

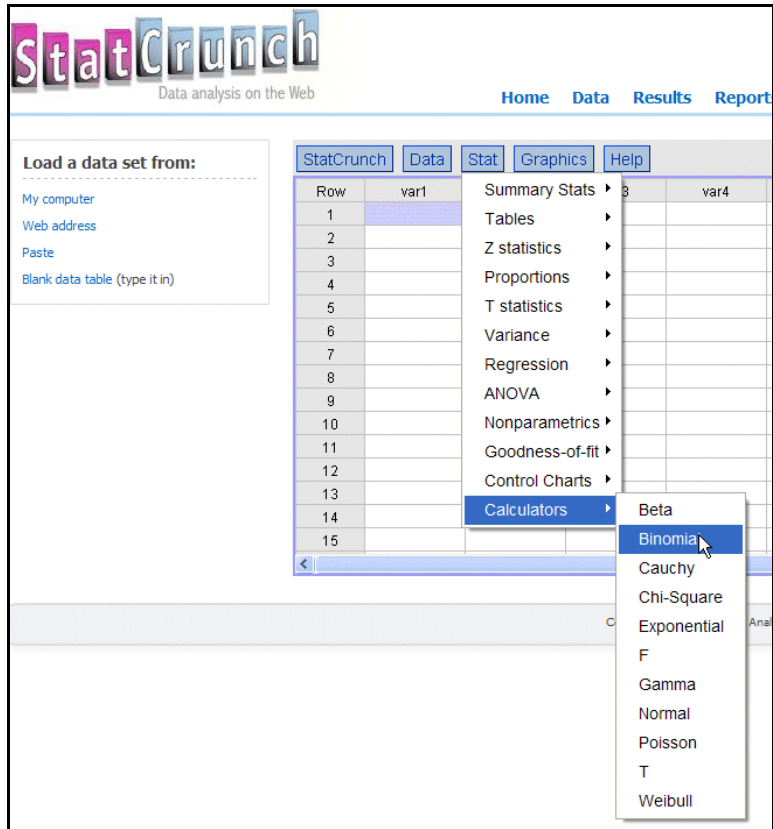
## BINOMIAL PROBABILITY

In chapter 4, you learn how to calculate binomial probabilities in a number of different ways: use a formula (something you will most likely never do in real life); use a table (something you might do in real life); use a computer program (something you will most likely do in real life).

In example 4.26, you are shown how to use a binomial table. You can also use StatCrunch.

As shown on the right, click on...

STAT/CALCULATORS/BINOMIAL.



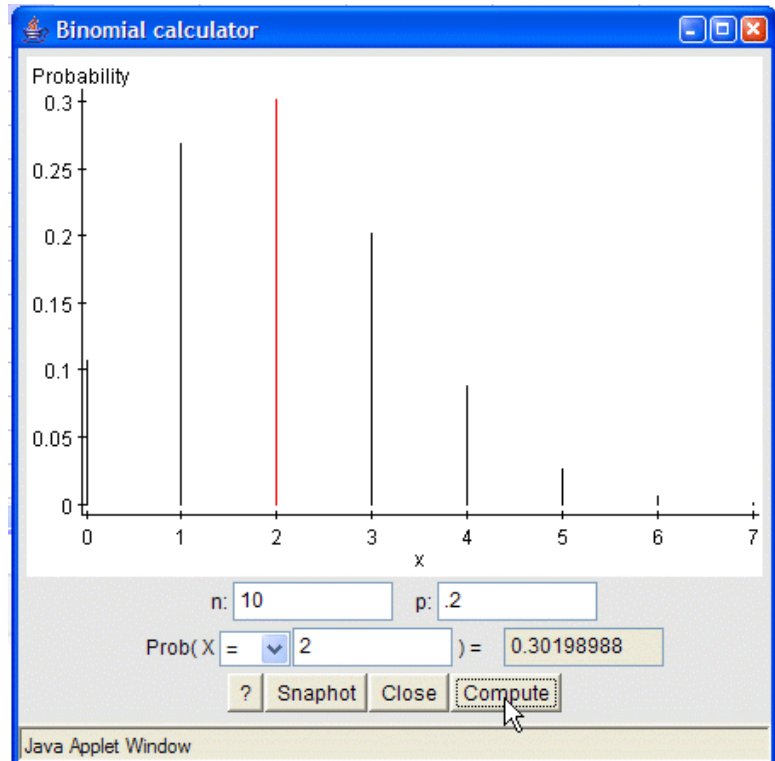
The screenshot shows the StatCrunch website interface. The 'Stat' menu is open, and the 'Calculators' sub-menu is also open, showing 'Binomial' selected. The background shows a data table with columns 'var1' and 'var4' and rows numbered 1 to 15.

