Hypothesis test

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Since in 2020 the coronavirus broke out, we will look into the police shooting events happened from 2015 to 2019.
Now that we want to study the distribution of the number of everyday shootings, we first construct a histogram to give a rough knowledge. After gathering the five-year data together, we find that the data shown by the histogram fit a Poisson distribution to some extent, which motivate us to use hypothesis test to prove our view.
Now we give the null hypothesis that the number of everyday shootings from 2015 to 2019 follows a Poisson distribution. Then we approximate the parameter k using sample mean, which can be expressed as:

$$\hat{k} = \frac{\sum_{i=0}^{max}(i \times O_i)}{n}$$

where O_i is the number of days counting for each number of shootings from 0 to 9, and n denotes for total days in these five years. After that, referring to Cochran's Rule, we can construct a random variable X such that:

$$X^2 = \sum_{i=0}^{max} \frac{(E_i - O_i)^2}{E_i}$$

follows a Chi-squared distribution, where E_i is the expected days for each shooting number.
Finally, we can decide whether to reject the null hypothesis by comparing the computed X^2 with $\chi^2_{0.05,8}$ at $\alpha = 0.05$ level.