

The Format, Syntax, and Semantics of a Maple Worksheet File

MWS Version 6.0

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Abstract

The classic Maple worksheet file, which has extension “.mws”, stores the contents of a worksheet created in the classic Maple graphical user interface (GUI). An mws file is an ASCII file with a hierarchical structure that reflects the structure of the worksheet.

This document describes the format, syntax, and semantics of an mws file. Not all elements are completely described; for some the syntax was too complicated to analyze, for others the semantics could not be discerned.

Release History

Dates are UTC.

- 1.1** (8 Oct 2004 by J. Riel): Initial CVS commit
- 1.2** (13 Oct 2004 by J. Riel): Uploaded to Maple-Expert group for comments
- 1.3** (14 Oct 2004 by J. Riel): Fixed errors and typos
- 1.4** (14 Oct 2004 by J. Riel): Changed tt font. Added info fields to PDF. Added §3.3.1 **Quoted Strings**.
- 1.5** (15 Oct 2004 by J. Riel): Moved subsections to ./syntaxdir files.
- 1.6** (28 Oct 2004 by J. Riel): Moved subsection headers back into main file. Added *<dimen>* field. Changed several *<unknown>* *<dimen>* fields to *<ascent>*; the meaning of that term is unknown but used in the mw-format.
- 1.7** (2 Oct 2004 by J. Riel): Removed incorrect *<dimensions>* field in plot syntax, diagram **19**.

Contents

1	Introduction	3
2	Format	3
2.1	Character Format	3
2.2	End of Line Marker	3
2.3	Line Lengths	3
2.4	White Space	3
3	Syntax and Semantics	4
3.1	Keywords	4
3.2	Notation	5
3.3	Common Terms	5
3.3.1	Quoted Strings	5
3.4	Worksheet	6
3.5	Version	7
3.6	User Style Table	7
3.6.1	Character Style	7
3.6.2	Paragraph Style	8
3.7	Section	10
3.8	Group	10
3.9	Paragraph	10
3.10	Text	10
3.11	Maple Text	11
3.12	Xpp Edit	11
3.13	Xpp Math	11
3.14	Rtable	12
3.15	Rtable Handles	12
3.16	Page-break	12
3.17	Bitmap	12
3.18	Hyperlink	13
3.19	Plot	13
3.19.1	Plot Data	13
3.19.2	Plot Data	13
3.20	Spreadsheet	14
3.20.1	Row Heights and Column Widths	15
3.20.2	Spreadsheet Options	15
3.20.3	Cell	16
3.20.4	Cell Options	16
3.20.5	R5 Math Object	16
3.21	Object	17
3.22	Mark	17
3.23	View Properties	17
3.24	Page Numbers	18

1 Introduction

The classic Maple¹ worksheet file, which has extension “.mws,” stores the contents of a Maple worksheet. The contents of an mws file obey a well-defined syntax. This document describes that syntax and explains, briefly, the meaning of each element. Some of the elements have fields whose purpose I could not discern. Other elements (particularly those that generate output) were too complicated to describe.

So far as I am aware, Maplesoft has not released a description of the internals of an mws file. The information in this document has been determined by inspection and experimentation with the worksheets generated by classic Maple, primarily on a Linux computer. I have attempted to use standard terms for the various elements, however, my choice of nomenclature may not coincide with that used internally by Maplesoft. Undoubtedly there are many errors; if you find any please report them to me and I will update this accordingly.

2 Format

2.1 Character Format

The allowable characters in an mws file are 7-bit ASCII characters. An extended ASCII (8-bit) character in a *<quoted-string>* is represented by an *<octal-constant>*.

2.2 End of Line Marker

The end of line marker (EOLM) in an mws file depends on the system in which the file was created. Unix uses line feed (LF), Macintosh uses carriage return (CR), and Microsoft uses CRLF to designate the end of a line. Maple can read a worksheet created with any of these conventions.

2.3 Line Lengths

The lines in an mws file created by Maple are generally of equal length, 70 characters long, not including the EOLM. There are a few exceptions to this rule.

An EOLM normally follows the *<version>* statement and the *<user-style-table>*. Consequently, the lines on which the end of these statements occur are frequently less than 70 characters.

If the white space that separates syntactical elements in a file occurs at position 69, then the EOLM immediately follows it.

If a white space in a *<quoted-string>* occurs at position 70, then a ‘\+’ is appended to the line, followed by the EOLM. When the file is read by Maple, the ‘\+*<eol>*’ characters are removed.

2.4 White Space

The space character generally separates elements within syntax statements. Extra white space (spaces, tabs, CRs, and LFs) are allowed between elements, however, at least one space character is usually required.

¹Maple is a computer algebra system available from www.maplesoft.com. The current release of Maple (9.5) supports two GUIs: standard and classic. The standard GUI uses an XML-based format for saving worksheets, the classic GUI uses the mws format described here. Both GUIs can read and write both types of files.

3 Syntax and Semantics

An `mws` file consists of a sequence of statements. Each statement has the form `{KEYWORD arg1 arg2 ... argn}`, that is, an opening brace, ‘{’, a keyword in uppercase letters, ‘KEYWORD’, arguments, `arg1 arg2 ... argn`, and a closing brace, ‘}’. White space may be inserted, but is not required, between each statement. The remainder of this document describes, in detail, the syntax for each type of statement permitted in an `mws` file.

3.1 Keywords

Table 1 lists the known keywords and gives the section in which their syntax is described.

Keyword	Section
BITMAP	3.17 Bitmap
CELL	3.20.3 Cell
CELLOPTS	3.20.3 Cell
COLWIDTHS	3.20.1 Row Heights and Column Widths
CSTYLE	3.6.1 Character Style
EXCHG	3.8 Group
GLPLOT2D	3.19 Plot
GLPLOT3D	3.19 Plot
HYPERLNK	3.18 Hyperlink
MARK	3.22 Mark
MPLTEXT	3.11 Maple Text
NAME	3.20 Spreadsheet
OLE	3.21 Object
PAGEBK	3.16 Page-break
PAGENUMBERS	3.24 Page Numbers
PARA	3.9 Paragraph
PLOTDATA	3.19 Plot
PSTYLE	3.6.2 Paragraph Style
R5MATHOBJ	3.20.5 R5 Math Object
ROWHEIGHTS	3.20.1 Row Heights and Column Widths
RTABLE	3.14 Rtable
RTABLE_HANDLES	3.15 Rtable Handles
SECT	3.7 Section
SPREADSHEET	3.20 Spreadsheet
SSOPTS	3.20.2 Spreadsheet Options
TEXT	3.10 Text
URLLINK	3.18 Hyperlink
USTYLETAB	3.6 User Style Table
VERSION	3.5 Version
VIEWOPTS	3.23 View Properties
XPEDIT	3.12 Xpp Edit
XPPMATH	3.13 Xpp Math

Table 1: Known keywords

3.2 Notation

A variant of Backus-Naur format (BNF) notation is used to describe the syntax. Table 2 lists the symbols used to describe the syntax.

