

Chapter 14 / Example 2

Test for binomial probability

A food scientist is trying to determine whether a new version of cheddar cheese is regarded as more tasty than the original type.

In order to do this he decides to carry out a test with 20 people in which they are given the two types of cheese without knowing which is the original and which is new, and he asks them to pick the one they prefer. His null hypothesis is that there is no preference, so each cheese is equally likely to be selected, and his alternative hypothesis is that the new cheese is preferred. He decides to perform the test with a 5% significance level.

Let X be the number of people in the test who prefer the new cheese.

- 1 If p is the proportion of people in the population who would prefer the new cheese, state the null and alternative hypotheses.
- 2 Find the critical region for this test.
- 3 State the least possible significance level of the test

In the test, 18 out of the 20 people preferred the new cheese.

- 4 State the conclusion of the test.
- 5
 - a Find $P(X \geq 18)$ under the assumption that the null hypothesis is true.
 - b How does this confirm your answer to question 3?

$H_0: p = 0.5, H_1: p > 0.5$

$X \sim B(20, 0.5)$. Find $P(X \geq r) \leq 0.05$

Open a new document and add a Calculator page.

Type $f1(x)$ and press **ctrl** **[2nd]** **[=]**.

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

Enter 20 as the number of trials, 0.5 as the probability of success, x as the lower bound and 20 as the upper bound.

Press **enter** or click OK with the touchpad.

The function $f1(x)$ is defined.

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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.

x	f1(x):=
	binomCdf.
1.	0.999999
2.	0.99998
3.	0.999799
4.	0.998712
5.	0.994091
f1(x):=binomCdf(20,0.5,x,20)	

Scroll down the table using ▼.

From the table, $P X \geq 14 > 0.0577$ and $P X \geq 15 > 0.0207$.

The critical region is $X \geq 15$

The least possible significance level is 2.07%

18 is in the critical region so we reject the null hypothesis.

x	f1(x):=
	binomCdf.
12.	0.251722
13.	0.131588
14.	0.057659
15.	0.020695
16.	0.005909
0.020694732693264	

$P X \geq 18 = 0.000201$

The p -value is 0.000201.

x	f1(x):=
	binomCdf.
15.	0.020695
16.	0.005909
17.	0.001288
18.	0.000201
19.	0.00002
2.01225280761E-4	