Hemlock Command Implementor's Manual

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Abstract

This document describes how to write commands for the Hemlock text editor, as of version M3.0. Hemlock is a customizable, extensible text editor whose initial command set closely resembles that of ITS/TOPS-20 Emacs. Hemlock is written in the CMU Common Lisp implementation of Common Lisp and has been ported to other implementations.

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Chapter 1

Introduction

Hemlock is a text editor which follows in the tradition of editors such as EMACS and the Lisp Machine editor ZWEI. In its basic form, Hemlock has almost the same command set as EMACS, and similar features such as multiple buffers and windows, extended commands, and built in documentation.

Both user extensions and the original commands are written in Lisp, therefore a command implementor will have a working knowledge of this language. Users not familiar with Lisp need not despair however. Many users of Multics EMACS, another text editor written in Lisp, came to learn Lisp simply for the purpose of writing their own editor extensions, and found, to their surprise, that it was really pretty easy to write simple commands.

This document describes the Common Lisp functions, macros and data structures that are used to implement new commands. The basic editor consists of a set of Lisp utility functions for manipulating buffers and the other data structures of the editor as well as handling the display. All user level commands are written in terms of these functions. To find out how to define commands see chapter 7.

Chapter 2

Representation of Text

2.1. Lines

In Hemlock all text is in some *line*. Text is broken into lines wherever it contains a newline character; newline characters are never stored, but are assumed to exist between every pair of lines. The implicit newline character is treated as a single character by the text primitives.

linep *line* [*Function*]
This function returns **t** if *line* is a **line** object, otherwise **nil**.

line-string *line* [*Function*]
Given a *line*, this function returns as a simple string the characters in the line. This is **setf**'able to set the **line-string** to any string that does not contain newline characters. It is an error to destructively modify the result of **line-string** or to destructively modify any string after the **line-string** of some line has been set to that string.

line-previous *line* [*Function*]
line-next *line* [*Function*]
Given a *line*, **line-previous** returns the previous line or **nil** if there is no previous line. Similarly, **line-next** returns the line following *line* or **nil**.

line-buffer *line* [*Function*]
This function returns the buffer which contains this *line*. Since a line may not be associated with any buffer, in which case **line-buffer** returns **nil**.

line-length *line* [*Function*]
This function returns the number of characters in the *line*. This excludes the newline character at the end.

line-character *line index* [*Function*]
This function returns the character at position *index* within *line*. It is an error for *index* to be greater than the length of the line or less than zero. If *index* is equal to the length of the line, this returns a **#\newline** character.

line-plist *line* [*Function*]
This function returns the property-list for *line*. **setf**, **getf**, **putf** and **remf** can be used to change properties. This is typically used in conjunction with **line-signature** to cache information about the line's contents.

line-signature *line* [*Function*]

This function returns an object that serves as a signature for a *line*'s contents. It is guaranteed that any modification of text on the line will result in the signature changing so that it is not **eql** to any previous value. The signature may change even when the text remains unmodified, but this does not happen often.

2.2. Marks

A mark indicates a specific position within the text represented by a line and a character position within that line. Although a mark is sometimes loosely referred to as pointing to some character, it in fact points between characters. If the **charpos** is zero, the previous character is the newline character separating the previous line from the mark's **line**. If the charpos is equal to the number of characters in the line, the next character is the newline character separating the current line from the next. If the mark's line has no previous line, a mark with **charpos** of zero has no previous character; if the mark's line has no next line, a mark with **charpos** equal to the length of the line has no next character.

This section discusses the very basic operations involving marks, but a lot of Hemlock programming is built on altering some text at a mark. For more extended uses of marks see chapter 4.

2.2.1. Kinds of Marks

A mark may have one of two lifetimes: *temporary* or *permanent*. Permanent marks remain valid after arbitrary operations on the text; temporary marks do not. Temporary marks are used because less bookkeeping overhead is involved in their creation and use. If a temporary mark is used after the text it points to has been modified results will be unpredictable. Permanent marks continue to point between the same two characters regardless of insertions and deletions made before or after them.

There are two different kinds of permanent marks which differ only in their behavior when text is inserted *at the position of the mark*; text is inserted to the left of a *left-inserting* mark and to the right of *right-inserting* mark.

2.2.2. Mark Functions

markp *mark* [*Function*]

This function returns **t** if *mark* is a **mark** object, otherwise **nil**.

mark-line *mark* [*Function*]

This function returns the line to which *mark* points.

mark-charpos *mark* [*Function*]

This function returns the character position of the character after *mark*. If *mark*'s line has no next line, this returns the length of the line as usual; however, there is actually is no character after the mark.

mark-kind *mark* [*Function*]

This function returns one of **:right-inserting**, **:left-inserting** or **:temporary** depending on the mark's kind. A corresponding **setf** form changes the mark's kind.

previous-character *mark* [*Function*]
next-character *mark* [*Function*]

This function returns the character immediately before (after) the position of the *mark*, or **nil** if there is no previous (next) character. These characters may be set with **setf** when they exist; the **setf** methods

for these forms signal errors when there is no previous or next character.

2.2.3. Making Marks

mark *line charpos* **&optional** *kind* [*Function*]

This function returns a mark object that points to the *charpos*'th character of the *line*. *Kind* is the kind of mark to create, one of **:temporary**, **:left-inserting**, or **:right-inserting**. The default is **:temporary**.

copy-mark *mark* **&optional** *kind* [*Function*]

This function returns a new mark pointing to the same position and of the same kind, or of kind *kind* if it is supplied.

delete-mark *mark* [*Function*]

This function deletes *mark*. Delete any permanent marks when you are finished using it.

with-mark (**(***mark pos* [*kind*]**)**)***** {*form*}* [*Macro*]

This macro binds to each variable *mark* a mark of kind *kind*, which defaults to **:temporary**, pointing to the same position as the mark *pos*. On exit from the scope the mark is deleted. The value of the last *form* is the value returned.

