An introduction to the Xcas interface

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Abstract

This document describes the Xcas software, which combines a computer algebra system, dynamic geometry, and a spreadsheet. It explains how to organize your worksheet. It does not explain in detail the functions and syntax of the Xcas computer algebra system (see the relevant documentation).

1 A first session

To run `xcas` ,

- under Windows
  you must select the xcasen program in the Xcas program group,
- under Linux
  type `xcas` in a terminal (xterm, rxvt, ...), or from a Gnome session, select Xcas in the Education menu,
- under Mac OS X.4, 5
  click on the `xcas` icon in Applications.

You should see a new window with a menubar on the top (the main menubar), a tab, a line with buttons (including a status button) and a large space for this session. The cursor should be in what we call the first level of the session; that is, in the white space at the right of the number 1 just below the session menubar (otherwise click in this white space). Type, for example, `30!` then hit the return key. You should see the answer and a new white space (with a number 2 at the left) ready for another entry. Try a few more operations; e.g., type `1/3+1/6` and hit return, or use the `Graphic` menu, `Curves` then `plotfunc`, etc.

You should now have a session with a few numbered pairs of input/answers, each pair is named a level. The levels created so far are all command lines (a command line is where you type a command following the computer algebra system syntax). Inside Xcas, there are other kinds of levels, the most frequently used being comments, programs, geometry (2-d or 3-d) and spreadsheet levels.

The most important editing operations are:

- Using the main menubar to enter an Xcas function name, for example
  `Cmds->Integer->is_prime`
  A dialog box will appear with short help on the function, some examples and related commands.
- Modifying an existing input field and reevaluating it after it has been modified by hitting the return key.

- Selecting a level or a group of levels with the mouse. Selected level(s) may be moved or erased.
- Using copy-paste, which follows Windows rules (Ctrl-C copy, Ctrl-X cut, Ctrl-V paste) or Linux rules (select with the mouse to copy, paste with the middle mouse button or with the paste button at the bottom).

Online help may be accessed using the main menubar `Help->Index` (short help, click on `Details` for more help inside your browser) and `Help->Manuals`. If you know a function name, you can also type the beginning and hit the tab key (at the left of the Q key on a qwerty keyboard).

You can save your work using the `Save` button or the `File` menu; this menu provides other disk and printing operations.

The software configuration parameters are grouped in three sections: Cas (computer algebra system), Graph (geometry and graphics), and General (everything else). The main menubar `Cfg` items will help you modify the configuration (for the Cas configuration you may also hit the status button, in the middle of the buttons line at the top of the session).

The buttons at the top of the session, just below the tab are:

- at the left, the help button,
- in the middle left, the Save button for quick session saving,
- in the middle, the status button (displaying Config followed by the number of digits, the angle unit, etc.), you can click on it to modify the cas configuration,
- in the middle right, a STOP button to interrupt a computation,
- at the right, a Kbd button that makes a scientific keyboard appear or disappear.
- at the far right, a [x] that closes the session.

In the next sections, we will explain in more detail the capabilities of the Xcas interface: online help, the different kinds of levels, the management of sessions and the configuration.

2 Online help

If you know a command name but want to check the syntax, type the beginning of the command name, then the tab key. This will display the command index, with the current position at the first command after the command name beginning. You get a short description and a few examples displayed. Left-clicking on an example should complete the command line with this example. Right-clicking will fill up the arguments inputlines with the example, so that you can modify some of these arguments before clicking OK. You can get a more detailed help inside your browser by clicking on the Details button (this works for most but not all commands).

If you don't know a command name, you might find it using the menus or browsing the table of contents of the CAS manual. If you know the TI89/TI Nspire CAS or the Maple language, you can also try their command names.

3 Level types

Each session is a numbered collection of levels, each level has a type: command line, comment, expression editor, spreadsheet, program, 2-d or 3-d geometry, or logo-like turtle.

3.1 Command line

If no command line is available, you can get a new one by the `Toolbox->New entry` menu. You can modify existing command lines or write in a new command line. The following shortcuts are available.