Enter the parameters from the example in the appropriate boxes then click on compute. The 'k' in the example has a value of 2 and that is entered in the box labeled PROB(X).

Make sure you highlight the '=' to the right of PROB(X) since the example asks for the probability of EXACTLY 2 occurrences.

Click on COMPUTE.

The calculated value is 0.30198, which rounds to 0.3020 --- the value in Rosner.



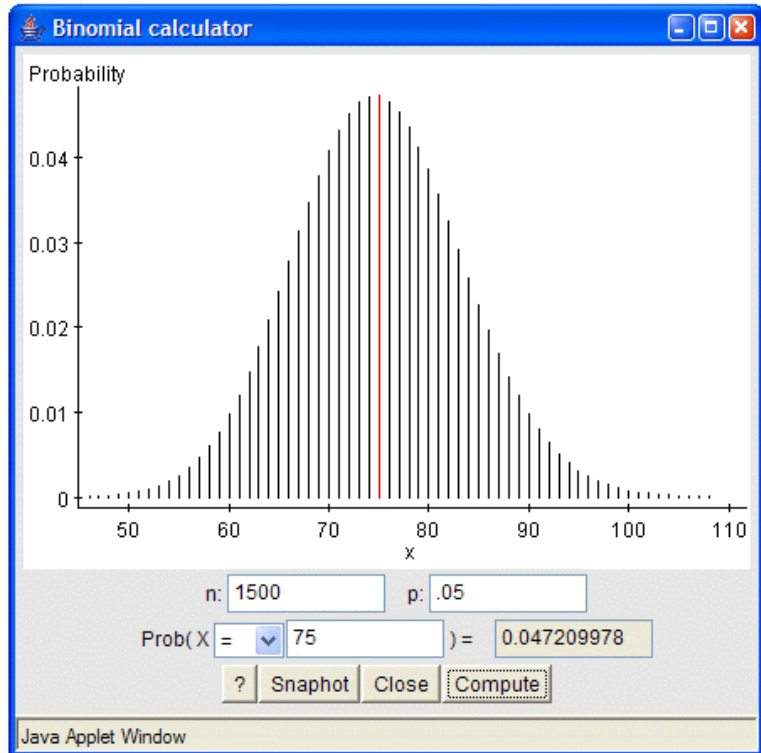
In example 4.29, you are shown how to use Excel to calculate a binomial probability. You can try that, but you can also use StatCrunch.

The value of N (1500) is much too large to ever appear in a table. However, the calculation is easy to do in StatCrunch.

This example is a bit different than the last one in that you are asked to calculate BOTH the probability of EXACTLY 75 cases and the probability of AT LEAST 75 cases. AT LEAST is the equivalent of 75 OR MORE cases.

To compute the probability of EXACTLY 75 cases, make sure the symbol after PROB(X to is '='.