2.2.4. Moving Marks

These functions destructively modify marks to point to new positions. Other sections of this document describe mark moving routines specific to higher level text forms than characters and lines, such as words, sentences, paragraphs, Lisp forms, etc.

move-to-position *mark charpos* **&optional** *line* [*Function*]

This function changes the *mark* to point to the given character position on the line *line*. *Line* defaults to *mark*'s line.

move-mark *mark new-position* [*Function*]

This function moves *mark* to the same position as the mark *new-position* and returns it.

line-start *mark* **&optional** *line* [*Function*]
line-end *mark* **&optional** *line* [*Function*]

This function changes *mark* to point to the beginning or the end of *line* and returns it. *Line* defaults to *mark*'s line.

buffer-start *mark* **&optional** *buffer* [*Function*]
buffer-end *mark* **&optional** *buffer* [*Function*]

These functions change *mark* to point to the beginning or end of *buffer*, which defaults to the buffer *mark* currently points into. If *buffer* is unsupplied, then it is an error for *mark* to be disassociated from any buffer.

mark-before *mark* [*Function*]
mark-after *mark* [*Function*]

These functions change *mark* to point one character before or after the current position. If there is no character before/after the current position, then they return **nil** and leave *mark* unmodified.

character-offset *mark n* [*Function*]

This function changes *mark* to point *n* characters after (*n* before if *n* is negative) the current position. If there are less than *n* characters after (before) the *mark*, then this returns **nil** and *mark* is unmodified.

line-offset *mark n* **&optional** *charpos* [*Function*]

This function changes *mark* to point *n* lines after (*n* before if *n* is negative) the current position. The character position of the resulting mark is

(min (line-length *resulting-line***) (mark-charpos** *mark***))**

if *charpos* is unspecified, or

(min (line-length *resulting-line***)** *charpos***)**

if it is. As with **character-offset**, if there are not *n* lines then **nil** is returned and *mark* is not modified.

2.3. Regions

A region is simply a pair of marks: a starting mark and an ending mark. The text in a region consists of the characters following the starting mark and preceding the ending mark (keep in mind that a mark points between characters on a line, not at them).

By modifying the starting or ending mark in a region it is possible to produce regions with a start and end which are out of order or even in different buffers. The use of such regions is undefined and may result in arbitrarily bad behavior.

2.3.1. Region Functions

region *start end* [*Function*]

This function returns a region constructed from the marks *start* and *end*. It is an error for the marks to point to non-contiguous lines or for *start* to come after *end*.

regionp *region* [*Function*]

This function returns **t** if *region* is a **region** object, otherwise **nil**.

make-empty-region [*Function*]

This function returns a region with start and end marks pointing to the start of one empty line. The start mark is a **:right-inserting** mark, and the end is a **:left-inserting** mark.

copy-region *region* [*Function*]

This function returns a region containing a copy of the text in the specified *region*. The resulting region is completely disjoint from *region* with respect to data references -- marks, lines, text, etc.

region-to-string *region* [*Function*]
string-to-region *string* [*Function*]

These functions coerce regions to Lisp strings and vice versa. Within the string, lines are delimited by newline characters.

line-to-region *line* [*Function*]

This function returns a region containing all the characters on *line*. The first mark is `:right-inserting` and the last is `:left-inserting`.

region-start *region* [*Function*]
region-end *region* [*Function*]

This function returns the start or end mark of *region*.

region-bounds *region* [*Function*]

This function returns as multiple-values the starting and ending marks of *region*.

set-region-bounds *region start end* [*Function*]

This function sets the start and end of region to *start* and *end*. It is an error for *start* to be after or in a different buffer from *end*.

count-lines *region* [*Function*]

This function returns the number of lines in the *region*, first and last lines inclusive. A newline is associated with the line it follows, thus a region containing some number of non-newline characters followed by one newline is one line, but if a newline were added at the beginning, it would be two lines.

count-characters *region* [*Function*]

This function returns the number of characters in a given *region*. This counts line breaks as one character.

check-region-query-size *region* [*Function*]
Region Query Size (initial value 30) [Hemlock *Variable*]

check-region-query-size counts the lines in *region*, and if their number exceeds the Region Query Size threshold, it prompts the user for confirmation. This should be used in commands that perform destructive operations and are not undoable. If the user responds negatively, then this signals an editor-error, aborting whatever command was in progress.

Chapter 3

Buffers

A buffer is an environment within Hemlock consisting of:

1. A name.
2. A piece of text.
3. A current focus of attention, the point.
4. An associated file (optional).
5. A write protect flag.
6. Some variables (page 23).
7. Some key bindings (page 28).
8. Some collection of modes (page 33).
9. Some windows in which it is displayed (page 39).
10. A list of modeline fields (optional).

3.1. The Current Buffer

current-buffer [*Function*]
Set Buffer Hook [Hemlock *Variable*]
After Set Buffer Hook [Hemlock *Variable*]

current-buffer returns the current buffer object. Usually this is the buffer that **current-window** (page 39) is displaying. This value may be changed with **setf**, and the **setf** method invokes Set Buffer Hook before the change occurs with the new value. After the change occurs, the method invokes After Set Buffer Hook with the old value.

current-point [*Function*]

This function returns the **buffer-point** of the current buffer. This is such a common idiom in commands that it is defined despite its trivial implementation.

current-mark [*Function*]
pop-buffer-mark [*Function*]
push-buffer-mark *mark* **&optional** *activate-region* [*Function*]

current-mark returns the top of the current buffer's mark stack. There always is at least one mark at the beginning of the buffer's region, and all marks returned are right-inserting.

pop-buffer-mark pops the current buffer's mark stack, returning the mark. If the stack becomes

empty, this pushes a new mark on the stack pointing to the buffer's start. This always deactivates the current region (see section 4.4).

push-buffer-mark pushes *mark* into the current buffer's mark stack, ensuring that the mark is right-inserting. If *mark* does not point into the current buffer, this signals an error. Optionally, the current region is made active, but this never deactivates the current region (see section 4.4). *Mark* is returned.

buffer-list [*Variable*]

This variable holds a list of all the buffer objects made with **make-buffer**.

buffer-names [*Variable*]

This variable holds a **string-table** (page 67) of all the names of the buffers in ***buffer-list***. The values of the entries are the corresponding buffer objects.

buffer-history [*Variable*]

This is a list of buffer objects ordered from those most recently selected to those selected farthest in the past. When someone makes a buffer, an element of Make Buffer Hook adds this buffer to the end of this list. When someone deletes a buffer, an element of Delete Buffer Hook removes the buffer from this list. Each buffer occurs in this list exactly once, but it never contains the ***echo-area-buffer***.

change-to-buffer *buffer* [*Function*]

This switches to *buffer* in the **current-window** maintaining **buffer-history**.

previous-buffer [*Function*]

This returns the first buffer from ***buffer-history*** that is not the **current-buffer**. If none can be found, then this returns **nil**.