- Tab: show completions.
- Enter: parse and evaluate the current command line. You can type Enter while the cursor is at any position. A new command line will be added if it was the last level of the session or if the next level is not a command line.
- Shift-Enter: make a new line in the current command line.
- Ctrl-C: copy the selection to the clipboard.
- Ctrl-V: paste the clipboard contents.
- Ctrl-X: cut and copy the selection to the clipboard.
- Ctrl-U: erase the command line without copying to the clipboard.
- Esc: erase the command line and copy it to the clipboard.
- Ctrl-Z: cancel the last edit command.
- Up and down: move in the current command line if it is a multiline command line.
- PageUp and PageDown: move to the previous or next level.
- Ctrl-Up and Ctrl-Down: replace the selection with the previous or next command that has been validated in a previous command line (history saving mechanism).

When you evaluate a command line, a log output may be displayed (written in blue over white by default), followed by the answer, which might be an expression or a graphic (2-d or 3-d) widget if the answer is a graphic object (for lists, the widget type corresponds to the type of the last evaluated object).

If you do not want to see the answer displayed (for example if you store a large matrix in a variable), just finish your command line with `:;`

3.2 Comments

Comments are inserted using the `Toolbox->New comment` menu. They are by default written in green instead of red over white. Comments are not evaluated when pressing Enter (the effect is to put the cursor to the next level).

3.3 Expression editor

Typing the shortcut `Alt-e` or using the menu `Expression->New expression` will open an expression editor above the current level. The scientific keyboard should automatically appear (press the x button at the top right of the keyboard if you don't want it).

The expression editor lets you enter complex mathematical expression in 2-d like on a paper. For example, suppose you want to enter

$$\left(\frac{x+1}{x+2}\right)\cdot\left(3+\frac{4}{x}\right)^5$$

Open an expression editor (`Alt-e`) then type

- $x + 1$ ↑, this will select $x + 1$
- / (for the division)
- $x + 2$ ↑↑
- * 3 ↑ + 4 ↑ / x
- ↑↑↑ ^ 5

You can now move the selection in the tree of the expression with the arrows keys :

- ↑ moves up one level in the tree, that is select the function or operator with the current selection as argument (it also selects the other arguments of the function/operator),
- ↓ moves down one level in the three, that is select the first argument of the function/operator of the current selection,
- ← or → selects the left or right sibling of the current selection,
- Ctrl-← or Crtl-→ exchanges the current selection with its left or right sibling.

Another example, let's enter

$$\int_0^{+\infty} \frac{1}{1+x^2}$$

Type `Alt-e` to open a new expression editor.

- Use the $\int$ key on the scientific keyboard or `Ctrl-R` on the keyboard to get an indefinite integral.
- Use the `,` key to switch to a definite integral. (To do the reverse operation, you can select each bound and press the backspace key).
- Use ↓ to replace 0 by the function `1/(1+x^2)`.
- Use ↑ and ← to select the upper bound.
- Use the ∞ key on the scientific keyboard to replace the 1.
- Use the Enter key to evaluate the integral.

We now list the other special keys in the expression editor:

- `"`: Outside editor mode (no visible cursor), edit the selection like in a command line, this is especially useful if you want to edit a function name. In editor mode, switch between considering the edit as a string and as a normal edit.
- `,`: if a sequence is selected, add a 0 to the end of the sequence and select it. If the selection is not a sequence, creates a sequence of size 2 with first element the selection, init the second element to 0 and select it. You can move the newly created 0 in the sequence with Ctrl-→ and Ctrl-←.
- `(`: if a sequence is selected, make it the arguments to a user function, the name of the user function is initialized to `f` and selected (type the function name to replace the `f` by your function name). If a vector is selected, it is replaced by a sequence.
- `[`: if a sequence is selected, it is replaced by a vector, if a vector is selected, an indexed vector/matrix position is created where the variable name of the vector/matrix is initialized to `m` and selected (type the matrix/list name to replace `m`).