\rightarrow	production operator
$\langle symbol \rangle$	a symbol
$\langle symbol \rangle_i$	the subscript i indicates this is the i -th argument.
$\langle symbol \rangle_{i-j}$	the subscript $i - j$ indicates this field consists of arguments i to j .
$?$	suffix indicating symbol is used once or nonce.
$*$	suffix indicating symbol is used none or more times.
$+$	suffix indicating symbol is used one or more times.
$()$	used to group symbols
$[]$	used for character ranges, as in regular expressions.
$' '$	used to quote characters that should appear as typed.
$_$	a single space.

Table 2: BNF notation

3.3 Common Terms

Diagram 1 describes the syntax of terms common to many of the syntax diagrams.

3.3.1 Quoted Strings

This section expands on aspects of a *quoted-string*, described in diagram 1.

A double-quote, `""`, in a quoted-string must be “backslashed”, that is, prepended with a backslash character, `\`. Similarly, a backslash must be backslashed. The open and closed braces, `{` and `}`, should be backslashed; this is not strictly necessary, however, Maple does so when generating an `mws` file.

A carriage return is normally inserted by using the combination `\n`. It may also be inserted with the *octal-constant* `\014` (LF) or `\015` (CR).

The octal-constant `\000` (NULL) should never be inserted. It is used by the ‘C’ language as a string terminator; apparently Maple’s worksheet parser interprets it the same way. The results can be strange.

Other than the characters `\`, `""`, `n`, and the octits ([0-7], a backslash before a character has no effect. The backslash is ignored and the character interpreted literally.

Diagram 1 Definition of common terms

$\langle \text{boolean} \rangle \rightarrow [01]$. (0) false, (1) true. If true, then the action associated with the field name is performed, otherwise it is not performed.

$\langle \text{byte} \rangle \rightarrow$ an integer in the range $[0 - 255]$.

$\langle \text{dimen} \rangle \rightarrow \langle \text{posint} \rangle$. Dimension, usually height, width or ‘‘ ascent ,’’ in hundredths of an inch.

$\langle \text{integer} \rangle \rightarrow$ any integer.

$\langle \text{m-string} \rangle \rightarrow \langle \text{quoted-string} \rangle$. Contains a description of the pretty-printed Maple output. I understand only a fraction of its syntax; not enough to bother documenting here.

$\langle \text{nonnegint} \rangle \rightarrow '0' \mid \langle \text{posint} \rangle$. A nonnegative integer. Include 0.

$\langle \text{octal-constant} \rangle \rightarrow '\'[0-3][0-7][0-7]$. An octal constant counts as one character. See $\langle \text{quoted-string} \rangle$.

$\langle \text{posint} \rangle \rightarrow$ a positive integer. Does not include 0.

$\langle \text{quoted-string} \rangle \rightarrow '\''\langle \text{string} \rangle''$. A string delimited by double quotes. Its value does not include the delimiting quotes. Double quotes in a quoted string are escaped by backslashing. The length of the string (used by some statements) is the displayed length of the string, a backslashed double quote ‘‘\’’ counts as one character. An extended ASCII character is inserted into a quoted string by using an $\langle \text{octal-constant} \rangle$.

$\langle \text{rgb} \rangle \rightarrow \langle \text{byte} \rangle \langle \text{byte} \rangle \langle \text{byte} \rangle$. The three bytes specify the intensity of the red, green, and blue colors, respectively. ‘0’ is fully off, ‘255’ is fully on.

$\langle \text{style-id} \rangle \rightarrow \langle \text{nonnegint} \rangle$. Specifies a character or paragraph style. The built-in styles are in the range $[0 - 200]$, the Maple-supplied but not built-in styles are in the range $[201 - 255]$, user defined styles begin at 256.

$\langle \text{tristate} \rangle \rightarrow [012]$. (0) inherit from $\langle \text{ref-id} \rangle$, (1) yes, (2) no. Also no if $\langle \text{tristate} \rangle$ is 0 and $\langle \text{ref-id} \rangle$ is ‘-1’.

$\langle \text{unknown} \rangle \rightarrow$ This means that I do not know what the field does.

3.4 Worksheet

The $\langle \text{worksheet} \rangle$ statement defines the overall syntax of a Maple worksheet. Diagram 2 describes the syntax of this statement.

Diagram 2 Worksheet syntax

$\langle \text{worksheet} \rangle \rightarrow \langle \text{top-matter} \rangle \langle \text{main-section} \rangle \langle \text{end-matter} \rangle$

$\langle \text{top-matter} \rangle \rightarrow \langle \text{version} \rangle \langle \text{user-style-table} \rangle$

$\langle \text{main-section} \rangle \rightarrow \langle \text{section} \rangle$

$\langle \text{end-matter} \rangle \rightarrow \langle \text{mark} \rangle? \langle \text{view-properties} \rangle? \langle \text{page-numbers} \rangle? (\langle \text{rtable-handles} \rangle \langle \text{rtable} \rangle+)?$

Note that each element of $\langle \text{end-matter} \rangle$ is optional. If $\langle \text{mark} \rangle$ is omitted, the initial cursor position is the first character in the worksheet. Omitting $\langle \text{view-properties} \rangle$ and $\langle \text{page-numbers} \rangle$ appears to cause Maple to open the worksheet with standard defaults.

3.5 Version

The *<version>* statement defines the version of the mws format used in the file. The version of an mws generally does not change with each release of Maple, rather, it changes when new elements are added to the worksheet that require additional syntax. Diagram 3 describes the syntax of this statement.

