

Chapter 14 / **Example 18****Type I and type II errors**

A machine produces components needed for a software company. The probability of a fault occurring in the production of a single component has to be less than 0.02. A sample of size 50 is taken from the output and tested to see if any were faulty. A test was performed with the hypotheses $H_0: p = 0.02$ and $H_1: p > 0.02$ at a 5% significance level.

- a** State a suitable model for the number of faults in the sample; include any additional assumptions you are making.
- b** Find
 - i** the critical region for the test
 - ii** the probability of a type I error.
- c** Earlier testing indicates that the probability of a fault is 0.04. If this is the case find the probability of a type II error.

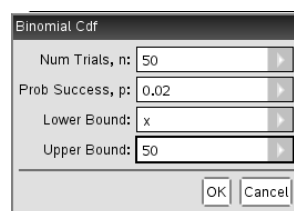
Open a new document and add a Calculator page.

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

Press menu 5:Probability | 5:Distributions | B:Binomial Cdf...

Enter 50 as the number of trials, 0.02 as the probability of success and x as the lower bound and 50 as the upper bound.

Press enter or click OK with the touchpad.



Press ctrl [doc] [+page] and add a new Lists & Spreadsheet page.

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

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

From the table, $P(X \geq 3) = 0.0784$ and $P(X \geq 4) = 0.0178$.

The critical region is $X \geq 4$

The probability of a type I error is 0.0178

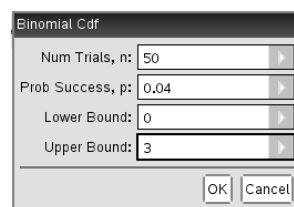
	f1(x):=	binomCdf
1.	0.63583	
2.	0.264229	
3.	0.078428	
4.	0.017758	
5.	0.00321	
		0.017758080694143

Press ctrl [left arrow] to return to the Calculator page

Press menu 5:Probability | 5:Distributions | B:Binomial Cdf...

Enter 50 as the number of trials, 0.04 as the probability of success and 0 as the lower bound and 3 as the upper bound.

Press enter or click OK with the touchpad.

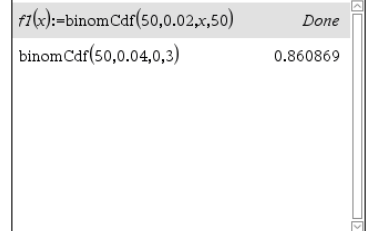


Chapter 14 / **Example 18**

Type I and type II errors

$$P(X \leq 3 | p = 0.04) = 0.861$$

This is the probability of a type II error.



The image shows a TI-Nspire CX calculator screen. The top line displays the function definition $f1(x) := \text{binomCdf}(50, 0.02, x, 50)$ followed by a 'Done' button. The bottom line shows the calculation $\text{binomCdf}(50, 0.04, 0, 3)$ resulting in the value 0.860869.

$f1(x) := \text{binomCdf}(50, 0.02, x, 50)$	Done
$\text{binomCdf}(50, 0.04, 0, 3)$	0.860869