- Keys in combination with the Ctrl key:
  - Ctrl-A: select All.
  - Ctrl-C: copy the selection to the clipboard (like under windows).
  - Ctrl-V: paste the selection from the clipboard.
  - Ctrl-T: translate the selection to LaTeX and copy it to the clipboard (the translation is also copied to the `Msg` output, click on the `Msg` button to make it visible or hide it).
  - Ctrl-E: evaluate the selection.
  - Ctrl-F: factor the selection.
  - Ctrl-N: apply normal to the selection.
  - Ctrl-P: apply partfrac to the selection.
  - Ctrl-I (or Tab key): completion key (open the position in the index at the function whose name begins the same).
  - Ctrl-R: integral.
  - Ctrl-S: simplify the selection.
  - Ctrl-L: limit.
  - Ctrl-D: derivative.
  - Ctrl-Z: undo.
  - Ctrl-Y: redo.

3.4 Programs

Programs may be written in a command line if they are one or two lines long, but for more complex programs, it is a good idea to put them in a separate program level, using the `Prg->New program` menu. This will open an editor in a new level. Type your program (the `Prg` menu may help you for the syntax of tests, loops, function definition, etc.), and press the `OK` button once completed. If parsing is successful, you can test your program in any command line.

The `Prg` menu has items to open or import an existing (program) file inside the current text, save or export the current program (independently from the worksheet). You can also use the menu to insert programming structures. There are buttons to find the next occurence of a search string, to parse the current program (errors are displayed in the message area) and to save the program (the current filename is displayed at the right of the save button).

The keywords of the language are highlighted. In Xcas programming mode, the tab key may be used for indentation (experimental feature).

Tip: before pressing the `OK` button, check the programming syntax by looking at the status area button in the middle at the top of the session. If you need to change the syntax, hit the status button and select the right syntax.

3.5 Geometry and graphics

A graphic output is made of a 2-d or 3-d scene with controls, it corresponds to a unique command line above it. You can create some examples easily using the `Graphic` menu.

A geometry figure is the display of a 2-d or 3-d graphic scene representing the graphical objects of the command lines that are on its left.

- You can create some geometric objects using the mouse (points, lines, triangles, circles, etc.).

- Alternatively you can enter command lines, with the help of the Geo menu.
- Interactive geometry is implemented by moving points in pointer mode or by moving special objects called parameters or cursors.

3.5.1 Common features

The controls are common to 2-d, 3-d graphics or geometry. You can move left, right, up and down the window, redefine it using coordinates, zoom in and out, pause and restart an animation using the buttons and the `M` menu at the right of the graphic, or using the `Graphic` menu. In 2-d, the coordinates of the mouse are displayed while it is in the graphic area. You can modify the visualization window with the mouse (drag to move, use the scroll button for centered zoom in/out, or select an area with the right mouse button for an area zoom in). In 3-d, you can rotate the representation along the current x, y, z axis with a mouse drag outside of the scene rendering, or by using the x,X, y,Y and z,Z keys (if the focus is in the 3-d scene).

Note that the controls apply only to the visualization, not to the creation of graphic objects. For example, if you create a plot of a function, the discretisation parameters for this plot (e.g. minimal value for x) are fixed and will not change if you move the minimal visualisation value using the controls. You must recreate a graphical object if you did not correctly choose the parameters. For example if you run the command `plot(sin(x))`, the minimal value for computation of x will be the default value (Xmin from the Geo configuration, -10 by default). If you move the minimal value of x for visualization below Xmin, you will not see the plot there. To see the plot below Xmin, you would have to specify something like `plot(sin(x),x=-20..0)` and validate the command line. This limitation does not apply to geometric objects (points, segments, lines and circles) which will always be drawn if they are visible.

An `M` menu is available below the controls (its items are also available from the top `Graphic` menu), it contains items to print and control the screen. You can export a graph to encapsulated postscript and to PNG (you must have the converting tools netpbm or ImageMagic installed, this should be installed by the Xcas installer under Windows. If they are not installed under Linux, run your software installer or open a Terminal and type
`sudo apt-get install imagemagick`
for Debian/Ubuntu distributions or
`sudo yum install imagemagick`
for Fedora-compatible distributions).