3.2. Buffer Functions

make-buffer *name* **&key :modes :modeline-fields :delete-hook** [*Function*]
Make Buffer Hook [Hemlock *Variable*]
Default Modeline Fields [Hemlock *Variable*]

make-buffer creates and returns a buffer with the given *name*. If a buffer named *name* already exists, **nil** is returned. *Modes* is a list of modes which should be in effect in the buffer, major mode first, followed by any minor modes. If this is omitted then the buffer is created with the list of modes contained in Default Modes (page 33). *Modeline-fields* is a list of modeline-field objects (see section 3.3) which may be **nil**. **delete-hook** is a list of delete hooks specific to this buffer, and **delete-buffer** invokes these along with Delete Buffer Hook.

Buffers created with **make-buffer** are entered into the list ***buffer-list***, and their names are inserted into the string-table ***buffer-names***. When a buffer is created the hook Make Buffer Hook is invoked with the new buffer.

bufferp *buffer* [*Function*]

Returns **t** if *buffer* is a **buffer** object, otherwise **nil**.

buffer-name *buffer* [*Function*]
Buffer Name Hook [Hemlock *Variable*]

buffer-name returns the name, which is a string, of the given *buffer*. The corresponding **setf** form invokes Buffer Name Hook with *buffer* and the new name and then sets the buffer's name. When the user supplies a name for which a buffer already exists, the **setf** method signals an error.

buffer-region *buffer* [*Function*]

Returns the *buffer*'s region. This can be set with **setf**. Note, this returns the region that contains all the text in a buffer, not the **current-region** (page 19).

buffer-pathname *buffer* [*Function*]
Buffer Pathname Hook [Hemlock *Variable*]

buffer-pathname returns the pathname of the file associated with the given *buffer*, or nil if it has no associated file. This is the truename of the file as of the most recent time it was read or written. There is a **setf** form to change the pathname. When the pathname is changed the hook Buffer Pathname Hook is invoked with the buffer and new value.

buffer-write-date *buffer* [*Function*]

Returns the write date for the file associated with the buffer in universal time format. When this the **buffer-pathname** is set, use **setf** to set this to the corresponding write date, or to **nil** if the date is unknown or there is no file.

buffer-point *buffer* [*Function*]

Returns the mark which is the current location within *buffer*. To move the point, use **move-mark** or **move-to-position** (page 5) rather than setting **buffer-point** with **setf**.

buffer-mark *buffer* [*Function*]

This function returns the top of *buffer*'s mark stack. There always is at least one mark at the beginning of *buffer*'s region, and all marks returned are right-inserting.

buffer-start-mark *buffer* [*Function*]
buffer-end-mark *buffer* [*Function*]

These functions return the start and end marks of *buffer*'s region:

```
(buffer-start-mark buffer)  <==>
  (region-start (buffer-region buffer))
and
(buffer-end-mark buffer)  <==>
  (region-end (buffer-region buffer))
```

buffer-writable *buffer* [*Function*]

This function returns **t** if the *buffer* can be altered, **nil** if it can't. There is a **setf** form to change this value. If a buffer is not writable, then any attempt to modify text in the buffer results in an error.

buffer-modified *buffer* [*Function*]
Buffer Modified Hook [Hemlock *Variable*]

buffer-modified returns **t** if the *buffer* has been modified, **nil** if it hasn't. This attribute is set whenever a text-altering operation is performed on a buffer. There is a **setf** form to change this value.

Buffer Modified Hook is invoked with the buffer whenever the value of the modified flag changes.

with-writable-buffer (*buffer*) **&rest** *forms* [*Macro*]
This macro executes *forms* with *buffer*'s writable status set. After *forms* execute, this resets the *buffer*'s writable and modified status.

buffer-signature *buffer* [*Function*]
This function returns an arbitrary number which reflects the buffer's current *signature*. The result is **eql** to a previous result if and only if the buffer has not been modified between the calls.

buffer-variables *buffer* [*Function*]
This function returns a string-table (page 67) containing the names of the buffer's local variables. See chapter 6.

buffer-modes *buffer* [*Function*]
This function returns the list of the names of the modes active in *buffer*. The major mode is first, followed by any minor modes. See chapter 8.

buffer-windows *buffer* [*Function*]
This function returns the list of all the windows in which the buffer may be displayed. This list may include windows which are not currently visible. See page 39 for a discussion of windows.

buffer-delete-hook *buffer* [*Function*]
This function returns the list of buffer specific functions **delete-buffer** invokes when deleting a buffer. This is **setf**'able.

delete-buffer *buffer* [*Function*]
Delete Buffer Hook [Hemlock *Variable*]
delete-buffer removes *buffer* from ***buffer-list*** (page 10) and its name from ***buffer-names*** (page 10). Before *buffer* is deleted, this invokes the functions on *buffer* returned by **buffer-delete-hook** and those found in Delete Buffer Hook. If *buffer* is the **current-buffer**, or if it is displayed in any windows, then this function signals an error.

delete-buffer-if-possible *buffer* [*Function*]
This uses **delete-buffer** to delete *buffer* if at all possible. If *buffer* is the **current-buffer**, then this sets the **current-buffer** to the first distinct buffer in **buffer-history**. If *buffer* is displayed in any windows, then this makes each window display the same distinct buffer.

3.3. Modelines

A Buffer may specify a modeline, a line of text which is displayed across the bottom of a window to indicate status information. Modelines are described as a list of **modeline-field** objects which have individual update functions and are optionally fixed-width. These have an **eql** name for convenience in referencing and updating, but the name must be unique for all created modeline-field objects. When creating a modeline-field with a specified width, the result of the update function is either truncated or padded on the right to meet the constraint. All modeline-field functions must return simple strings with standard characters, and these take a buffer and a window as arguments. Modeline-field objects are typically shared amongst, or aliased by, different buffers' modeline fields lists. These lists are unique allowing fields to behave the same wherever they occur, but different buffers may display these fields in different arrangements.

