

## Answer on Question #64972 – Math – Statistics and Probability

### Question

The amount of apples (in kg) produced per day by 10 orchards are given below:

218.2 179.5 207.3 224.3 213.7

199.7 184.7 194.4 203.5 185.4

Find the first four moments about the mean and the coefficient of kurtosis for the above data.

### Solution

The mean [1, p. 31] is

$$\bar{x} = \frac{\sum x_i}{n}$$

The mean is

$$\frac{218.2 + 179.5 + 207.3 + 224.3 + 213.7 + 199.7 + 184.7 + 194.4 + 203.5 + 185.4}{10} = 201.07$$

The k-th moment about the mean [2] is

$$\mu_k = \frac{\sum (x_i - \bar{x})^k}{n}$$

1<sup>st</sup> moment about the mean is

$$\begin{aligned} \mu_1 = \frac{1}{10} & [(218.2 - 201.07) + (179.5 - 201.07) + (207.3 - 201.07) + (224.3 - 201.07) \\ & + (213.7 - 201.07) + (199.7 - 201.07) + (184.7 - 201.07) \\ & + (194.4 - 201.07) + (203.5 - 201.07) + (185.4 - 201.07)] = 0 \end{aligned}$$

2<sup>nd</sup> moment about the mean is

$$\begin{aligned} \mu_2 = \frac{1}{10} & [(218.2 - 201.07)^2 + (179.5 - 201.07)^2 + (207.3 - 201.07)^2 + (224.3 - 201.07)^2 \\ & + (213.7 - 201.07)^2 + (199.7 - 201.07)^2 + (184.7 - 201.07)^2 \\ & + (194.4 - 201.07)^2 + (203.5 - 201.07)^2 + (185.4 - 201.07)^2] = 206.2461 \end{aligned}$$

3<sup>rd</sup> moment about the mean is

$$\begin{aligned} \mu_3 = \frac{1}{10} & [(218.2 - 201.07)^3 + (179.5 - 201.07)^3 + (207.3 - 201.07)^3 + (224.3 - 201.07)^3 \\ & + (213.7 - 201.07)^3 + (199.7 - 201.07)^3 + (184.7 - 201.07)^3 \\ & + (194.4 - 201.07)^3 + (203.5 - 201.07)^3 + (185.4 - 201.07)^3] = 126.3489 \end{aligned}$$

4<sup>th</sup> moment about the mean is

$$\begin{aligned}\mu_4 &= \frac{1}{10} [(218.2 - 201.07)^4 + (179.5 - 201.07)^4 + (207.3 - 201.07)^4 + (224.3 - 201.07)^4 \\ &\quad + (213.7 - 201.07)^4 + (199.7 - 201.07)^4 + (184.7 - 201.07)^4 \\ &\quad + (194.4 - 201.07)^4 + (203.5 - 201.07)^4 + (185.4 - 201.07)^4] \\ &= 75485.5925\end{aligned}$$

The coefficient of kurtosis [3, p. 3] is

$$\frac{\mu_4}{\mu_2^2}$$

The coefficient of kurtosis is

$$\frac{\mu_4}{\mu_2^2} = \frac{75485.5925}{206.2461^2} = 1.7746$$

### References:

1. Saylor Academy open textbook. Introductory statistics textbook. Retrieved from <https://www.saylor.org/site/textbooks/Introductory%20Statistics.pdf>.
2. Central Moment. An R Introduction to Statistics. Retrieved from <http://www.r-tutor.com/elementary-statistics/numerical-measures/moment>.
3. Sharon I. O'Donnell. Notes – Econ 2370 – Statistics and Probability. Retrieved from <http://www.uh.edu/~odonnell/econ2370/moment.pdf>.