

Review of CalculationCenter 2

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CalculationCenter was introduced in 2001 by Wolfram Research as a tool for basic technical computing. Taking advantage of the powerful Mathematica system, CalculationCenter integrates symbolics, numerics, graphics and typesetting in an easy to use form.

The software comes on a CD, and there is a Getting Started booklet providing, amongst other things, basic installation instructions: the program runs on a PC under Microsoft Windows 95 or later, or on a Macintosh machine under Mac OS 7.5.3 or later, occupying about 85 Mb of hard disk space. This includes the on-line help. The documentation accompanying the review software states that the retail price is £260 for a single user.

The first release having been reviewed in [1], this article only considers the enhancements and new features in release 2.

Statistics

CalculationCenter uses many but not all of the functions from Mathematica, which are made available in an encapsulated user-friendly form – via the so-called Controllers.

For this second release, the developers have brought a number of statistical functions within the scope of CalculationCenter. Some, like mean, median, mode and standard deviation, were already there. To these have been added a number of discrete and continuous distributions: binomial; geometric; hypergeometric; negative binomial; Poisson; normal; Student t; chi-square; F-ratio; beta; Cauchy; exponential; gamma; logistic; log normal; uniform; Weibull.

The toolbar on the opening screen has drop-down menus with the following headings: File; Edit; Calculate; Basic Math; Algebra; Calculus; Lists & Matrices; Graphics; Solvers; Defining Functions; Help. The new statistical tools are to

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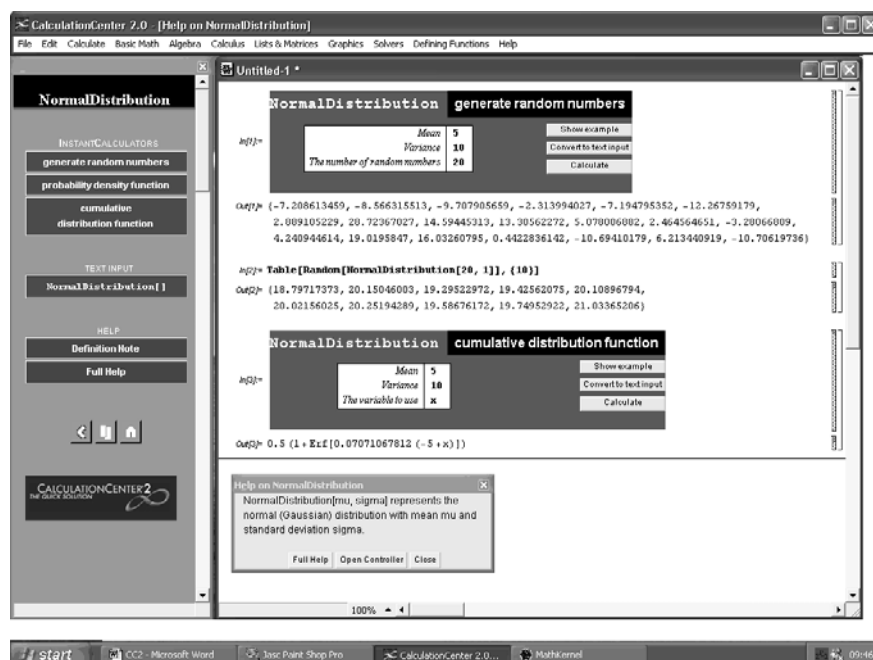


Fig 1: Normal distribution

be found in a sub-menu of Lists & Matrices. Clicking on Normal Distribution opens up a Controller window on the left containing buttons for the following InstantCalculators: generate random numbers; probability density function; cumulative distribution function. There are also help buttons and a button for the direct text input of the NormalDistribution function from Mathematica. Clicking on the first InstantCalculator opens up the box at the top of the notebook in Fig 1.

Beneath the heading, “generate random numbers”, are three buttons, and to the left are three placeholders for entering the mean, the variance and the number of random numbers to be generated. The uninitiated will probably need some help, and the best way forward is to press the topmost button for an example. The placeholders are filled in with 5 for mean, 10 for variance and 20 for the size of the output list. Now press the bottom button to perform the calculation. The InstantCalculator becomes an input, and the output is a list of 20 numbers, all in Mathematica style. If we press the middle button, “convert to text input”, the InstantCalculator is replaced by the command `Table[Random[NormalDistribution[5, 10]], {20}]`, which reveals enough of the syntax for us to try our own example. The simplest way is simply to edit the numerical entries in the above example and then enter it as a Mathematica command – shift enter if running under Windows. It is worth noting that even if the parameters are not changed, the list of random numbers in the output list alters each time the command is run.