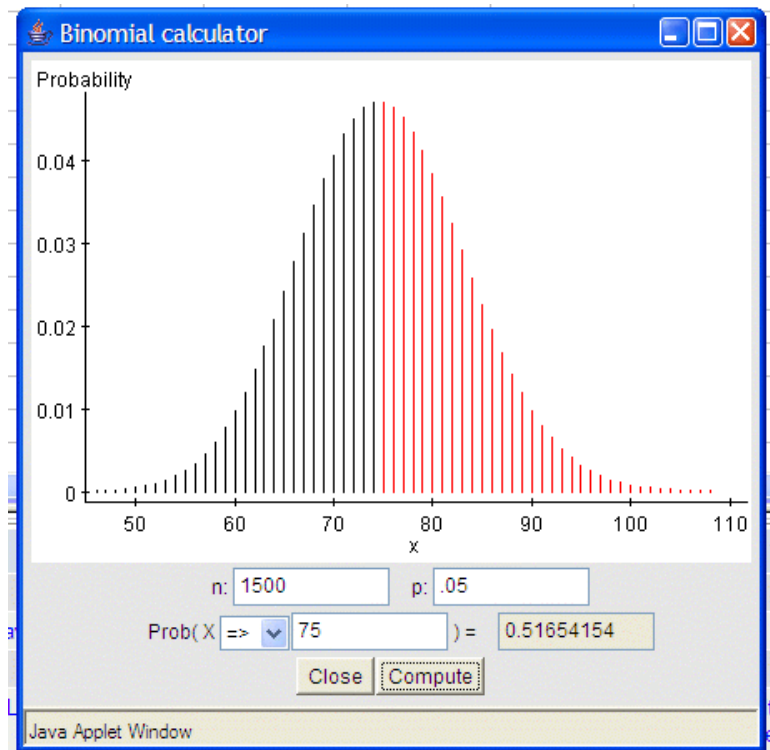
The calculated value of 0.04721 is equivalent to value 0.047 shown in Rosner.



To compute the probability of AT LEAST

75 cases, change the symbol after PROB(X to from '=' to '=>'.

The calculated value of 0.51654 is equivalent to value 0.517 shown in Rosner.



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For some practice, try using the data in example 4.30 and also try REVIEW QUESTIONS 4C using StatCrunch. Note, in the review questions, you will have to convert the probability  $1/9$  to a decimal before you enter a value in StatCrunch.

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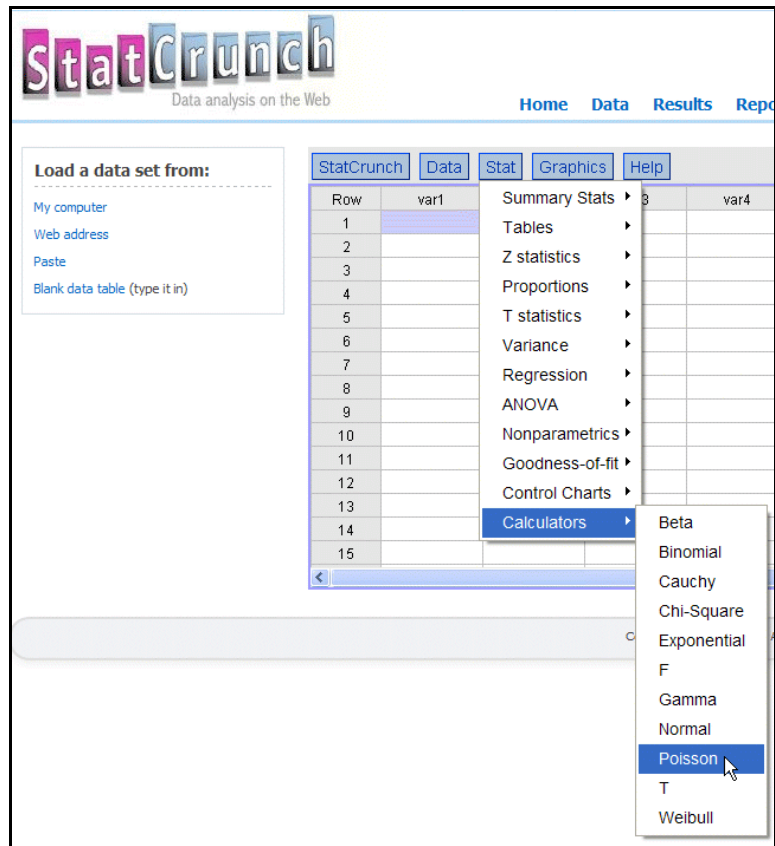
## POISSON PROBABILITY

The comments made about calculating binomial probabilities in real life also hold for the calculation of Poisson probabilities. You will most likely use a computer program.

In example 4.35, you are shown how to use a Poisson table. You can also use StatCrunch.

As shown on the right, click on...