Diagram 3 Version syntax

<version> → ‘{VERSION_’ *<major>*₁ *<minor>*₂ *<system>*₃ *<version>*₄ ‘}

*<major>*₁ → *<posint>*. Major release of the mws language. Maple checks this field when opening an mws file. If larger than its current version, it issues a warning. If much older it asks whether it should update the worksheet to the newer format.

*<minor>*₂ → *<nonnegint>*. Minor release of the mws language.

*<system>*₃ → *<quoted-string>*. Operating system on which the worksheet was generated. Does not appear to have an effect. The known values are “APPLE_PPC_MAC”, “IBM INTEL LINUX”, “IBM INTEL NT”, and “SUN SPARC SOLARIS”. It is curious that the string for the Macintosh uses underscores while the others uses spaces.

*<version>*₄ → *<quoted-string>*. Generally ‘” *<major>*.*<minor>* ‘”. Does not appear to have an effect.

3.6 User Style Table

The *<user-style-table>* statement defines custom character and paragraph styles for use in the worksheet. Diagram 4 describes the syntax of this statement.

Diagram 4 User style table syntax

<user-style-table> → ‘{USTYLETAB_’ *<character-style>** *<paragraph-style>** ‘}

3.6.1 Character Style

The *<character-style>* statement defines a custom character style. Diagram 5 describes the syntax of this statement.

Diagram 5 Character style syntax

$\langle character-style \rangle \rightarrow \text{'\{CSTYLE_}\langle name \rangle_1 \langle ref-id \rangle_2 \langle char-style-id \rangle_3 \langle family \rangle_4 \langle size-select \rangle_5 \langle size \rangle_6 \langle color \rangle_{7-9} \langle colored \rangle_{10} \langle italic \rangle_{11} \langle bold \rangle_{12} \langle underlined \rangle_{13} \langle unknown \rangle_{14-15} \langle read-only \rangle_{16} \langle line-break \rangle_{17} \langle unknown \rangle_{18} \langle pitch \rangle_{19} \langle executable \rangle_{20} \text{'}}$

$\langle name \rangle_1 \rightarrow \langle quoted-string \rangle$. Name of the character style. If not blank, the name appears in the style selection drop-down list when the worksheet is active.

$\langle ref-id \rangle_2 \rightarrow \text{'-1'} \mid \langle style-id \rangle$. Character style upon which the style is based. If ‘-1’ then this style is not based on another.

$\langle char-style-id \rangle_3 \rightarrow \langle style-id \rangle$. The identification of this character style.

$\langle family \rangle_4 \rightarrow \langle quoted-string \rangle$. Name of the font family.

$\langle size-select \rangle_5 \rightarrow [012]$. Selects the nominal $\langle font-size \rangle$, in points, of the displayed character using $\langle size \rangle_6$ and $\langle ref-id \rangle \langle font-size \rangle$, where $\langle ref-id \rangle \langle font-size \rangle$ is the computed $\langle font-size \rangle$ of $\langle ref-id \rangle$.

$$\langle font-size \rangle \rightarrow \begin{cases} \langle ref-id \rangle \langle font-size \rangle & \langle size-select \rangle = 0, \\ \langle size \rangle & \langle size-select \rangle = 1, \\ ((\langle ref-id \rangle \langle font-size \rangle)(4/3))^{-\langle size \rangle} & \langle size-select \rangle = 2 \text{ and } \langle size \rangle \leq 0, \\ ((\langle ref-id \rangle \langle font-size \rangle)(2/3))^{-1} \langle size \rangle & \langle size-select \rangle = 2 \text{ and } \langle size \rangle > 0. \end{cases}$$

$\langle size \rangle_6 \rightarrow \langle integer \rangle$. Used with $\langle size-select \rangle$ to set $\langle font-size \rangle$.

$\langle color \rangle_{7-9} \rightarrow \langle rgb \rangle$. Specifies the color of the characters.

$\langle colored \rangle_{10} \rightarrow \langle tristate \rangle$. If no, then text is not colored, regardless of $\langle color \rangle_{7-9}$ assignment.

$\langle italic \rangle_{11} \rightarrow \langle tristate \rangle$.

$\langle bold \rangle_{12} \rightarrow \langle tristate \rangle$.

$\langle underlined \rangle_{13} \rightarrow \langle tristate \rangle$.

$\langle unknown \rangle_{14} \rightarrow [02]$. Only values observed.

$\langle unknown \rangle_{15} \rightarrow [0-2]$. Only values observed.

$\langle read-only \rangle_{16} \rightarrow \langle boolean \rangle$. If yes, then text cannot be inserted in this region.

$\langle line-break \rangle_{17} \rightarrow [0-3]$. Determines allowable locations of line breaks: (0) use value from $\langle ref-id \rangle$, (1) at spaces, (2) anywhere, (3) at new lines.

$\langle unknown \rangle_{18} \rightarrow [0-1]$. Only values observed. Seems to affect the pitch.

$\langle pitch \rangle_{19} \rightarrow [0-3]$. Selects the pitch of the font: (0) use value from $\langle ref-id \rangle$, (1) any pitch, (2) variable pitch, (3) fixed pitch.

$\langle executable \rangle_{20} \rightarrow \langle boolean \rangle$. The text is executable. May also be set for hyperlinks.

3.6.2 Paragraph Style

The $\langle paragraph-style \rangle$ statement defines a custom paragraph style. Diagram 6 describes the syntax of this statement.

Diagram 6 Paragraph style syntax

$\langle \text{paragraph-style} \rangle \rightarrow \{ \text{PSTYLE}_{\cdot} \langle \text{name} \rangle_1 \langle \text{ref-id} \rangle_2 \langle \text{para-style-id} \rangle_3 \langle \text{unknown} \rangle_4 \langle \text{char-style} \rangle_5$
 $\langle \text{alignment} \rangle_6 \langle \text{line-spacing} \rangle_7 \langle \text{unknown} \rangle_8$
 $\langle \text{first-indent} \rangle_9 \langle \text{space-above} \rangle_{10} \langle \text{space-below} \rangle_{11}$
 $\langle \text{left-margin-select} \rangle_{12} \langle \text{left-margin} \rangle_{13} \langle \text{right-margin-select} \rangle_{14} \langle \text{right-margin} \rangle_{15}$
 $\langle \text{page-break-before} \rangle_{16} \langle \text{unknown} \rangle_{17} \langle \text{next-style} \rangle_{18} \langle \text{bullet} \rangle_{19} \{ \}$

$\langle \text{name} \rangle_1 \rightarrow \langle \text{quoted-string} \rangle$. The name of the paragraph style. If not blank, the name appears in the style selection drop-down list when the worksheet is active.