Fig 1 also shows the result of running the InstantCalculator for the cumulative distribution function. Of the two help

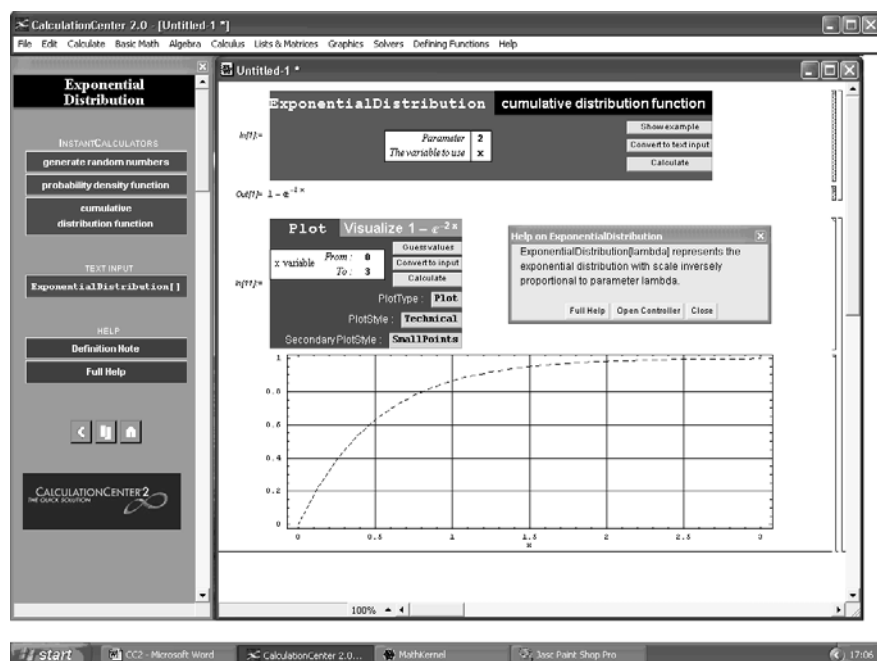
buttons, the first provides a brief description of the NormalDistribution function and its syntax – included in fig.1. The second opens up help pages for this function, related functions and how to put them to use.

An output which is a function – probability distribution or cumulative distribution (CDF) – can be plotted without the need to remember syntax by invoking the SmartPlot facility from the Home Controller. Fig 2 shows the result of using this for the CDF of the Exponential Distribution.

SmartPlot sees this CDF as a function defined for all x , and plots over an appropriate domain, including negative values. Of course, it cannot “know” that in the context of the exponential distribution, negative x makes no sense. The user has to adjust the domain of x , which is very easily performed within the InstantCalculator.

Inequality Plotting

Optimisation with constraints is becoming an ever more important area of applied mathematics. The simplest theory is that of linear programming, for which there are well established algorithms. Non-linear programming is very much more difficult and the available methods are less certain to achieve success. However, for both linear and non-linear problems it is always useful to get a picture of the region of solution space limited by the constraints. A new feature of CalculationCenter is InequalityPlot that enables regions defined by linear or algebraic non-linear inequalities in two variables to be plotted. The InstantCalculator for this is to be found through Graphics in the toolbar. Two examples of InequalityPlots are shown in Fig 3.



The first is a region bounded by two circles and two hyperbolae – use is made of the logical And to combine inequalities. The other puts together a solid circle and a solid rectangle using And and Or – the latter is not mentioned in the help page for InequalityPlot, although it can be found if one follows the sub-menus of Defining Functions on the toolbar.

Fig 2 CDF of the exponential distribution

Other new features

It is suggested in the accompanying literature that a significant number of users of the first release of CalculationCenter had migrated from other technical software including Microsoft Excel. Such a user might well inadvertently enter the Excel formula “=1+ASIN(2)”. An error message is generated, which suggests that the input should be replaced by “1+ArcSin[2]” by pressing a correct button.