STAT/CALCULATORS/POISSON



The screenshot shows the StatCrunch website interface. The 'Stat' menu is open, and the 'Calculators' sub-menu is selected, showing 'Poisson' as an option. The website header includes 'StatCrunch Data analysis on the Web' and navigation links for 'Home', 'Data', 'Results', and 'Reports'. The main content area shows a data table with columns 'Row', 'var1', and 'var4'. The 'Stat' menu is open, and the 'Calculators' sub-menu is selected, showing 'Poisson' as an option.

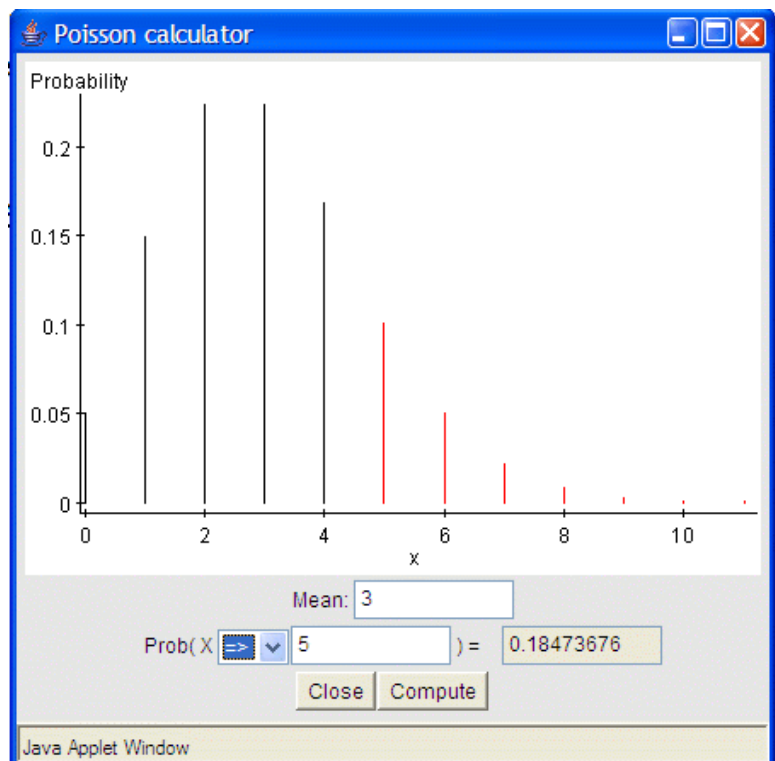
The example asks you to calculate the probability of AT LEAST 5 events given a mean of 3.

Once again, AT LEAST 5 translates to 5 OR MORE events. If you use the table, you have to: calculate the probability of 0, 1, 2, 3, and 4 events; add those probabilities; find the complement of the sum calculated in the last step. That's a good way to learn how to use the table.

In StatCrunch, fill in the parameters as shown on the right and click on COMPUTE.

The answer 0.1847376 rounds to 0.1847, not the 0.1848 shown in Rosner. But the intermediate values in Rosner are rounded, not the final value!

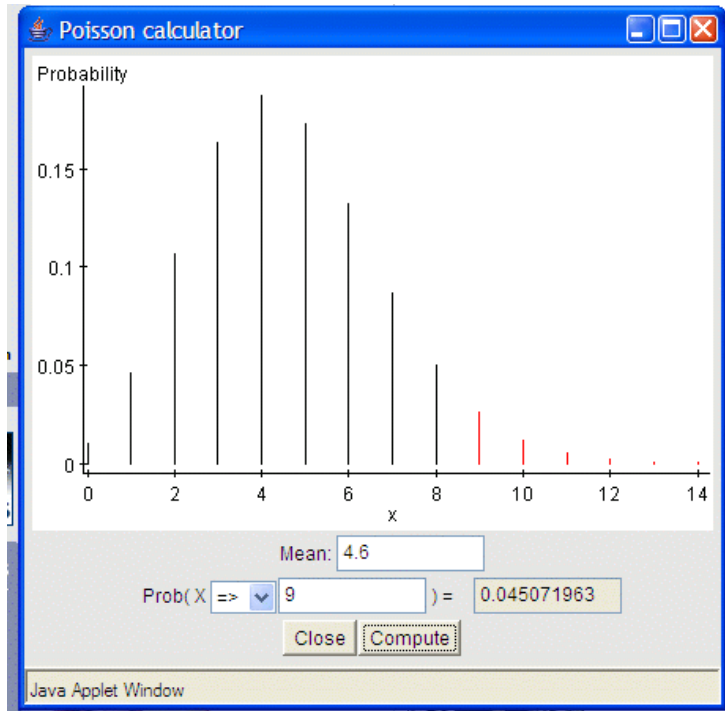
Close enough.