$\langle \text{ref-id} \rangle_2 \rightarrow \text{'-1'} \mid \langle \text{style-id} \rangle$. Paragraph style on which this style is based. If ‘-1’ then this style is not based on another.

$\langle \text{para-style-id} \rangle_3 \rightarrow \langle \text{style-id} \rangle$. The identification number of this paragraph style.

$\langle \text{unknown} \rangle_4 \rightarrow [1]$. Only value observed.

$\langle \text{char-style} \rangle_5 \rightarrow \langle \text{character-style} \rangle$. Sets the default character style for the paragraph.

$\langle \text{alignment} \rangle_6 \rightarrow [0-3]$. Sets the alignment of the lines in the paragraph: (0) default, (1) left, (2) right, (3) center.

$\langle \text{line-spacing} \rangle_7 \rightarrow [0-3]$. Sets the spacing between lines in the paragraph: (0) use value from $\langle \text{ref-id} \rangle$, (1) 1, (2) 2, (3) 1.5.

$\langle \text{unknown} \rangle_8 \rightarrow [0]$. Only value observed.

$\langle \text{first-indent} \rangle_9 \rightarrow \langle \text{integer} \rangle$. Number of points to indent first line of paragraph. A negative value creates a hanging indent, however, a value of ‘-1’ means use the value from $\langle \text{ref-id} \rangle$.

$\langle \text{space-above} \rangle_{10} \rightarrow \text{'-1'} \mid \langle \text{nonnegint} \rangle$. Number of points above paragraph. ‘-1’ means use the value from $\langle \text{ref-id} \rangle$.

$\langle \text{space-below} \rangle_{11} \rightarrow \text{'-1'} \mid \langle \text{nonnegint} \rangle$. Number of points above paragraph. ‘-1’ means use the value from $\langle \text{ref-id} \rangle$.

$\langle \text{left-margin-margin-select} \rangle_{12} \rightarrow [0123]$. Selects how the left margin is set: (0) use $\langle \text{left-margin} \rangle$ from $\langle \text{ref-id} \rangle$, (1) no indent, (2) use $\langle \text{left-margin} \rangle$, (3) use $\langle \text{left-margin} \rangle$ (preferred).

$\langle \text{left-margin} \rangle_{13} \rightarrow \langle \text{integer} \rangle$. Amount to indent left margin, in points. A negative value moves margin off worksheet.

$\langle \text{right-margin-margin-select} \rangle_{14} \rightarrow [0123]$. Selects how the right margin is set: (0) use $\langle \text{right-margin} \rangle$ from $\langle \text{ref-id} \rangle$, (1) no indent, (2) use $\langle \text{right-margin} \rangle$, (3) use $\langle \text{right-margin} \rangle$ (preferred).

$\langle \text{right-margin} \rangle_{15} \rightarrow \langle \text{dimen} \rangle$ Amount to indent right margin, in points. A negative value moves margin off worksheet.

$\langle \text{page-break-before} \rangle_{16} \rightarrow [012]$. Start new page immediately before paragraph.

$\langle \text{unknown} \rangle_{17} \rightarrow [02]$. Only values observed.

$\langle \text{next-style} \rangle_{18} \rightarrow \text{'-1'} \mid \langle \text{paragraph-style id} \rangle$. The default style for the following paragraph. If ‘-1’ then use that specified by $\langle \text{ref-id} \rangle$.

$\langle \text{bullet} \rangle_{19} \rightarrow [0235]$. Selects bullet indicator to insert at the start of each line: (0) none, (2) dot, (3) dash, and (5) indent.

3.7 Section

The $\langle section \rangle$ statement provides a hierarchical structure to the contents of a worksheet. It combines subsections, groups, paragraphs and page-breaks into a single block that can be collapsed and expanded in the GUI. Diagram 7 describes the syntax of this statement.

Diagram 7 Section syntax

$$\langle section \rangle \rightarrow \text{'\{SECT_ \langle collapsed \rangle_1 \langle section-elements \rangle^* \text{'}}$$
$$\langle collapsed \rangle_1 \rightarrow \langle boolean \rangle. \text{ Controls whether section is collapsed or expanded.}$$
$$\langle section-element \rangle \rightarrow \langle section \rangle \mid \langle group \rangle \mid \langle paragraph \rangle \mid \langle page-break \rangle.$$

3.8 Group

The $\langle group \rangle$ statement combines a sequence of $\langle paragraph \rangle$ and $\langle page-break \rangle$ statements into a single block. In the Maple GUI, a block of grouped paragraphs is normally indicated by brackets in the left-margin. Diagram 8 describes the syntax of this statement.

Diagram 8 Group syntax

$$\langle group \rangle \rightarrow \text{'\{EXCHG_ \langle group-element \rangle^* \text{'}}$$
$$\langle group-element \rangle \rightarrow \langle paragraph \rangle \mid \langle page-break \rangle$$

3.9 Paragraph

The $\langle paragraph \rangle$ statement groups the various statements that generate output. Diagram 9 describes the syntax of this statement.

Diagram 9 Paragraph syntax

$$\langle paragraph \rangle \rightarrow \text{'\{PARA_ \langle para-style-id \rangle_1 \langle prompt \rangle_2 \langle is-output \rangle_3 \langle bookmark \rangle_4 \langle paragraph-element \rangle^* \text{'}}$$
$$\langle para-style-id \rangle_1 \rightarrow \langle style-id \rangle. \text{ Identifies the paragraph style.}$$
$$\langle prompt \rangle_2 \rightarrow \langle quoted-string \rangle. \text{ Prepended to each line in the paragraph.}$$
$$\langle is-output \rangle_3 \rightarrow \langle boolean \rangle. \text{ True (1) indicates that the paragraph is Maple output. This may be used with } \langle view-properties \rangle \langle show-outputs \rangle \text{ to show or hide the output, however, I have not been able to demonstrate it.}$$
$$\langle bookmark \rangle_4 \rightarrow \langle quoted-string \rangle. \text{ Used by } \langle hyperlink \rangle \text{ to link to a paragraph.}$$
$$\langle paragraph-element \rangle \rightarrow \mid \langle bitmap \rangle \mid \langle hyperlink \rangle \mid \langle maple-text \rangle \mid \langle object \rangle \mid \langle plot \rangle \mid \langle spreadsheet \rangle \mid \langle text \rangle \mid \langle xpp-edit \rangle \mid \langle xpp-math \rangle$$

3.10 Text

The $\langle text \rangle$ statement holds the format and content of text regions of a worksheet. Diagram 10 describes the syntax of this statement.