Whenever one of the following changes occurs, all of a buffer's modeline fields are updated:

- A buffer's major mode is set.
- One of a buffer's minor modes is turned on or off.
- A buffer is renamed.
- A buffer's pathname changes.
- A buffer's modified status changes.
- A window's buffer is changed.

The policy is that whenever one of these changes occurs, it is guaranteed that the modeline will be updated before the next trip through redisplay. Furthermore, since the system cannot know what modeline-field objects the user has added whose update functions rely on these values, or how he has changed Default Modeline Fields, we must update all the fields. When any but the last occurs, the modeline-field update function is invoked once for each window into the buffer. When a window's buffer changes, each modeline-field update function is invoked once; other windows' modeline fields should not be affected due to a given window's buffer changing.

The user should note that modelines can be updated at any time, so update functions should be careful to avoid needless delays (for example, waiting for a local area network to determine information).

make-modeline-field &key :name :width :function [*Function*]
modeline-field-p *modeline-field* [*Function*]
modeline-field-name *modeline-field* [*Function*]

make-modeline-field returns a modeline-field object with *name*, *width*, and *function*. *Width* defaults to **nil** meaning that the field is variable width; otherwise, the programmer must supply this as a positive integer. *Function* must take a buffer and window as arguments and return a **simple-string** containing only standard characters. If *name* already names a modeline-field object, then this signals an error.

modeline-field-name returns the name field of a modeline-field object. If this is set with **setf**, and the new name already names a modeline-field, then the **setf** method signals an error.

modeline-field-p returns **t** or **nil**, depending on whether its argument is a **modeline-field** object.

modeline-field *name* [*Function*]

This returns the modeline-field object named *name*. If none exists, this returns nil.

modeline-field-function *modeline-field* [*Function*]

Returns the function called when updating the *modeline-field*. When this is set with **setf**, the **setf** method updates *modeline-field* for all windows on all buffers that contain the given field, so the next trip through redisplay will reflect the change. All modeline-field functions must return simple strings with standard characters, and they take a buffer and a window as arguments.

modeline-field-width *modeline-field* [*Function*]

Returns the width to which *modeline-field* is constrained, or **nil** indicating that it is variable width. When this is set with **setf**, the **setf** method updates all modeline-fields for all windows on all buffers that contain the given field, so the next trip through redisplay will reflect the change. All the fields for any such modeline display must be updated, which is not the case when setting a modeline-field's function.

buffer-modeline-fields *buffer* [*Function*]

Returns a copy of the list of *buffer*'s modeline-field objects. This list can be destructively modified without affecting display of *buffer*'s modeline, but modifying any particular field's components (for example, width or function) causes the changes to be reflected the next trip through redisplay in every modeline display that uses the modified modeline-field. When this is set with **setf**, **update-modeline-fields** is called for each window into *buffer*.

buffer-modeline-field-p *buffer field* [*Function*]

If *field*, a modeline-field or the name of one, is in buffer's list of modeline-field objects, it is returned; otherwise, this returns nil.

update-modeline-fields *buffer window* [*Function*]

This invokes each modeline-field object's function from *buffer*'s list, passing *buffer* and *window*. The results are collected regarding each modeline-field object's width as appropriate, and the window is marked so the next trip through redisplay will reflect the changes. If window does not display modelines, then no computation occurs.

update-modeline-field *buffer window field-or-name* [*Function*

This invokes the modeline-field object's function for *field-or-name*, which is a modeline-field object or the name of one for *buffer*. This passes *buffer* and *window* to the update function. The result is applied to the *window*'s modeline display using the modeline-field object's width, and the window is marked so the next trip through redisplay will reflect the changes. If the window does not display modelines, then no computation occurs. If *field-or-name* is not found in *buffer*'s list of modeline-field objects, then this signals an error. See **buffer-modeline-field-p** above.

Chapter 4

Altering and Searching Text

4.1. Altering Text

A note on marks and text alteration: `:temporary` marks are invalid after any change has been made to the text the mark points to; it is an error to use a temporary mark after such a change has been made. If text is deleted which has permanent marks pointing into it then they are left pointing to the position where the text was.

`insert-character` *mark character* [*Function*]
`insert-string` *mark string* [*Function*]
`insert-region` *mark region* [*Function*]

Inserts *character*, *string* or *region* at *mark*. **`insert-character`** signals an error if *character* is not **`string-char-p`**. If *string* or *region* is empty, and *mark* is in some buffer, then Hemlock leaves **`buffer-modified`** of *mark*'s buffer unaffected.

`ninsert-region` *mark region* [*Function*]

Like **`insert-region`**, inserts the *region* at the *mark*'s position, destroying the source region. This must be used with caution, since if anyone else can refer to the source region bad things will happen. In particular, one should make sure the region is not linked into any existing buffer. If *region* is empty, and *mark* is in some buffer, then Hemlock leaves **`buffer-modified`** of *mark*'s buffer unaffected.

`delete-characters` *mark n* [*Function*]

This deletes *n* characters after the *mark* (or *-n* before if *n* is negative). If *n* characters after (or *-n* before) the *mark* do not exist, then this returns **`nil`**; otherwise, it returns **`t`**. If *n* is zero, and *mark* is in some buffer, then Hemlock leaves **`buffer-modified`** of *mark*'s buffer unaffected.

`delete-region` *region* [*Function*]

This deletes *region*. This is faster than **`delete-and-save-region`** (below) because no lines are copied. If *region* is empty and contained in some buffer's **`buffer-region`**, then Hemlock leaves **`buffer-modified`** of the buffer unaffected.

`delete-and-save-region` *region* [*Function*]

This deletes *region* and returns a region containing the original *region*'s text. If *region* is empty and contained in some buffer's **`buffer-region`**, then Hemlock leaves **`buffer-modified`** of the buffer unaffected. In this case, this returns a distinct empty region.

filter-region *function region* [*Function*]

Destructively modifies *region* by replacing the text of each line with the result of the application of *function* to a string containing that text. *Function* must obey the following restrictions:

1. The argument may not be destructively modified.
2. The return value may not contain newline characters.
3. The return value may not be destructively modified after it is returned from *function*.