In example 4.36, you are shown how to use Excel to compute Poisson probabilities for a mean that is not in the table in the appendix, 4.6.

Once again, enter the appropriate parameters in StatCrunch and you get the answer (when rounded) shown in Rosner.

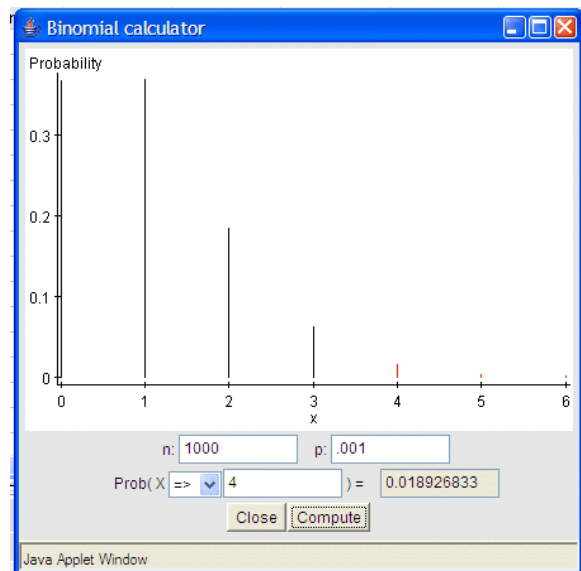
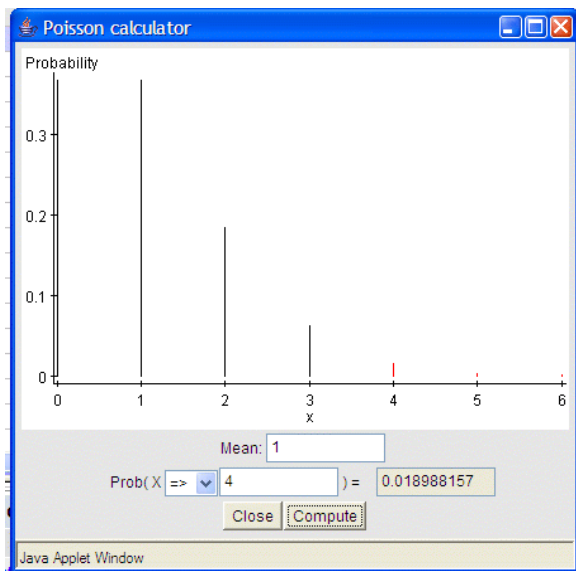
For some practice, Try REVIEW QUESTIONS 4D using StatCrunch. You can also try examples 4.31, 4.33, 4.34, and 4.35.



## POISSON APPROXIMATION TO THE BINOMIAL

In section 4.13, Rosner discusses using a Poisson approximation to the binomial. Given the availability of computer programs, there really is no need to use a Poisson approximation if you have all the parameters needed to calculate a binomial probability ---  $n$ ,  $k$ , and  $p$ . Using the approximation in place of the true value when you have all the parameters is a hold over from the pre-computer program era. Also, calculating the exact binomial probability means that you can avoid answering the question posed in Rosner in the middle of page 110 --- "How large should  $n$  be or how small should  $p$  be before the approximation is 'adequate'?".

In example 4.39, Rosner shows how the Poisson approximation is close to the exact binomial. You can also do that in StatCrunch as follows.



The values are equivalent (when rounded) and are the same as those shown in Rosner. However, why use an approximation when you can calculate the exact value? The answer to that question is that there is no good reason.