Titles and axis legends must be part of the command(s) that generate the graph or geometry window. For example, try this on a command line

```
f(t):=sin(t);title="Graph of f on a period",
   labels=["t","f(t)"],legend=["cm","m"],
      plot(f(t),t=-pi..pi,legend="f")
```

3.5.2 2-d geometry

Use the `Geo->New figure 2d` menu to make a new 2-d geometry session. This will open a new level with a "subsession" (group of command lines) at the left, a 2-d screen in the middle, and the controls at the right. If there are parameters, they will be below the controls at the right. The subsession is a list of command line levels. Evaluation of a command line level will automatically reevaluate all levels below (i.e. with a higher level number), therefore if you use one level to define an object and modify the definition of this object later, all objects depending on this object will be modified. Modification of a level defining a point or a 1-d parameter can be done interactively with the mouse either in the geometry screen or in the parameter area (below the controls).

The geometry level has a mode, which affects how the mouse behaves.

- In all modes, right-clicking (or double-clicking) on an object displays a dialog box so that you can easily modify the object attributes (or delete the object).
- In 2-d frame mode, draging the mouse will move the visualization window and scrolling will zoom in/out.
- In pointer mode, you can move an existing point, push the mouse near the point (when the mouse is near enough, it will show a different cursor) and move the mouse, release it at the new postion.
- In point mode, the mouse can be used to define new points or segments. To define a new point, just click somewhere not near another point or segment. To define a segment, press the mouse button at the beginning, move the mouse, release the mouse at the end of the segment (if you release the mouse out of the screen, the segment will be cancelled).
- You can draw a few more complex object with the mouse using the other modes, like triangles, circles, bisectors, ...
- You may also type Xcas commands (from the Geo menu) in a command line at the left of the graphic. Each command may evaluate to a graphic object and be displayed or to a non graphical object which may be used later in the construction.

To erase a geometrical object, right-click on it, select Delete or select its level in the subsession at the left, and use the `Edit->Delete selected levels` menu or Backspace key.

For example, you can click three points with the mouse (in point mode), this will create 3 levels with definitions for points A,B,C. Then you can make the circle containing A, B, C either by selecting the `Circles->circumcircle` mode and click on A,B,C or by entering in a command line the `circumcircle` command (menu `Geo->Circles->circumcircle`)

```
c:=circumcircle(A,B,C)
```

Remark: how to work with several figures in a tab

When you create objects in a figure with a mouse, the name of the created object is automatically chosen. This name is shared between figures in the same tab so that they don't interfere if you have several figures in the same tab. If you want to copy a part of a figure in another figure, enter in a level of the target figure the instruction `eval([ ],1)` where you put inside the brackets the names of the objects to be copied (e.g. `eval([A,B,AB],1)` will copy A, B and AB from a previous figure to the new figure). If you change the initial figure (where A, etc. were defined), you must reevaluate the instruction in the target figure to reflect the changes (press Enter in the first level of the target figure).

3.5.3 Parameters

Parameters are real values which can move in a fixed interval, e.g. between -5 and +5. The real value may be changed by clicking on arrows below the controls at the right of the geometrical representation. There are two kinds of parameters: formal and numeric parameters. Formal parameters have a formal name which is used in all exact calculations, and a numeric value which is used for all numeric evaluations (including graphical representation of objects depending on the parameter). They can therefore be used to make an analytical proof of a geometric theorem using the CAS engine while displaying a figure. Numeric parameters always evaluate to their numeric value, they

can not be used to make an analytic proof (only to make conjectures like with most interactive geometry software).

To add a new parameter, use the `Geo->Edit->Add parameter` menu. For example, add a level with `f(x):=a*x^2+b*x+c` then define 3 parameters named a, b, c and add the command `plot(f(x))`, then move one of them to see the influence of each parameter on the shape of the parabola. You could also add a level `mini:=solve(diff(f(x),x))` and `M:=point(mini[0],f(mini[0]))` to display the minimum. Note that the coordinates of M are displayed in terms of a and b under the command line defining M at the left. You would have to add a level with `evalf(coordinates(M))` to see the current numeric value.

3.5.4 3-d rendering.

There are several options for 3-d graph rendering that can be configured by clicking on the cfg button. First, you have to choose between intrinsic colors or a scene viewed with 1 to 8 light spots, see below.

Then you can choose the x, y, z range that will be visible. The position of the eye visualizing the scene can be changed by specifying a plane equation (normal to the vision direction). You can also easily change the viewpoint outside of the cfg configuration window either with the mouse (push outside of the parallelepiped, drag the mouse and release it at your option) or with the x,X, y,Y, z,Z keys to rotate around the x, y or z axis.

