

Every year a statistics teacher takes her class out to observe the traffic passing the school gates during a Tuesday lunch hour. Over the years she has established that the average number of lorries passing the gates in a lunch hour is 7.5. During the last 12 months a new bypass has been built and the number of lorries passing the school gates in this year's experiment was 4. Test, at the 5% level of significance, whether or not the mean number of lorries passing the gates during a Tuesday lunch hour has been reduced.

We let X be the number of lorries passing gates in lunch hour

We choose a Poisson distribution to model the random variable X (as we are dealing with independent events in time)

Our null hypothesis (which we assume to be true) is :

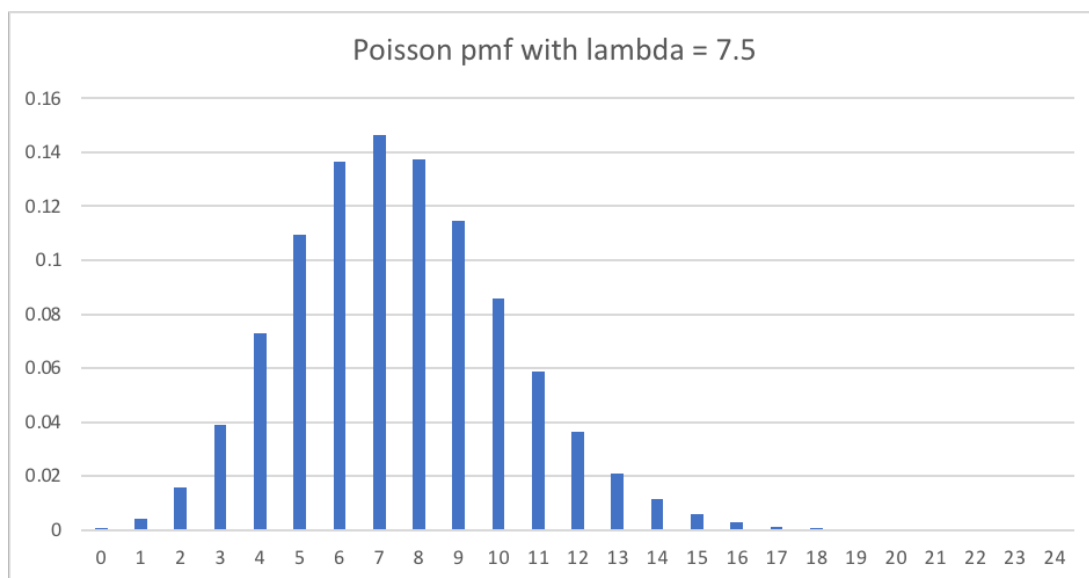
$$H_0 : X \sim P_0(7.5) \quad \text{ie } \lambda = 7.5$$

We want to test H_0 against the alternative

$$H_A : \lambda < 7.5$$

What kind of observations of X would make us reject H_0 (in favour of H_A)?

The answer to this question depends on the **significance level** of the test



If we look at the pmf of X under H_0 , we are looking for values of X which are so low (left-tail test) that they have a "small probability" of occurring if H_0 is true.

This "small probability" is the **significance level** and is chosen in advance of taking the observation.

Noting that $P(X \leq 2) \approx 2\%$

$$\text{and } P(X \leq 3) \approx 5.9\%$$

We take $X \leq 2$ to be our **critical region** where we would reject H_0 .

As the observed value (4) is not in the critical region we cannot reject H_0 , so $\lambda = 7.5$.