The strings are passed in order, and are always simple strings.

Using this function, a region could be uppercased by doing:

```
(filter-region #'string-upcase region)
```

4.2. Text Predicates

start-line-p *mark* [*Function*]

Returns **t** if the *mark* points before the first character in a line, **nil** otherwise.

end-line-p *mark* [*Function*]

Returns **t** if the *mark* points after the last character in a line and before the newline, **nil** otherwise.

empty-line-p *mark* [*Function*]

Return **t** of the line which *mark* points to contains no characters.

blank-line-p *line* [*Function*]

Returns **t** if *line* contains only characters with a Whitespace attribute of 1. See chapter 9 for discussion of character attributes.

blank-before-p *mark* [*Function*]
blank-after-p *mark* [*Function*]

These functions test if all the characters preceding or following *mark* on the line it is on have a Whitespace attribute of **1**.

same-line-p *mark1 mark2* [*Function*]

Returns **t** if *mark1* and *mark2* point to the same line, or **nil** otherwise; That is,

```
(same-line-p a b) <==> (eq (mark-line a) (mark-line b))
```

mark< *mark1 mark2* [*Function*]
mark<= *mark1 mark2* [*Function*]
mark= *mark1 mark2* [*Function*]
mark/= *mark1 mark2* [*Function*]
mark>= *mark1 mark2* [*Function*]
mark> *mark1 mark2* [*Function*]

These predicates test the relative ordering of two marks in a piece of text, that is a mark is **mark>** another if it points to a position after it. If the marks point into different, non-connected pieces of text, such as different buffers, then it is an error to test their ordering; for such marks **mark=** is always false and **mark/=** is always true.

line< *line1 line2* [*Function*]
line<= *line1 line2* [*Function*]
line>= *line1 line2* [*Function*]
line> *line1 line2* [*Function*]
These predicates test the ordering of *line1* and *line2*. If the lines are in unconnected pieces of text it is an error to test their ordering.

lines-related *line1 line2* [*Function*]
This function returns **t** if *line1* and *line2* are in the same piece of text, or **nil** otherwise.

first-line-p *mark* [*Function*]
last-line-p *mark* [*Function*]
first-line-p returns **t** if there is no line before the line *mark* is on, and **nil** otherwise. *Last-line-p* similarly tests tests whether there is no line after *mark*.

4.3. Kill Ring

kill-ring [*Variable*]
This is a ring (see section 16.2) of regions deleted from buffers. Some commands save affected regions on the kill ring before performing modifications. You should consider making the command undoable (see section 16.3), but this is a simple way of achieving a less satisfactory means for the user to recover.

kill-region *region current-type* [*Function*]
This kills *region* saving it in ***kill-ring***. *Current-type* is either **:kill-forward** or **:kill-backward**. When the **last-command-type** (page 31) is one of these, this adds *region* to the beginning or end, respectively, of the top of ***kill-ring***. The result of calling this is undoable using the command Undo (see the *Hemlock User's Manual*). This sets **last-command-type** to *current-type*, and it interacts with **kill-characters**.

kill-characters *mark count* [*Function*]
Character Deletion Threshold (initial value 5) [Hemlock *Variable*]
kill-characters kills *count* characters after *mark* if *count* is positive, otherwise before *mark* if *count* is negative. When *count* is greater than or equal to Character Deletion Threshold, the killed characters are saved on ***kill-ring***. This may be called multiple times contiguously (that is, without **last-command-type** (page 31) being set) to accumulate an effective count for purposes of comparison with the threshold.

This sets **last-command-type**, and it interacts with **kill-region**. When this adds a new region to ***kill-ring***, it sets **last-command-type** to **:kill-forward** (if *count* is positive) or **:kill-backward** (if *count* is negative). When **last-command-type** is **:kill-forward** or **:kill-backward**, this adds the killed characters to the beginning (if *count* is negative) or the end (if *count* is positive) of the top of ***kill-ring***, and it sets **last-command-type** as if it added a new region to ***kill-ring***. When the kill ring is unaffected, this sets **last-command-type** to **:char-kill-forward** or **:char-kill-backward** depending on whether *count* is positive or negative, respectively.

This returns mark if it deletes characters. If there are not *count* characters in the appropriate direction, this returns nil.

4.4. Active Regions

Every buffer has a mark stack (page 9) and a mark known as the point where most text altering nominally occurs. Between the top of the mark stack, the `current-mark`, and the `current-buffer`'s point, the `current-point`, is what is known as the `current-region`. Certain commands signal errors when the user tries to operate on the `current-region` without its having been activated. If the user turns off this feature, then the `current-region` is effectively always active.

When writing a command that marks a region of text, the programmer should make sure to activate the region. This typically occurs naturally from the primitives that you use to mark regions, but sometimes you must explicitly activate the region. These commands should be written this way, so they do not require the user to separately mark an area and then activate it. Commands that modify regions do not have to worry about deactivating the region since modifying a buffer automatically deactivates the region. Commands that insert text often activate the region ephemerally; that is, the region is active for the immediately following command, allowing the user wants to delete the region inserted, fill it, or whatever.

Once a marking command makes the region active, it remains active until:

- a command uses the region,
- a command modifies the buffer,
- a command changes the current window or buffer,
- a command signals an editor-error,
- or the user types **C-g**.

Active Regions Enabled (initial value `t`) [Hemlock *Variable*]
: When this variable is non-`nil`, some primitives signal an editor-error if the region is not active. This may be set to `nil` for more traditional Emacs region semantics.

`*ephemerally-active-command-types*` [*Variable*]
: This is a list of command types (see section 7.3), and its initial value is the list of `:ephemerally-active` and `:unkill`. When the previous command's type is one of these, the `current-region` is active for the currently executing command only, regardless of whether it does something to deactivate the region. However, the current command may activate the region for future commands. `:ephemerally-active` is a default command type that may be used to ephemerally activate the region, and `:unkill` is the type used by two commands, Un-kill and Rotate Kill Ring (what users typically think of as **C-y** and **M-y**).