By using the r key or by selecting `M->3-d->Rotate animation`, you can get a visualization animation by rotation around the origin. By default, it will rotate the viewpoint around the z axis but this is configurable from the `cfg` button. You can configure:

- `Anim`: what will be animated, viewpoint if bit 8 is 1, spot number 7 to 0 if bit 7 to 0 are set to 1. For example, 255 will move all spots leaving the viewpoint unchanged.
- `t`: interval between 2 redrawings.
- `n`: number of steps for a round trip.
- `x`, `y`, `z`: coordinates of the axes.
- `d`: normally 0, may be nonzero if you want also to move the number of images of a programmed animation.

You can specify the axis of rotation in the command line defining the scene by

```
gl_rotation_axis=[x,y,z]
```

where `x,y,z` are the coordinates of the axis of rotation.

Do not confuse visualization animation with programmed animation obtained by instructions like `animate, animate3d, animation`.

3.5.5 3-d spots

If you enable `Lights` in the `cfg` configuration of a 3-d graph, the scene will be rendered by the OpenGL lighting algorithm. You can enable 1 to 8 spots of light, each is configurable (buttons `L0` to `L7`).

Each spot has geometric properties: it may be a positional spot if $w = 1$ or a directional spot if $w = 0$

- A positional spot ($w = 1$) is at position x, y, z and has a direction, defined by `x->, y->, z->`. Light coming from a positional spot may be attenuated, the attenuation may depend on the distance between the spot and the object (with a quadratic, `att0, att1, att2` in the spot configuration), and by the cosine of the angle between the spot direction and the segment spot-object to an exponent (`exp` in the spot configuration). In addition, the spot may light only inside a cone of angle configurable by the `cutoff` value (in degrees, use 180 for no cutoff or a value between 0 and 90). An additional attenuation comes from the cosine of the angle incoming direction-normal to the object, so that zenithal lighting is maximal.

- A directional spot $w = 0$ (emulating e.g. Sun light), does not attenuate (except for the angle between the direction of the spot and the normal). The direction is defined by x, y, z.

Objects from the scene may have their own properties with respect to three kinds of light:

- ambient light, emulating light coming from all directions and diffused in all directions without attenuation,

- diffuse light, emulating light coming from one direction and diffused in all directions with an attenuation factor proportional to the cosine of the angle of the incoming direction and the normal to the object,

- specular light, emulating light coming from one direction and reflected preferentially in the direction symmetric with respect to the normal of the object.

In addition, an object may have intrinsic light, called emission. Each property must be specified for 4 channels: r (red), b (blue) and g (green) for the colors, and a (alpha) for transparency (if you enable `Blending`). Object properties must be specified in their definition (on the command line):

- `gl_material=[gl_front,gl_ambient,[r,g,b,a]]`
  specifies the property for ambient light, use `gl_diffuse`, `gl_specular` or `gl_emission` instead of `gl_ambient` for diffuse, specular or intrinsic light. Default is 0.2 for ambient, 0.8 for diffuse and 0 for emission on r,g,b channels and 1 on alpha channels.

- `gl_material=[gl_front,gl_shininess,n]`
  specifies the exponent n that will be used for specular light. The exponent is that of $\cos(\theta)$, where θ is the angle between reflected incoming light and visualization direction (default is $n = 50$).

- `gl_texture="filename"` specify an image filename that will be mapped on a sphere or a polygon or a parametric defined surface.

Summing up, the formula for light on each channel is :

$$\begin{aligned} l &= o_e + o_a \sum_{j=1}^{8} l_{a,j} + o_s \sum_{j=1}^{8} l_{s,j} \cos(\gamma_j)^S + \\ &\quad + o_d \sum_{j=1}^{8} l_{d,j} \cos(\alpha_j)^{e_j} \cos(\beta_j) \frac{1}{a_{0,j} + a_{1,j} d_j + a_{2,j} d_j^2} \end{aligned}$$

where :

- o_e, o_a, o_d, o_s are the material properties with respect to ambiant, diffuse, specular light, S is the "shininess" (exponent for specular light),