Diagram 10 Text syntax

$\langle text \rangle \rightarrow \text{'\{TEXT_} \langle char-style-id \rangle_1 \langle length \rangle_2 \langle text-content \rangle_3 \text{'}}$

$\langle char-style-id \rangle_1 \rightarrow \langle style-id \rangle$. Specifies the character style of the output.

$\langle length \rangle_2 \rightarrow \langle nonnegint \rangle$. The number of displayed characters in $\langle text-content \rangle$.

$\langle text-content \rangle_3 \rightarrow \langle quoted-string \rangle$. The displayed text.

3.11 Maple Text

The $\langle maple-text \rangle$ statement inserts an input statement in Maple input format. Diagram 11 describes the syntax of this statement.

Diagram 11 Maple text syntax

$\langle maple-text \rangle \rightarrow \text{'\{MPLTEXT_} \langle executable \rangle_1 \langle char-style-id \rangle_2 \langle length \rangle_3 \langle contents \rangle_4 \text{'}}$

$\langle executable \rangle_1 \rightarrow \langle boolean \rangle$.

$\langle char-style-id \rangle_2 \rightarrow \langle style-id \rangle$. Specifies the character style of the displayed text.

$\langle length \rangle_3 \rightarrow \langle nonnegint \rangle$. The length of $\langle contents \rangle$, not including the delimiting quotes. Each escaped character and octal content is counted as one character.

$\langle contents \rangle_4 \rightarrow \langle quoted-string \rangle$

3.12 Xpp Edit

The $\langle xpp-edit \rangle$ statement inserts an input statement in math notation format. Diagram 12 describes the syntax of this statement.

Diagram 12 Xpp-edit syntax

$\langle xpp-edit \rangle \rightarrow \text{'\{XPPEDIT_} \langle char-style-id \rangle_1 \langle executable \rangle_2 \langle text-content \rangle_3 \langle display-content \rangle_4 \text{'}}$

$\langle char-style-id \rangle_1 \rightarrow \langle style-id \rangle$. Specifies the character style of the displayed text.

$\langle executable \rangle_2 \rightarrow \langle boolean \rangle$. If true, the displayed text is executable.

$\langle text-content \rangle_3 \rightarrow \langle quoted-string \rangle$.

$\langle display-content \rangle_4 \rightarrow \langle m-string \rangle$.

3.13 Xpp Math

The $\langle xpp-math \rangle$ statement inserts an output region in math notation. Diagram 13 describes the syntax of this statement.

Diagram 13 Xpp-math syntax

$\langle xpp-math \rangle \rightarrow \text{'\{XPPMATH_} \langle char-style-id \rangle_1 \langle math-string \rangle_2 \text{'}}$

$\langle char-style-id \rangle_1 \rightarrow \langle style-id \rangle$. Specifies the character style of the output.

$\langle math-string \rangle_2 \rightarrow \langle m-string \rangle$.

3.14 Rtable

The *<rtable>* statement contains the data stored within an rtable. Diagram 14 describes the syntax of this statement.

Diagram 14 Rtable syntax

<rtable> → ‘{RTABLE_} *<data>*₁ ‘}’

*<data>*₁ → *<string>*. Note that *<string>* is not a *<quoted-string>*, there are no delimiting quotes. It is delimited by the closing brace. Braces in *<data>* must be escaped with a backslash, ‘\’.

3.15 Rtable Handles

The *<rtable-handles>* statement contains a handle for each rtable statement in the worksheet. Diagram 15 describes the syntax of this statement.

Diagram 15 Rtable-handles syntax

<rtable-handles> → ‘{RTABLE_HANDLES_} *<handle>*+ ‘}’

<handle> → *<posint>*. There is one handle for each *<rtable>* statement in the worksheet.

3.16 Page-break

The *<page-break>* statement inserts a page-break when the worksheet is printed or converted to L^AT_EX. Diagram 16 describes the syntax of this statement.

Diagram 16 Page-break syntax

<page-break> → ‘{PAGEBK_}’

3.17 Bitmap

The *<bitmap>* statement stores a bitmap image that is displayed in the worksheet. Diagram 17 describes the syntax of this statement.

Diagram 17 Bitmap syntax

<bitmap> → ‘{BITMAP_} *<width>*₁ *<height>*₂ *<ascent>*₃ *<unknown>*₄ *<contents>*₅ ‘}’

*<width>*₁ → *<dimen>*. The width of the displayed image.

*<height>*₂ → *<dimen>*. The height of the displayed image.

*<ascent>*₃ → *<dimen>*. Usually the same as *<height>*. Appears to have no effect.

*<unknown>*₄ → [1].

*<contents>*₅ → *<quoted-string>*. A string encoding of the bitmap image.

3.18 Hyperlink

The $\langle \text{hyperlink} \rangle$ statement inserts a hyperlink into the worksheet. Diagram 18 describes the syntax of this statement.

Diagram 18 Hyperlink syntax

$\langle \text{hyperlink} \rangle \rightarrow \{ \langle \text{hyperlink-keyword} \rangle \text{ ' } \langle \text{hyperlink-style-id} \rangle_1 \langle \text{contents} \rangle_2 \langle \text{link-type} \rangle_3 \langle \text{target} \rangle_4 \langle \text{bookmark} \rangle_5 \}$

$\langle \text{hyperlink-keyword} \rangle \rightarrow$ 'HYPERLNK' | 'URLLINK'. The two keywords, 'HYPERLNK' and 'URLLINK', are synonyms. The former is preferred. If a worksheet is read into Maple, and then saved as an mws file, any 'URLLINK' keywords are converted to 'HYPERLNK' keywords.

$\langle \text{hyperlink-style-id} \rangle_1 \rightarrow$ 17. This corresponds to the character style 'Hyperlink'. Changing this number has no effect on the displayed style of the hyperlink; the worksheet converts the field to 17.