`activate-region` [*Function*]
: This makes the `current-region` active.

`deactivate-region` [*Function*]
: After invoking this the `current-region` is no longer active.

`region-active-p` [*Function*]
: Returns whether the `current-region` is active, including ephemerally. This ignores Active Regions Enabled.

check-region-active [*Function*]
This signals an editor-error when active regions are enabled, and the **current-region** is not active.

current-region &optional *error-if-not-active deactivate-region* [*Function*]
This returns a region formed with **current-mark** and **current-point**, optionally signaling an editor-error if the current region is not active. *Error-if-not-active* defaults to **t**. Each call returns a distinct region object. Depending on *deactivate-region* (defaults to **t**), fetching the current region deactivates it. Hemlock primitives are free to modify text regardless of whether the region is active, so a command that checks for this can deactivate the region whenever it is convenient.

4.5. Searching and Replacing

Before using any of these functions to do a character search, look at character attributes (page 35). They provide a facility similar to the syntax table in real EMACS. Syntax tables are a powerful, general, and efficient mechanism for assigning meanings to characters in various modes.

search-char-code-limit [*Constant*]
An exclusive upper limit for the char-code of characters given to the searching functions. The result of searches for characters with a char-code greater than or equal to this limit is ill-defined, but it is *not* an error to do such searches. Bits and font are always ignored.

new-search-pattern *kind direction pattern* **&optional** *result-search-pattern* [*Function*]
Returns a *search-pattern* object which can be given to the **find-pattern** and **replace-pattern** functions. A search-pattern is a specification of a particular sort of search to do. *direction* is either **:forward** or **:backward**, indicating the direction to search in. *kind* specifies the kind of search pattern to make, and *pattern* is a thing which specifies what to search for.

The interpretation of *pattern* depends on the *kind* of pattern being made. Currently defined kinds of search pattern are:

:string-insensitive
Does a case-insensitive string search, *pattern* being the string to search for.

:string-sensitive
Does a case-sensitive string search for *pattern*.

:character Finds an occurrence of the character *pattern*. This is case sensitive.

:not-character
Find a character which is not the character *pattern*.

:test Finds a character which satisfies the function *pattern*. This function may not be applied an any particular fashion, so it should depend only on what its argument is, and should have no side-effects.

:test-not Similar to as **:test**, except it finds a character that fails the test.

:any Finds a character that is in the string *pattern*.

:not-any Finds a character that is not in the string *pattern*.

result-search-pattern, if supplied, is a search-pattern to destructively modify to produce the new pattern. Where reasonable this should be supplied, since some kinds of search patterns may involve large data structures.

search-pattern-p *search-pattern* [*Function*]

Returns **t** if *search-pattern* is a **search-pattern** object, otherwise **nil**.

get-search-pattern *string direction* [*Function*]

last-search-pattern [*Variable*]

last-search-string [*Variable*]

get-search-pattern interfaces to a default search string and pattern that search and replacing commands can use. These commands then share a default when prompting for what to search or replace, and save on consing a search pattern each time they execute. This uses Default Search Kind (see the *Hemlock User's Manual*) when updating the pattern object. This returns the pattern, so you probably don't need to refer to ***last-search-pattern***, but ***last-search-string*** is useful when prompting.

find-pattern *mark search-pattern* [*Function*]

Find the next match of *search-pattern* starting at *mark*. If a match is found then *mark* is altered to point before the matched text and the number of characters matched is returned. If no match is found then **nil** is returned and *mark* is not modified.

replace-pattern *mark search-pattern replacement* **&optional** *n* [*Function*]

Replace *n* matches of *search-pattern* with the string *replacement* starting at *mark*. If *n* is **nil** (the default) then replace all matches. A mark pointing before the last replacement done is returned.

Chapter 5

The Current Environment

5.1. Different Scopes

In Hemlock the values of *variables* (page 23), *key-bindings* (page 28) and *character-attributes* (page 35) may depend on the **current-buffer** (page 9) and the modes active in it. There are three possible scopes for Hemlock values:

buffer local	The value is present only if the buffer it is local to is the **current-buffer**.
mode local	The value is present only when the mode it is local to is active in the **current-buffer**.
global	The value is always present unless shadowed by a buffer or mode local value.

5.2. Shadowing

It is possible for there to be a conflict between different values for the same thing in different scopes. For example, there be might a global binding for a given variable and also a local binding in the current buffer. Whenever there is a conflict shadowing occurs, permitting only one of the values to be visible in the current environment.

The process of resolving such a conflict can be described as a search down a list of places where the value might be defined, returning the first value found. The order for the search is as follows:

1. Local values in the current buffer.
2. Mode local values in the minor modes of the current buffer, in order from the highest precedence mode to the lowest precedence mode. The order of minor modes with equal precedences is undefined.
3. Mode local values in the current buffer's major mode.
4. Global values.

Chapter 6

Hemlock Variables

Hemlock implements a system of variables separate from the normal Lisp variables; this is done for the following reasons.

1. Hemlock has different scope rules which are useful in an editor. Hemlock variables can be local to a *buffer* (page 9) or a *mode* (page 33).
2. Hemlock variables have *hooks* (page 25), functions which are called when the variable is set.
3. There is a database of variable names and documentation which makes it easier to find out what variables exist and what their values mean.

6.1. Variable Names

To the user, a variable name is a case insensitive string. This string is referred to as the *string name* of the variable. A string name is conventionally composed of words separated by spaces.

In Lisp code a variable name is a symbol. The name of this symbol is created by replacing any spaces in the string name with hyphens. This symbol name is always interned in the Hemlock package and referring to a symbol with the same name in the wrong package is an error.

`*global-variable-names*` [*Variable*]

Holds a string-table of the names of all the global Hemlock variables. The value of each entry is the symbol name of the variable.

`current-variable-tables` [*Function*]

This returns a list of variable tables currently established globally, in the **`current-buffer`**, and by the modes of the **`current-buffer`**. This list is suitable for use with **`prompt-for-variable`**.

6.2. Variable Functions

In the following descriptions *name* is the symbol name of the variable.