- $l_{a,j}, l_{d,j}, l_{s,j}$ are the properties of spot j for ambiant, diffuse and specular light,
- $a_{0,j}, a_{1,j}, a_{2,j}$ are attenuation coefficients of spot j, replaced by 1,0,0 if $w = 0$ (no attenuation),
- d_j is the distance of spot j to the object,
- α_j is the angle between the direction of spot j and the segment from spot j and the object, except if α_j is greater to the angle of cutoff of spot j ($\alpha_j = \pi/2$), or if $w = 0$ ($\alpha_j = 0$, no attenuation for directionnal light),
- β_j is the angle between the segment spot j-object and the normal to the object (if $w = 0$, replace spot j-object by the spot direction),
- γ_j is the angle between the reflection of the direction of the spot with respect to the normal of the object and the segment's object-eye.

3.5.6 3-d geometry

3-d geometry is based on the same principles as 2-d geometry: a subsession at the left and the representation in the middle. Mouse interaction outside the representation will change the viewpoint, inside the representation it will depend on the mode: draw a point, a segment, ... according to the mouse plane displayed above (all mouse clicks are supposed to refer to this plane, which is perpendicular to the visualisation axis).

3.6 Spreadsheet

Use the `Spreadsheet->new spreadsheet` menu to add a spreadsheet level. You will see a small configuration screen where you can change the number of rows/columns, if an attached graph is displayed, and also a variable name that you can use to get values from command lines outside of the spreadsheet (using the matrix notation, e.g. `a[1,2]` will return the value of the cell at row 2, column 3 in `xcas` syntax mode, or at row 1, column 2 in other syntax modes). You can modify the spreadsheet configuration by clicking on the status line above the cells or with the spreadsheet `File->variable name` menu later). If you have chosen to display the graph inside the spreadsheet configuration, it will dynamically display all cells that evaluate to a graphic object. You may also display all the graphic objects of the spreadsheet in a separate window, either in 2-d or in 3-d by clicking on the 2d or 3d button at the right of the spreadsheet menu.

A cell may contain a fixed value (any valid Xcas object: integers, reals, symbols, algebraic objects, strings, ...) or a formula depending on other cells. The syntax for formulas is the same as for many spreadsheets, begin with an =, then enter an algebraic expression where other cells are represented using a symbol made of the column name (e.g. A) and the row number (e.g. 1). When copying cells, cell dependance in a formula is considered relative unless you write a dollar ($) sign before the column name or row number. You can enter an area instead of a cell name, an area is always a rectangular area, it is made of two cell names separated by `..` representing opposite vertices of the rectangular area.

To enter a new value or formula in a cell, click on the cell, then enter your value or formula with the keyboard. As soon as you type a normal character, the focus will move from the sheet to the command line above the sheet. To help enter formula, you can use the mouse to select a cell or a cell area. Once the value or formula is correct press the enter key to validate it. You can cancel your edit at any time by clicking on a different cell.

To modify a cell value, click on the cell so that the value or formula is displayed in the command line above, then click in the command line, modify it and press Enter.

You can move in the sheet using the mouse or the direction keys, or using the "goto" input value at the topleft of the sheet. Just enter a cell name then enter to move there. If the cell does not exist, the sheet will be enlarged to make it exist. You can also enter an area in the "goto" input value to select this area without the mouse. You must use the "goto" input value to make special selections that are not connected areas, for example `A1..B3,D,F` will "select" the subtable with rows 1 to 3 and columns A, B, D and F. You can copy and paste a rectangular area with the mouse like this: select the rectangular area with the mouse, click on the target cell, click on the command line, type Ctrl-U to erase the previous value then click on the middle button and type enter.

If you want to copy a cell formula to an area of the spreadsheet, press at the right bottom part of the cell (when the mouse is on the correct area of the cell, it will display a different cursor) and move the mouse over the area you want to copy, then release the mouse. You can also copy cells using a menu item in the spreadsheet `Edit` menu, you can either copy to the left, or to the bottom, or to a rectangular area previously selected with the mouse (in this case the cell which was below the mouse when you pressed the button will be copied to the rectangular area).

