

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.

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

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

Press $\boxed{\text{F1}}$ $\boxed{\text{Y=}}$ to display the equation entry screen.

Press $\boxed{2\text{nd}}$ $\boxed{\text{VARS}}$ $\boxed{\text{DISTR}}$ D:poissoncdf

Enter 4.2 as the value of λ and X as the x value.

Navigate down to Paste and press $\boxed{\text{ENTER}}$.

Poissoncdf
 $\lambda: 4.2$
 $x \text{ value}: X$
 Paste

Press $\boxed{2\text{nd}}$ $\boxed{\text{F5}}$ $\boxed{\text{TABLE}}$

Plot1 Plot2 Plot3
 $\text{Y1} = \text{Poissoncdf}(4.2, X)$
 $\text{Y2} =$
 $\text{Y3} =$
 $\text{Y4} =$
 $\text{Y5} =$
 $\text{Y6} =$
 $\text{Y7} =$
 $\text{Y8} =$
 $\text{Y9} =$

From the table, $P(X \leq 7) = 0.936$ and $P(X \leq 8) = 0.972$.

The critical region is $X \geq 9$

$$P(X \geq 9) = 1 - P(X \leq 8) = 1 - 0.9721 = 0.0279$$

This is the probability of a type I error.

X	Y1			
0	.015			
1	.07798			
2	.21024			
3	.3954			
4	.58983			
5	.75314			
6	.86746			
7	.93606			
8	.97207			
9	.98887			
10	.99593			

X=0

Press $\boxed{2\text{nd}}$ $\boxed{\text{MODE}}$ $\boxed{\text{QUIT}}$.

Press $\boxed{2\text{nd}}$ $\boxed{\text{VARS}}$ $\boxed{\text{DISTR}}$ D:poissoncdf

Enter 5.04 as the value of λ and 8 as the x value.

Navigate down to Paste and press $\boxed{\text{ENTER}}$.

Poissoncdf
 $\lambda: 5.04$
 $x \text{ value}: 8$
 Paste

Chapter 14 / **Example 19**

Type I and type II errors

Press **ENTER**.

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

This is the probability of a type II error.

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poissoncdf(5.04,8)  
.....929263884
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