


IIT Madras

ONLINE DEGREE

Statistics for Data Science – 1
Professor. Usha Mohan
Pratyush P (Support Team)
Department of Management Studies
Indian Institute of Technology, Madras
Week - 03
Tutorial - 07

(Refer Slide Time: 00:14)

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Preeti found the following ages (in years) of 8 tigers. Those tigers were randomly selected from the 20 tigers at her local zoo:
5, 9, 13, 15, 17, 3, 5, 1.
Then the value of standard deviation for these 8 tigers' age is

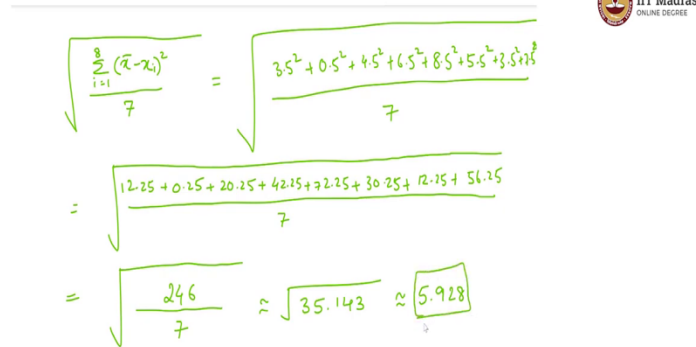
$$\bar{x} = \frac{5+9+13+15+17+3+5+1}{8} = \frac{68}{8} = 8.5$$
$$\sqrt{\frac{\sum_{i=1}^8 (\bar{x} - x_i)^2}{7}} = \sqrt{\frac{35^2 + 0.5^2 + 4.5^2 + 6.5^2 + 8.5^2 + 5.5^2 + 3.5^2 + 1.5^2}{7}}$$
$$= 8.5$$

So, I read question. Preeti found the following ages of 8 tigers. So, these are the 8 ages Preeti has found they were selected randomly from 20 tigers at her local zoo, and the value of the standard deviation is being asked. Now this is clearly sample standard deviation, so we need to first find the mean, the mean, \bar{x} would be $5 + 9 + 13 + 15 + 17 + 3 + 5 + 1$, the whole divided by 8, which gives us $5 + 9$ is 14, 14 plus that 13 is 27, 27 + 15 is 42, 42 + 17 is 59, 59 + 3 is 62, 62 + 5 is 67 plus 1 is 68.

So, we are getting $68/8$ which is 8.5. This is our mean. Now, if you look at the deviations of each of these, because we as first going to have to calculate the variance, or we can calculate the standard deviation directly is the square root of the sum of the squares of the deviations. Here, I have used the \bar{x} minus x_i deviation is actually $x_i - \bar{x}$, but since we are squaring, it really does not matter the sign should not matter. So, we can go on like this. Then I goes from 1 to 8 here divided by 7 because it is sample standard deviation.

So, this we will get as square root of the whole thing by 7 in 2. Now, we will get $3.5^2 + 0.5^2 + 4.5^2 + 6.5^2 + 8.5^2 + 5.5^2 + 3.5^2 + 7.5^2$.

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The image shows a handwritten calculation for the sample standard deviation. It starts with the formula $\sqrt{\frac{\sum (\bar{x} - x_i)^2}{n}}$ and substitutes the values $\bar{x} = 3.5$ and $n = 7$. The numerator is calculated as $3.5^2 + 0.5^2 + 4.5^2 + 6.5^2 + 8.5^2 + 5.5^2 + 3.5^2 + 7.5^2$. This is then simplified to $\frac{12.25 + 0.25 + 20.25 + 42.25 + 72.25 + 30.25 + 12.25 + 56.25}{7}$. The final result is $\sqrt{\frac{246}{7}} \approx \sqrt{35.143} \approx 5.928$. The IIT Madras logo is visible in the top right corner of the slide.

$$\sqrt{\frac{\sum (\bar{x} - x_i)^2}{n}} = \sqrt{\frac{3.5^2 + 0.5^2 + 4.5^2 + 6.5^2 + 8.5^2 + 5.5^2 + 3.5^2 + 7.5^2}{7}}$$

$$= \sqrt{\frac{12.25 + 0.25 + 20.25 + 42.25 + 72.25 + 30.25 + 12.25 + 56.25}{7}}$$

$$= \sqrt{\frac{246}{7}} \approx \sqrt{35.143} \approx 5.928$$

So, this gives us then the $\sqrt{\frac{12.25 + 0.25 + 20.25 + 42.25 + 72.25 + 30.25 + 12.25 + 56.25}{7}}$ which further gives us square root of this denominators to the 7 the numerator will give us 12.5 + 2.25 is 32.75 plus 42.25 is 75 plus 72.25 is 147.25 plus 30.25 is 177.5 plus 12.25 is 189.75 plus 36.25 is 246, which is roughly the square root of 35.143 which is again roughly 5.928. So, this is the standard deviation of the ages of these tigers, sample standard deviation of course.

(Refer Slide Time: 04:28)



3) Preeti found the following ages (in years) of 8 tigers. Those tigers were randomly selected from the 20 tigers at her local zoo:

5, 9, 13, 15, 17, 3, 5, 1.

Then the value of standard deviation for these 8 tigers' age is 5.928 years

$$\bar{x} = \frac{5+9+13+15+17+3+5+1}{8} = \frac{68}{8} = 8.5$$

$$\sqrt{\frac{\sum_{i=1}^8 (x_i - \bar{x})^2}{7}} = \sqrt{\frac{35^2 + 0.5^2 + 4.5^2 + 6.5^2 + 8.5^2 + 5.5^2 + 3.5^2 + 1.5^2}{7}}$$
$$= \sqrt{\frac{12.25 + 0.25 + 20.25 + 42.25 + 72.25 + 30.25 + 12.25 + 56.25}{7}}$$

So, our answer is 5.928 years.