$\langle \text{contents} \rangle_2 \rightarrow$ $\langle \text{quoted-string} \rangle$

$\langle \text{link-type} \rangle_3 \rightarrow$ [1-5]. Designates the type of link: (1) worksheet, (2) help topic, (3) unknown, may not be used, (4) url, (5) definition.

$\langle \text{target} \rangle_4 \rightarrow$ $\langle \text{quoted-string} \rangle$.

$\langle \text{bookmark} \rangle_5 \rightarrow$ $\langle \text{quoted-string} \rangle$. Used with $\langle \text{link-type} \rangle=1$ (worksheet); points to the corresponding $\langle \text{bookmark} \rangle$ of a $\langle \text{paragraph} \rangle$ in the worksheet.

3.19 Plot

The $\langle \text{plot} \rangle$ statement stores the format and data of a Maple plot. Diagram 19 describes the syntax of this statement.

Diagram 19 Plot syntax

$\langle \text{plot} \rangle \rightarrow \{ \text{GLPLOT} \langle \text{dim} \rangle \text{ 'D' } \langle \text{width} \rangle_1 \langle \text{height} \rangle_2 \langle \text{ascent} \rangle_3 \langle \text{plot-data} \rangle_4 \}$

$\langle \text{dim} \rangle \rightarrow$ [23]. Sets the dimension of the plot: (2) two-dimensional, (3) three-dimensional.

$\langle \text{width} \rangle_1 \rightarrow$ $\langle \text{dimen} \rangle$. Width of plot.

$\langle \text{height} \rangle_2 \rightarrow$ $\langle \text{dimen} \rangle$. Height of plot.

$\langle \text{ascent} \rangle_3 \rightarrow$ $\langle \text{dimen} \rangle$. Usually the same as $\langle \text{width} \rangle$.

$\langle \text{plot-data} \rangle_4 \rightarrow$ $\langle \text{plot-data} \rangle$.

3.19.1 Plot Data

3.19.2 Plot Data

The $\langle \text{plot-data} \rangle$ statement stores the data, including assigned plot options, of a Maple plot. Diagram 20 describes the syntax of this statement.

Diagram 20 Plot-data syntax

$\langle plot-data \rangle \rightarrow \text{'\{PLOTDATA_} \langle dim \rangle_1 \langle plot-string \rangle_2 \langle unknown \rangle_3 \langle plot-style \rangle_4 \langle plot-symbol \rangle_5$
 $\langle line-style \rangle_6 \langle symbol-size \rangle_7 \langle thickness \rangle_8 \langle grid-style \rangle_9 \langle shading \rangle_{10} \langle light-model \rangle_{11} \langle axes \rangle_{12}$
 $\langle scaling \rangle_{13} \langle projection \rangle_{14} \langle phi \rangle_{15} \langle theta \rangle_{16} \langle unknown \rangle_{17} \langle show-legend \rangle_{18} \langle legend \rangle_{19} \text{'\}'}$

$\langle dim \rangle_1 \rightarrow [23]$. Sets the dimension of the data: (2) two-dimensional, (3) three-dimensional.

$\langle plot-string \rangle_2 \rightarrow \langle quoted-string \rangle$

$\langle unknown \rangle_3 \rightarrow [1]$.

$\langle plot-style \rangle_4 \rightarrow [1-7]$. (1) hidden, (2) patch, (3) patch no grid, (4) patch contour, (5) point, (6) line, (7) wireframe.

$\langle plot-symbol \rangle_5 \rightarrow [0-5]$. (0) default, (1) cross, (2) diamond, (3) box, (4) circle, (5) point.

$\langle line-style \rangle_6 \rightarrow [1-4]$. (1) solid, (2) dot, (3) dash, (4) dot-dash.

$\langle symbol-size \rangle_7 \rightarrow \langle posint \rangle$. Size of $\langle plot-symbol \rangle$, in points.

$\langle thickness \rangle_8 \rightarrow \langle nonnegint \rangle$. Thickness of plot. 0 is the default. 15 appears to be the maximum; above that the thickness of the line does not increase monotonically.

$\langle grid-style \rangle_9 \rightarrow [12]$. (1) triangular, (2) rectangular.

$\langle shading \rangle_{10} \rightarrow [0-59]$. (0) default, (1) xyz, (2) xy, (3) z, (4) z-hue, (5) z-grayscale, (9) none.

$\langle light-model \rangle_{11} \rightarrow [1-6]$. (1) none, (3) light1, (4) light2, (5) light3, (6) light4.

$\langle axes \rangle_{12} \rightarrow [1-4]$. (1) none, (2) boxed, (3) framed, (4) normal.

$\langle scaling \rangle_{13} \rightarrow [12]$. (1) constrained, (2) unconstrained.

$\langle projection \rangle_{14} \rightarrow \langle float \rangle$, in the range $[0, 1]$. Used if $\langle dim \rangle = 3$. Specifies the perspective: 0 is a wide-angle, 1 is orthogonal.

$\langle phi \rangle_{15} \rightarrow \langle float \rangle$. Used if $\langle dim \rangle = 3$. Specifies the azimuth of the projection, in degrees.

$\langle theta \rangle_{16} \rightarrow \langle float \rangle$. Used if $\langle dim \rangle = 3$. Specifies the colatitude of the projection, in degrees.

$\langle unknown \rangle_{17} \rightarrow [0]$.

$\langle show-legend \rangle_{18} \rightarrow \langle boolean \rangle$. (0) hide legend, (1) show legend.

$\langle legend \rangle_{19} \rightarrow \langle quoted-string \rangle$.

3.20 Spreadsheet

The $\langle spreadsheet \rangle$ statement describes the characteristics of a spreadsheet in a worksheet. Diagram 21 describes the syntax of this statement.

Diagram 21 Spreadsheet syntax

$\langle spreadsheet \rangle \rightarrow \{ \text{SPREADSHEET}__ \}$

$\langle ss-name \rangle_1 \langle row-heights \rangle_2 \langle col-widths \rangle_3 \langle ss-opts \rangle_4$
 $\langle table-width \rangle_5 \langle table-height \rangle_6 \langle table-ascent \rangle_7 \langle cell \rangle^* \{ \}$

$\langle ss-name \rangle_1 \rightarrow \{ \text{NAME}__ \langle name \rangle \}$ Specifies the name of the spreadsheet. This is the ‘ssid’ value used in the Spread package.

