Chapter 14 / **Example 19**

Type I and type II errors

In order to satisfy quality control the mean number of flaws in aluminium sheets must be less than or equal to 0.6 flaws per metre length. A length of 7 m is inspected.
Assuming the number of flaws follows a Poisson distribution:

a state the distribution of the number of flaws (X) in the length sampled, assuming an average of 0.6 flaws per metre

b state the hypotheses for the test

c find the critical region for the test at the 5% significance level

d find the probability of

i a type I error

ii a type II error, given the mean is in fact 0.72 flaws per metre.

$X \sim \text{Po}(4.2)$, H_0: $\mu = 4.2$, H_1: $\mu > 4.2$

$P(X \geq a) \leq 0.05$, $P(X \leq a - 1) \geq 0.95$

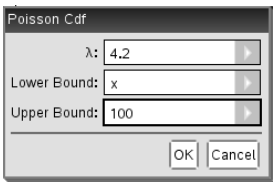
Open a new document and add a Calculator page.

Type f1(x) and press ctrl [:=]

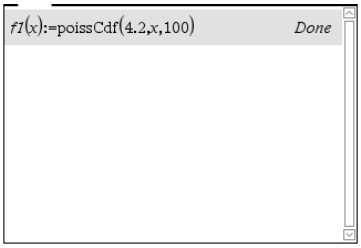
Press menu 5:Probability | 5:Distributions | K:PoissonCdf…

Enter 4.2 as the value of λ, x as the Lower Bound and 100 as the Upper Bound.

Press enter or click OK with the touchpad.



The function $f1(x)$ is defined.

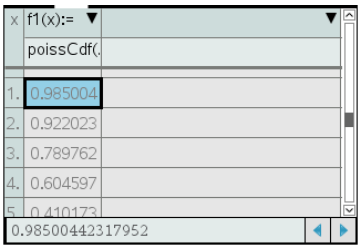


Add a new Lists & Spreadsheet page to your document by pressing ctrl doc (+page) 4:Add Lists & Spreadsheet

Press ctrl T to switch from a spreadsheet to a table.

Press enter to select the function $f1(x)$.

The function is shown in the table.



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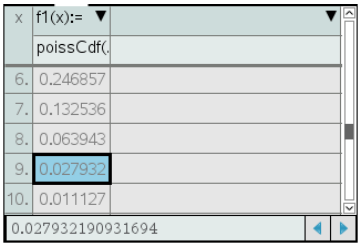
Type I and type II errors

Scroll down the table using ▼.

From the table, $P(X \geq 8) > 0.0639$ and $P(X \geq 9) > 0.0279$.

The critical region is $X \geq 9$

The probability of a type I error is 0.0279

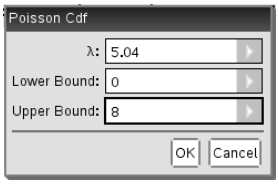


Press ctrl ◀ to return to the Calculator page

Press menu 5:Probability | 5:Distributions | K:PoissonCdf…

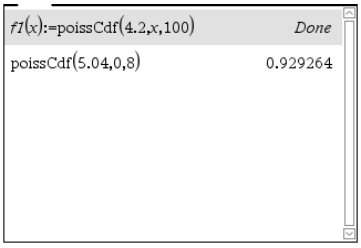
Enter 5.04 as the value of λ, 0 as the Lower Bound and 8 as the Upper Bound.

Press enter or click OK with the touchpad.



$P(X \leq 8 \mid p = 5.04) = 0.929$

This is the probability of a type II error.



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