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# Review of Maple 9

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Maple is one of the two surviving big *Computer Algebra Systems* (CAS) in common use for teaching and research in universities and colleges. Mathematically, Maple has been a mature product over several releases. Earlier reviews [1], [2], [3] and [4] speak amply of the recent developments with relevance to the educational scene.

One expects an annual upgrade to the program, reflecting the pressure from the competition as well as the input of those enthusiasts who submit wish lists or hammer away at the elimination of bugs and perceived deficiencies.

The package under review, Maple 9, is the latest release from the recently renamed Canadian company MapleSoft – previously called Waterloo Maple Inc., in recognition of its origins at the University of Waterloo.

Maple 9 is a big package, occupying about 150 Mb of permanent memory, and comes with several thick manuals: Learning Guide; Introductory Programming Guide; Advanced Programming Guide. Further resources are available from the web site [www.maplesoft.com](http://www.maplesoft.com)

The software comes with two interfaces, the Standard Worksheet interface and the so-called Classic Worksheet interface, which uses less memory. During beta-testing, the developers and marketing department were persuaded that it would be unwise to abandon the old interface, and accepted the logic of retaining it, at least for release 9.

As with earlier reviews, I only comment on those enhancements that seem relevant to the teaching of mathematics in undergraduate courses.

## ***New Interface Features***

The new Standard Worksheet interface, which is the future of Maple, provides more flexible formatting with fonts and colours, menu organization, management of sections and free-form sketch regions. If that is of no interest, then be assured that the full functionality of the mathematical engine is available for both interfaces.

In the list of new features for the Standard Worksheet, the one that initially caught my eye was the free-form sketch facility. Under mouse control this allows one to produce quick but crude drawings using a red, blue or black coloured pencil or infilling tool with pastel colours. The emphasis here is on the crude – my attempts at drawing squares and circles or write his name did not impress my 8 year-old son! SketchPad is probably more suited for use with an interactive whiteboard rather than a mouse, and is a facility requiring further development, but worth the effort.

The Help system has been improved and I found the new contents tree structure easy to navigate. So, for example, using the Topic Index from the Help menu, and searching for words starting with 'diff', one is presented with a list of help folders, from which it is easy to find whatever one needs. The earlier help system allowed one to search, but too often one encountered several deadends before finding the required page. Having said that, there are certain inquiries which lead to unintended confusion – see remarks later about the Student package.

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There have also been plotting improvements, resulting from a collaboration with Advance Visual Systems, Inc., who have supplied the plot rendering tool OpenViz. In particular, there is a transparency option with a parameter on a scale from 0 to 1 – this benefit has a trade-off with the color option.

Context-sensitive menus have been a part of Maple from several releases ago – right-click the output of an expression to give a list of routines to manipulate the expression or create a plot. There is now an Operations menu which provides the same information after an expression has been selected.

There is also a Tip of the Day pop-up when Maple is started. Just occasionally one encounters something useful. So I now know that `linalg` has been superseded by `LinearAlgebra`.

### **The Student Package**

The student package was introduced in release 8 – see [3] for an initial reaction – as a set of tools/tutorials for teaching calculus. This package has been renamed as Student. The old package has become a sub-package, and, as `Calculus1`, has been extended. Two new sub-packages, `LinearAlgebra` and `Precalculus`, have been added.

The Student package is aimed directly at the Teaching and Learning community, and, at least in the UK, is relevant to A-level, IB, Scottish Highers and above. It opens up the traditional black-box use of Maple by means of a more helpful tutorial approach, including the working through of some topics/problems in single steps.

In the `Precalculus` sub-package there are interactive tutors to investigate the following topics: lines; tangents; polynomials; rational functions; linear inequalities; compositions of functions; limits; standard functions (trigonometric, hyperbolic, exponential, and their inverses).

For example `PolynomialTutor()`; brings up a dialogue box for the input of a user defined polynomial expression, its graph and real roots. The software decides the domain of the polynomial, there being no user control. The `CompositionTutor` allows one to plot the graph of  $f(x)$ ,  $g(x)$ ,  $f(g(x))$  and  $g(f(x))$ , for selected functions or user defined ones. This is very nice. However, the human tutor will have to be on the alert for anomalies in certain special cases. For example, the discrepancy between the graphs of  $\cos(\arccos(x))$  and  $\arccos(\cos(x))$ . Although that is understandable within the Maple default of

complex numbers, it would make little sense to a precalculus student, or even the majority of early years university students. The `RationFunctionTutor` provides a nice way to visualize quotients of polynomials. There is, however, the frustration of having no control over the range of the variables, and in particular one does not always see all branches of a graph – try

$$(4x^2+2x-1)/(x-2).$$

Having said that, even the main program has difficulty with this function.