$\langle name \rangle \rightarrow \langle \text{quoted-string} \rangle$. The name of the spreadsheet corresponds to the identifier (ssid) used to access a spreadsheet in the Spread package.

$\langle row-heights \rangle_2 \rightarrow \langle \text{row-heights} \rangle$. Specifies the height of each row in the spreadsheet.

$\langle col-widths \rangle_3 \rightarrow \langle \text{col-widths} \rangle$. Specifies the width of each column in the spreadsheet.

$\langle ss-opts \rangle_4 \rightarrow \langle \text{ss-opts} \rangle$. Specifies the defaults for all the cell in the spreadsheet. Also controls the display of the border.

$\langle table-width \rangle_5 \rightarrow \langle \text{dimen} \rangle$. Width of spreadsheet.

$\langle table-height \rangle_6 \rightarrow \langle \text{dimen} \rangle$. Height of spreadsheet.

$\langle table-ascent \rangle_7 \rightarrow \langle \text{dimen} \rangle$. I do not know what this does; possibly it only has an affect in the standard GUI.

$\langle cell \rangle \rightarrow \langle \text{cell} \rangle$. Each non-empty cell in the spreadsheet is defined here.

3.20.1 Row Heights and Column Widths

The $\langle \text{row-heights} \rangle$ and $\langle \text{col-widths} \rangle$ statements specify the heights and widths of the cells in a spreadsheet. Diagram 22 describes the syntax of these statements.

Diagram 22 Row heights and column widths syntax

$\langle row-heights \rangle \rightarrow \{ \text{ROWHEIGHTS}__ \langle pair \rangle_{1-2+} \}$

$\langle col-widths \rangle \rightarrow \{ \text{COLWIDTHS}__ \langle pair \rangle_{1-2+} \}$

$\langle pair \rangle_{1-2} \rightarrow \langle \text{index} \rangle \langle \text{dimen} \rangle$.

$\langle \text{index} \rangle \rightarrow \langle \text{posint} \rangle$. An index to either a row or column of a cell. The index of the first row or column is 1.

$\langle \text{dimen} \rangle \rightarrow \langle \text{posint} \rangle$. Specifies the length of a dimension (height or width). Units are hundredths of an inch.

3.20.2 Spreadsheet Options

The $\langle \text{ss-opts} \rangle$ statement specifies the defaults for all the cells in the spreadsheet. It also controls the display of the border of the spreadsheet. Diagram 23 describes the syntax of this statement.

Diagram 23 Spreadsheet options syntax

$\langle ss-opts \rangle \rightarrow \{ \text{SSOPTS}__ \langle cell-options \rangle_1 \langle \text{show-border} \rangle_2 \}$

$\langle cell-options \rangle_1 \rightarrow \langle \text{cell-options} \rangle$.

$\langle \text{show-border} \rangle_2 \rightarrow \langle \text{boolean} \rangle$.

3.20.3 Cell

A $\langle cell \rangle$ statement specifies the format and content of a particular cell in a spreadsheet. Diagram 24 describes the syntax of this statement.

Diagram 24 Cell syntax

$\langle cell \rangle \rightarrow \text{'\{CELL_} \langle row \rangle_1 \langle col \rangle_2 \langle cell\text{-options} \rangle_3 \langle cell\text{-content} \rangle_4 \langle unknown \rangle_5 \text{'}}$

$\langle row \rangle_1 \rightarrow \langle index \rangle$. Index to row of cell.

$\langle col \rangle_2 \rightarrow \langle index \rangle$. Index to column of cell.

$\langle cell\text{-options} \rangle_3 \rightarrow \langle cell\text{-options} \rangle$.

$\langle cell\text{-content} \rangle_4 \rightarrow \langle r5\text{-math-object} \rangle$. The content of the cell. See diagram 26.

$\langle unknown \rangle_5 \rightarrow \langle boolean \rangle$.

3.20.4 Cell Options

The $\langle cell\text{-options} \rangle$ statement specifies the formatting options for the cells in a worksheet. Diagram 25 describes the syntax of this statement.

Diagram 25 Cell options syntax

$\langle cell\text{-options} \rangle \rightarrow \text{'\{CELLOPTS_} \langle alignment \rangle_1 \langle digits \rangle_2 \langle decimals \rangle_3 \langle eval \rangle_4 \langle colored \rangle_5 \langle color \rangle_{6-8} \text{'}}$

$\langle alignment \rangle_1 \rightarrow [0-3]$. Specifies the alignment of the contents of the cell: (0) use default, (1) left, (2) center, (3) right.

$\langle digits \rangle_2 \rightarrow \text{'-1'} \mid \langle posint \rangle$. Specifies digits used during calculation. If ‘-1’ then use default, otherwise use $\langle posint \rangle$.

$\langle decimals \rangle_3 \rightarrow \text{'-1'} \mid \langle posint \rangle$. Specifies the maximum number of digits to display to the right of the decimal point. If ‘-1’ then use default, otherwise use $\langle posint \rangle$.

$\langle eval \rangle_4 \rightarrow [012]$. Specifies how a cell is evaluated: (0) use default, (1) floating point, (2) symbolic.

$\langle colored \rangle_5 \rightarrow \langle boolean \rangle$. If false, use the default color from the table.

$\langle color \rangle_{6-8} \rightarrow \langle rgb \rangle$. Sets background color. These fields may operate slightly differently between the classic and standard GUIs. In the classic GUI when these fields are set to either ‘0 0 0’ or ‘255 255 255’ the cell background color is the default background color set by the window manager.

3.20.5 R5 Math Object

The $\langle r5\text{-math-object} \rangle$ statement holds the maple object that is stored in each non-empty cell of a spreadsheet. Diagram 26 describes the syntax of this statement.

Diagram 26 R5-math-object syntax

$\langle r5\text{-math-object} \rangle \rightarrow \text{'\{R5MATHOBJ_'} \langle text \rangle_1 \langle char\text{-style-id} \rangle_2 \langle math\text{-string} \rangle_3 \text{'}$

$\langle text \rangle_1 \rightarrow \langle \textit>quoted\text{-string} \rangle$.