`defhvar` *string-name documentation* **`&key :mode :buffer :hooks :value`** [*Function*]

Defines a Hemlock variable. An error will be signaled if a reference is made to a variable which is not defined.

string-name The string name of the variable to define.

documentation The documentation string for the variable.

:mode :buffer If *buffer* is supplied the variable is local to that buffer, likewise if *mode* is supplied it is local to that mode. If neither is supplied it is global.

:hooks :value The initial hook-list and value for the variable, which default to **nil**.

If a variable with the same name is already declared in the same place then its hooks and value are set to the value of *hooks* and *value* when these keywords are supplied.

variable-value *name* **&optional** *kind where* [*Function*]

This function returns the value of a Hemlock variable in some place. The following values for *kind* are defined:

:current Return the value present in the current environment, taking into consideration any mode or buffer local variables. This is the default.

:global Return the global value for the variable *name*.

:mode Return value for *name* in the mode named *where*.

:buffer Return the value for *name* in the buffer *where*.

When set with **setf**, the value of the specified variable is set and the functions in its hook list are called with the values for *name*, *kind*, *where* and the new value.

variable-documentation *name* **&optional** *kind where* [*Function*]
variable-hooks *name* **&optional** *kind where* [*Function*]
variable-name *name* **&optional** *kind where* [*Function*]

These function return the documentation, hooks and string name of a Hemlock variable. The *kind* and *where* arguments are the same as for **variable-value**. The documentation and hook list may be set using **setf**.

string-to-variable *string* [*Function*]

This function converts a string into the corresponding variable symbol name. *String* need not be the name of an actual Hemlock variable.

value *name* [*Macro*]
setv *name new-value* [*Macro*]

These macros get and set the current value of the Hemlock variable *name*. *Name* is not evaluated. There is a **setf** form for **value**.

hlet ({(*var value*)}*) {*form*}* [*Macro*]

This macro is very similar to **let** in effect; within its scope each of the Hemlock variables *var* have the respective *values*, but after the scope is exited by any means the binding is removed. This does not cause any hooks to be invoked. The value of the last *form* is returned.

hemlock-bound-p *name* **&optional** *kind where* [*Function*]

Returns **t** if *name* is defined as a Hemlock variable in the place specified by *kind* and *where*, or **nil** otherwise.

delete-variable *name* **&optional** *kind where* [*Function*]
Delete Variable Hook [Hemlock *Variable*]

delete-variable makes the Hemlock variable *name* no longer defined in the specified place. *Kind* and *where* have the same meanings as they do for **variable-value**, except that **:current** is not available, and the default for *kind* is **:global**

An error will be signaled if no such variable exists. The hook, Delete Variable Hook is invoked with the same arguments before the variable is deleted.

6.3. Hooks

Hemlock actions often have hooks associated with them, which are lists of functions to be called before that action is performed. Each variable and mode has such a hook, and the ways to manipulate these object-specific hooks are described with the rest of the actions defined on these objects. Many events that affect editor state also call functions in a hook list; these hooks are described along with the functions that invoke them.

A hook function may be specified either as a symbol with a function definition or a function, but it is recommended to use symbols, since this results in better behavior if the hook function is redefined.

add-hook *place hook-fun* [*Macro*]
remove-hook *place hook-fun* [*Macro*]

These macros add or remove a hook function in some *place*. If *place* is a symbol then it is interpreted as a Hemlock variable, it is taken to be a generalized variable.

invoke-hook *name* **&rest** *args* [*Function*]

Call all the functions in the list which is the value of the Hemlock variable *name*. An error will be signalled if no such variable is defined.

Chapter 7

Commands

7.1. Introduction

The way that the user tells Hemlock to do something is by invoking a *command*. Commands have three attributes:

name	A command's name provides a way to refer to it. Command names are usually capitalized words separated by spaces, such as Forward Word.
documentation	The documentation for a command is used by on-line help facilities.
function	A command is implemented by a Lisp function, which is callable from Lisp.

command-names [*Variable*]

Holds a string-table (page 67) associating command names to command objects. Whenever a new command is defined it is entered in this table.

7.1.1. Defining Commands

defcommand {*command-name* | (*command-name function-name*)} *lambda-list*
command-doc function-doc {*form*}* [*Macro*]

Defines a command named *name*. **defcommand** creates a function to implement the command from the *lambda-list* and *form*'s supplied. The *lambda-list* must specify one required argument, see section 7.4, which by convention is typically named **p**. If the caller does not specify *function-name*, **defcommand** creates the command name by replacing all spaces with hyphens and appending "**-command**". *Function-doc* becomes the documentation for the function and should primarily describe issues involved in calling the command as a function, such as what any additional arguments are. *Command-doc* becomes the command documentation for the command.

make-command *name documentation function* [*Function*]

Defines a new command named *name*, with command documentation *documentation* and function *function*. The command in entered in the string-table ***command-names*** (page 27), with the command object as its value. Normally command implementors will use the **defcommand** macro, but this permits access to the command definition mechanism at a lower level, which is occasionally useful.

commandp *command* [*Function*]

Returns **t** if *command* is a **command** object, otherwise **nil**.

command-documentation *command* [*Function*]
command-function *command* [*Function*]
command-name *command* [*Function*]
Returns the documentation, function, or name for *command*. These may be set with **setf**.

7.1.2. Command Documentation

Command documentation is a description of what the command does when it is invoked as an extended command or from a key. Command documentation may be either a string or a function. If the documentation is a string then the first line should briefly summarize the command, with remaining lines filling the details. Example:

```
(defcommand "Forward Character" (p)
  "Move the point forward one character.
   With prefix argument move that many characters, with negative
   argument go backwards."
  "Move the point of the current buffer forward p characters."
   . . .)
```

Command documentation may also be a function of one argument. The function is called with either **:short** or **:full**, indicating that the function should return a short documentation string or do something to document the command fully.

7.2. The Command Interpreter

The *command interpreter* is a function which reads keystrokes from the keyboard and dispatches to different commands on the basis of what is typed. When the command interpreter calls a command, we say it *invokes* the command. The command interpreter also provides several facilities for communication between sequential commands and does various house cleaning operations.

invoke-hook [*Variable*]
This variable contains a function which is called by the command interpreter when it wants to invoke a command. The function is passed the command and the prefix argument as arguments. The initial value is a function which simply funcalls the **command-function** of the command with the supplied prefix argument. This is useful for implementing keyboard macros and similar things.

