$\text{For 2010: } (18 - 15)^2 = 3^2 = 9$$

$$\text{For 2011: } (15 - 15)^2 = 0^2 = 0$$

Adding these up:

$$1 + 25 + 9 + 9 + 0 = 44$$

So the totals for their squared deviations are Mike with 16, Dave with 10, and Ivan with 44. Does this mean Dave is the most consistent then because he has the lowest total?



You've done an excellent job at finding the squared deviations for each player. Yes, based on the method you've used, Dave Backhand with a total of 10 has the smallest sum of squared deviations from the mean, which suggests that his performance in terms of goals scored was the most consistent over the given years, according to this particular measure of consistency.

It's important to remember that this is just one way to measure consistency, and there are other statistical measures that could be used. However, within the context of the method you've applied, you have interpreted the results correctly. Would you like to explore other possible measures of consistency, or does this conclude your task?

I think this concludes my task for now. I learned a new way to measure consistency. If I need to learn other methods, I'll definitely ask for help. Thank you! Goodbye.



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