$\langle char\text{-style-id} \rangle_2 \rightarrow \langle \textit>style\text{-id} \rangle$. Specifies the character style of the output.

$\langle math\text{-string} \rangle_3 \rightarrow \langle \textit>m\text{-string} \rangle$. The 2D math notation of $\langle text \rangle$.

3.21 Object

In Windows systems, the $\langle \textit>object \rangle$ statement can be used to insert an ActiveX object, specifically, an object-linking-and-embedding (OLE). Diagram 27 describes the syntax of this statement.

Diagram 27 Object syntax

$\langle object \rangle \rightarrow \text{'\{OLE_'} \langle display \rangle_1 \langle size \rangle_2 \langle unknown \rangle_3 \langle contents \rangle_4 \text{'}$

$\langle display \rangle_1 \rightarrow [14]$. Selects how image is displayed in the worksheet: (1) show image, (4) show icon.

$\langle size \rangle_2 \rightarrow \langle \textit>nonnegint} \rangle$. Roughly the size of the embedded object, in bytes.

$\langle unknown \rangle_3 \rightarrow [1]$. Only value observed—though not many were observed.

$\langle contents \rangle_4 \rightarrow \langle \textit>quoted\text{-string} \rangle$. The contents of the object.

3.22 Mark

The $\langle \textit>mark \rangle$ statement records the cursor position in the worksheet. When the worksheet is opened, the cursor returns to the mark. Diagram 28 describes the syntax of this statement.

Diagram 28 Mark syntax

$\langle mark \rangle \rightarrow \text{'\{MARK_'} \langle block\text{-selection} \rangle_1 \langle position\text{-in-string} \rangle_2 \text{'}$

$\langle block\text{-selection} \rangle_1 \rightarrow \text{'"'} \langle block\text{-number} \rangle (\text{'_'} \langle block\text{-number} \rangle)^* \text{'"}$. Each $\langle block\text{-number} \rangle$ corresponds to a $\langle \textit>section\text{-element} \rangle$ (see diagram 7). Numbering starts from 0. The left-most $\langle block\text{-number} \rangle$ is the top-most element in the hierarchy. For example, "1 0" calls out the 0-th sub-element of the 1-th element. The $\langle \textit>main\text{-section} \rangle$ in $\langle \textit>worksheet} \rangle$ is not counted.

$\langle block\text{-number} \rangle \rightarrow \langle \textit>nonnegint} \rangle$. See $\langle block\text{-selection} \rangle$

$\langle position\text{-in-string} \rangle_2 \rightarrow \langle \textit>nonnegint} \rangle$. Position in selected text. 0 puts the cursor to the left of the first character of the string.

3.23 View Properties

The $\langle \textit>view\text{-properties} \rangle$ statement controls the display of features of the worksheet. Its fields select the displaying of section and group ranges, invisible characters, input and output regions, plots, spreadsheets, and graphics. It also sets the zoom factor. Diagram 29 describes the syntax of this statement.

Diagram 29 View-Properties syntax

$\langle view-properties \rangle \rightarrow \text{'\{VIEWOPTS_}$
 $\langle show-section-ranges \rangle_1 \langle show-group-ranges \rangle_2 \langle show-invisible-characters \rangle_3$
 $\langle zoom-fraction \rangle_{4-5} \langle zoom-menu \rangle_6 \langle show-spreadsheets \rangle_7 \langle show-inputs \rangle_8 \langle show-outputs \rangle_9$
 $\langle show-graphics \rangle_{10} \text{'}'$

$\langle show-section-ranges \rangle_1 \rightarrow \langle boolean \rangle$.
 $\langle show-group-ranges \rangle_2 \rightarrow \langle boolean \rangle$.
 $\langle show-invisible-characters \rangle_3 \rightarrow \langle boolean \rangle$
 $\langle zoom-fraction \rangle_{4-5} \rightarrow \langle zoom-num \rangle_4 \langle zoom-denom \rangle_5$. The fraction $\langle zoom-num \rangle / \langle zoom-denom \rangle$ is the zoom factor when the worksheet is opened.
 $\langle zoom-num \rangle_4 \rightarrow \langle posint \rangle$. Numerator of $\langle zoom-fraction \rangle$.
 $\langle zoom-denom \rangle_5 \rightarrow \langle posint \rangle$. Denominator of $\langle zoom-fraction \rangle$.
 $\langle zoom-menu \rangle_6 \rightarrow \text{'180'[1-7]}$. The final digit corresponds to the seven selections in the zoom menu. This field does not appear to affect the worksheet; the zoom factor is set by $\langle zoom-fraction \rangle_{4-5}$.
 $\langle show-spreadsheets \rangle_7 \rightarrow \langle boolean \rangle$.
 $\langle show-inputs \rangle_8 \rightarrow \langle boolean \rangle$.
 $\langle show-outputs \rangle_9 \rightarrow \langle boolean \rangle$.
 $\langle show-graphics \rangle_{10} \rightarrow \langle boolean \rangle$.

3.24 Page Numbers

The $\langle page-numbers \rangle$ statement controls the properties of page numbers, which are added to each page of a worksheet when it is printed or converted to a \LaTeX file. The numbers do not appear in the GUI. Diagram 30 describes the syntax of this statement.

Diagram 30 Page-numbers syntax

$\langle page-numbers \rangle \rightarrow \text{'\{PAGENUMBERS_}$
 $\langle enabled \rangle_1 \langle vertical-location \rangle_2 \langle horizontal-location \rangle_3 \langle number-style \rangle_4 \langle first-number \rangle_5$
 $\langle begin-initial-page \rangle_6 \text{'}'$

$\langle enabled \rangle_1 \rightarrow \langle boolean \rangle$. If true (1), print page numbers.
 $\langle vertical-location \rangle_2 \rightarrow [01]$. Set the vertical location of the page number: (0) top of page, (1) bottom of page.
 $\langle horizontal-location \rangle_3 \rightarrow [012]$. Set the horizontal location of the page number: (0) left of page, (1) center of page, (2) right of page.
 $\langle number-style \rangle_4 \rightarrow \langle style-id \rangle$. Specifies the character style of the page number.
 $\langle first-number \rangle_5 \rightarrow \langle posint \rangle$.
 $\langle begin-initial-page \rangle_6 \rightarrow \langle boolean \rangle$. If true, print the page number of the initial page.