Single-stepping through examples is more evident in the other sub-packages. In particular, the `IntTutor` is very much geared up to this approach. For example, the integration of  $(\sin(x))^2$ , yields to a sequence of hint/apply hint requests. In some cases the full application of the sequence exceeds the capacity of the output box, which is frustrating.

This brings me to the help pages for the Student package, which are mixed up. The help page for a component of sub-package X could be within the help pages for that sub-package, but it could be within the help pages of sub-package Y.

### **Summary**

Maple 9 is the best release of this excellent CAS in terms of mathematical coverage and cosmetics. It suffers two problems. It was released too early, before some major issues, revealed during beta testing were addressed. As a CAS, with an international student market, it does not properly engage with the real requirements of the learning and teaching community worldwide. I find the Student package useful in parts in that it provides some interesting pointers for teachers, but it is otherwise rather thrown together.

### **References**

- [1] D Graham, Review of Maple 7, *MSOR Connections*, November 2001
- [2] G Keady, Maplets, *MSOR Connections*, May 2002
- [3] M McCabe, Maple goes GUI with Maplets – A Review of Maple 8, *MSOR Connections*, November 2002
- [4] G Gamble and G Keady, MapleNet and Maplets under Maple 8, *MSOR Connections*, February 2003

**Supplier Comments from Tom Lee Ph.D., Vice President Marketing and Executive Product Director, Maplesoft**

The Maple user community is diverse and spans the spectrum of skill levels and specializations: from high school to leading edge scientific research. Maple 9's feature set and release schedule were determined from assessing all of different and often disparate demands of the Maple community. We receive demands ranging from "more features more often" to "no more changes...I'm perfectly happy". Sometimes it is challenging to reconcile such differing perspectives. Ultimately, we have concluded, based on user feedback, that timely, predictably scheduled releases is the best option. This in combination with addressing user concerns like the ones expressed in Dr. Blackhouse's concluding comments, as quickly as possible, is the best route.

I would also like to draw readers' attention to Maple 9.5, which is now available from Maplesoft's UK partner, Adept Scientific. This latest version, released in May 2004, is notable for its integration of robust numerics with Maple's leading-edge symbolics. Among the new features are integrated algorithms for optimisation problems, solvers for differential-algebraic equation systems, a built-in dictionary of engineering and mathematical terms, new programming and application development features, and a new student multivariate calculus package including computational routines, topic-specific visualisation and interactive tutors. It also offers enhanced support of Maplesoft's MapleNet and Maple T.A. e-learning solutions. Full details of Maple 9.5 are at <http://maple.adeptscience.co.uk>.

## Significant Statistics...*Significance*

**Significance**, launched in 2004, is a new quarterly magazine for anyone interested in statistics and the analysis and interpretation of data. Its aim is to communicate and demonstrate in an entertaining and thought-provoking way the practical use of statistics in all walks of life and to show how statistics benefit society.

Articles are largely non-technical and hence accessible and appealing, not only to members of the profession, but also to all users of statistics. Students and teachers of statistics will find articles of interest in **Significance**, as will people working in central and local government, medicine and healthcare, administration, economics, business and commerce, industry, social studies, survey research, science and the environment. As well as promoting the discipline and covering topics of professional relevance, **Significance** contains a mixture of statistics in the news, case-studies, reviews of existing and newly developing areas of statistics, the application of techniques in practice and problem solving, all with an international flavour.

The first issue of **Significance** includes:

- *Janet Heffernan and Jonathan Tawn* on their experiences of contributing to the High Court Investigation into the sinking of the MV Derbyshire - extreme value statistics played a vital role in solving the mystery surrounding the sinking;
- *David Spiegelhalter and Nicky Best* on the Shipman Enquiry;
- *Angela Dale* on the census, focusing on issues involved in access to data versus the risk of disclosure;
- *Simon Briscoe* on why the Financial Times decided to do a house price index, what the various available measures show, what is in the FT index, and how it will be 5 years until we have a perfect index;
- *Wally Gilks* presenting a personal view of the new science of bioinformatics, and the challenges it presents to statisticians.

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