The error-correcting capability, mentioned in the earlier review [1], has been extended to spot syntax errors such as entering function arguments in the wrong order. For example if one wanted to append the number 4 to the list {1, 2, 3}, the correct syntax is `Append[{1, 2, 3}, 4]` with output {1, 2, 3, 4}. If, by mistake, the 4 and the list are switched as arguments, the output is an error message suggesting the correct order. However, it is not clear how far this error correction facility extends. For example, inputting `Position[{0, 1, 2, 3, 4}, 3]` with {4} as output, tells us that the number 3 is the fourth element in the list. Reversing the order produces {} as output, which is either logically correct or an error, depending on which version of the help page one consults for Position, as a Mathematica function. Curiously there has been a change of output format for Position: `Position[{0, 1, 2, 3, 1}, 1]` now produces a column as output, visually different, but mathematically equivalent to the old format {{2}, {5}}.

Other improvements, untested by the reviewer, include: Support for document saving when using HTML with MathML 2.0, and recognition of formulas in MathML format and their use as input if supported by the CalculationCenter function set; new import and export formats; speed improvements in functions which sort and group data.

Conclusion

The omission of statistical distribution functions from the first version of CalculationCenter has now been remedied, and this will certainly give the package a wider appeal. I like the InequalityPlot function and the enhanced error-correcting capabilities. I hope that in the next version the developers will consider the bringing forward of more optimisation tools, particularly for linear programming.

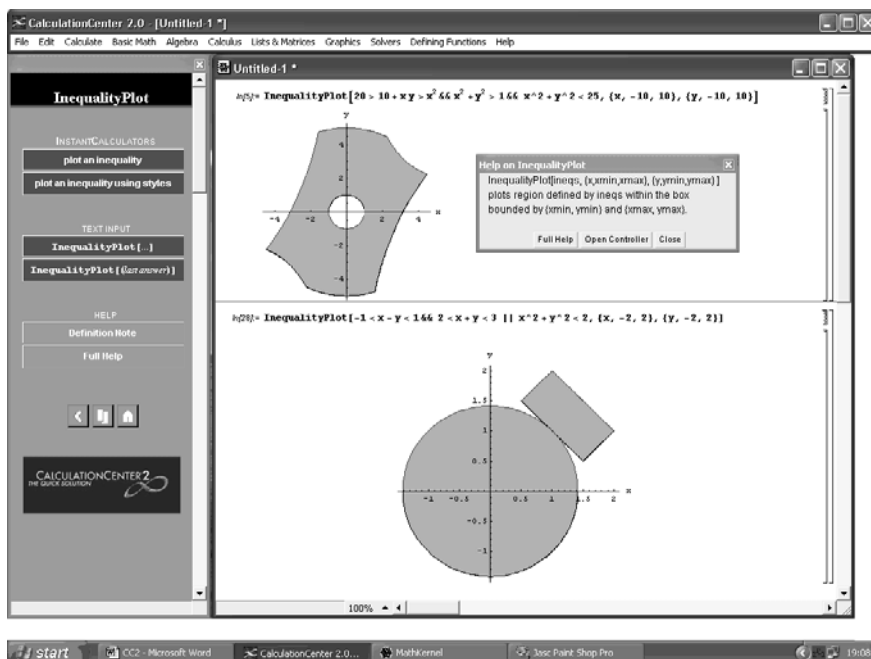


Fig 3: Two InequalityPlots

CalculationCenter offers no serious programming facilities, and this might be thought of as a deficiency in software with a retail price of £260.

References

- [1] N Backhouse, Review of CalculationCenter, *MSOR Connections* 1.3, August 2001

Supplier Comments from Jon McLoone

“Programming capabilities, like several of the features that Dr Backhouse notes are a consequence of our aim to optimize CalculationCenter for quick learning and ease-of-use on smaller problems. CalculationCenter limits itself to defining functions, conditions and automating repetitive steps, rather than burdening the user with study of additional programming constructs. If users need a powerful programming language they are encouraged to consider Mathematica.

It should be noted that, under the new Wolfram Research site programmes, the discounts are valid for most Wolfram Research products. This means that if your institution holds a Mathematica discount agreement, or site license then you may be able to add CalculationCenter for as little as GBP 78 or rent for GBP 42 per year including upgrades and home use.

Our sales people on info@wolfram.co.uk will be happy to tell you if you are covered by a site programme.”