The spreadsheet can be saved, exported, imported, etc. using the spreadsheet `File` menu. The spreadsheet is also saved as part of the session (but not as a standalone spreadsheet) when you save the whole session. When you load a session, the spreadsheet will not be evaluated automatically, you must reevaluate it with the `reeval` button explicitly (or modify one cell).

Xcas does not provide filters for native binary spreadsheet formats, but you can import spreadsheets from other software or data using copy/paste or by saving them in the CSV (comma separated values) text format: cells values must always be separated by the same character e.g. a comma, and another character should be used to start a new row like a newline. For example, you can select a spreadsheet area inside Open Office and paste it inside Xcas. If you want to import formulas instead of values, use the Tools->Option menu of Open Office, find the spreadsheet Display item and check Formulas. Select the area inside Open Office, then paste at the same upper left cell position inside Xcas. Alternatively you can save the spreadsheet in CSV format inside Open Office with the `File->Save as` menu item, then select CSV in the choosebox below. Then inside Xcas, use the `File->Insert CSV` menu item, select the file, change the separators if Xcas made a bad guess. Note that Xcas must use row notation starting at 1 instead of 0 for Open Office CSV formula import (this is the default).

Click on the status line or select inside the `Edit` menu for configuration and sheet modification operations. Configuration operations should be self-explanatory, except for matrix fill cells : when entering a matrix in the command line, you can choose between two modes, either the matrix will fill a rectangular area of cells, or it will fill only one cell.

The `Stats` menu is useful to make statistical plots in the corresponding graph. When you make a graph using this menu, you will have to select the data area where the statistic function will be applied (e.g. a polygonplot on `A1..B10`) and a target cell. The target cell is a regular cell which was empty and will contain the formula defining the graphic object that will be displayed. If you check the value box, the graph will not change later, but if you don't check the value box and modify one data cell later, the graph will be updated like any cell depending on this data cell would be.

3.7 Logo-like turtle

To add a turtle session, use the `Turtle-> new turtle` menu. A logo level is made of three parts, the graphic display in the middle, a subsession of command lines at the left and an editor at the right. Command lines are executed as in a main session (command lines below an evaluated command are not reevaluated unlike in a geometry session). The editor records all commands.

In a logo level, you can pilot a turtle, giving it orders like forward 10 steps, turn left or right, etc. It will display a trace using a pen with a defined color. You can use any language construction of Xcas to program the turtle's moves. The current language uses French command names (e.g. avance=move forward, etc.), the most important commandnames are available by clicking on the buttonbar below the turtle screen (check that the cursor is on a command line before clicking on the button corresponding to the command you want to enter). Most commands have a default argument (e.g. 10 for avance), if you want to add parameters, do not add parentheses. Logo commands use the same syntax as the `return` statement, if you want to specify priorities, put parenthesis around the command and arguments, like this: `(hasard 10)`.

4 Session management

Xcas may open different sessions, each with its own levels. You can move levels inside a session or copy a level from one session to another session.

To move one level in the session, press the mouse on its level number and release it at the destination. If you want to move some contiguous levels, click on the first level, then shift-click on the last level (that is, click on the mouse while pushing the shift key). You can now move these levels by pressing the mouse in the selected area and releasing it at its destination. You can also copy these levels to another session by Ctrl-C/Ctrl-V or select/middle click.

You can delete the selected levels. You can paste the selected levels elsewhere by clicking with the middle mouse button on another level number. You can merge the selected levels in a single level. You can also group the selected levels in a section and give it a section name, sections may be folded or unfolded.

The `File` menu of a session will let you save/export/load/import a session in/from the current session. The `Session` menu from the top menu will let you insert a new session.

5 Configuration

There are three main categories of configuration: CAS configuration for the computer algebra commands, graphic configuration for the default graphic options when creating a new graph, and general configuration for other configuration items (like colors or browser for help display, etc.). The first one is accessed by the status button in the middle of the buttons line at the top of the session. All configuration items are also accessible using the main `Cfg` menu.

6 Customization

You can alter part of the main menubar by editing a file named `xcasmenu`, either system-wide by the administrator (in the Xcas `doc/en` subdirectory), or only for you (in the directory where you start `xcas`). The same applies to the Examples item, the filename being `xcasex`. The file `keywords` may be used to translate Xcas command names to another language.