Command Abort Hook [Hemlock *Variable*]
The command interpreter invokes the function in this variable whenever a command is aborted (for example, if someone called **editor-error**).

When Hemlock initially starts the command interpreter is in control, but commands may read from the keyboard themselves and assign whatever interpretation they will to the characters read. Commands may call the command interpreter recursively using the function **recursive-edit** (page 32).

7.2.1. Binding Commands to Keys

The command interpreter determines which command to invoke on the basis of *key bindings*. A key binding is an association between a command and a sequence of keystrokes. A sequence of keystrokes is called a *key*, and is represented by a single character or a sequence (list or vector) of characters.

The set of key bindings in effect at any given time is determined by the current environment (page 21), since key bindings may be local to a mode or buffer. When the command interpreter tries to find the binding for a key it checks first to see if there is a local binding in the **current-buffer** (page 9), then if there is a binding in each

of the minor modes and the major mode for the current buffer (page 33), and finally checks to see if there is a global binding. If no binding is found then the command interpreter beeps or flashes the screen to indicate this.

command-char-code-limit [*Constant*]
command-char-bits-limit [*Constant*]

Hemlock implementation is not required to support entirely arbitrary characters in key bindings; **command-char-code-limit** is the upper bound on character codes, and **command-char-bits-limit** is the limit for bits. These constants are analogous to the Common Lisp constants **char-code-limit** and **char-bits-limit**, and will be less than or equal to them. Bits not supported and font are ignored. Note that no attempt is made to define some virtual character set in which bindings can be specified in an implementation independent fashion; key bindings should be set up in file that contains nothing else so that they may be easily changed for different implementations.

bind-key *name key* **&optional** *kind where* [*Function*]

Make *key* be bound to the command *name* in some environment. There are three possible values of *kind*:

:global	The default, make a global key binding.
:mode	Make a mode specific key binding in the mode whose name is *where*.
:buffer	Make a binding which is local to buffer *where*.

If the specified key is some prefix of a key binding which already exists in the specified place, then the new one will override the old one, effectively deleting it. Normally global and mode bindings are made only at load time. **do-alpha-chars** is useful for setting up bindings in certain new modes.

command-bindings *command* [*Function*]

Returns a list of the places where *command* is bound. A place is specified as a list of the key vector, the kind of binding, and then either the mode of buffer the binding is local to, or **nil** if it is a global binding.

delete-key-binding *key* **&optional** *kind where* [*Function*]

Removes the binding of *key* in some place. *kind* is the kind of binding to delete, one of **:global**, the default, **:mode** or **:buffer**. If *kind* is **:mode**, *where* is the mode name, and if *kind* is **:buffer**, then *where* is the buffer. This function signals an error if *key* is unbound.

get-command *key* **&optional** *kind where* [*Function*]

Returns the command bound to *key*; if *key* is not bound return **nil**. If the sequence given is a prefix and not a unique key then the keyword **:prefix** is returned. There are four cases of *kind*:

:current	Return the current binding of *key* using the current buffer's search list. This is the default. If there are any transparent key bindings for *key*, then they are returned in a list as a second value.
:global	Return the global binding of *key*.
:mode	Return the binding of *key* in the mode named *where*.
:buffer	Return the binding of *key* local to the buffer *where*.

map-bindings *function kind* **&optional** *where* [*Function*]

This function maps over the key-bindings in some place. For each binding, *function* is passed the key bound and the command bound to it. *Kind* and *where* are as in **get-command**, except that **:current** is not available. The key is not guaranteed to remain valid after a given iteration.

7.2.2. Key Translation

Key translation is a process that the command interpreter applies to keys before doing anything else. There are two kinds of key translations: substitution and bit-prefix. In either case, key translation is done when a specified character sequence appears in a key.

In a substitution translation, the matched subsequence is replaced with another character sequence. Key translation is not recursively applied to the substituted characters.

In a bit-prefix translation, the matched subsequence is removed, and specified bits are set in the next character in the key.

If the key being translated ends in a prefix of some translation, or if there is no character following a bit-prefix translation, then the matched characters are not translated. If there is a binding for this partially untranslated key, then the command interpreter will invoke that command, otherwise it will wait for more characters to be typed.

key-translation *key* [*Function*]

Return the key translation for *key*, or **nil** if there is none. If *key* is a prefix of a translation, then **:prefix** is returned. Whenever *key* appears as a subsequence of a key argument to the binding manipulation functions, that portion will be replaced with the translation. A key translation may also be a list **(:bits** {*bit-name*}***)**. In this case, the named bits will be set in the next character in the key being translated.

7.2.3. Transparent Key Bindings

Key bindings local to a mode may be *transparent*. A transparent key binding does not shadow less local key bindings, but rather indicates that the bound command should be invoked before the first normal key binding. Transparent key bindings are primarily useful for implementing minor modes such as auto fill and word abbreviation. There may be several transparent key bindings for a given key, in which case all of the commands bound are invoked in the order they were found. If there no normal key binding for a key typed, then the command interpreter acts as though the key is unbound even if there are transparent key bindings.

The **:transparent-p** argument to **defmode** (page 34) determines whether the key bindings in a mode are transparent or not.

7.2.4. Interactive

Hemlock supports keyboard macros. A user may enter a mode where the editor records his actions, and when the user exits this mode, the command Last Keyboard Macro plays back the actions. Some commands behave differently when invoked as part of the definition of a keyboard macro. For example, when used in a keyboard macro, a command that **message**'s useless user confirmation will slow down the repeated invocations of Last Keyboard Macro because the command will pause on each execution to make sure the user sees the message. This can be eliminated with the use of **interactive**. As another example, some commands conditionally signal an editor-error versus simply beeping the device depending on whether it executes on behalf of the user or a keyboard macro.

interactive [*Function*]

This returns **t** when the user invoked the command directly.

7.3. Command Types

In many editors the behavior of a command depends on the kind of command invoked before it. Hemlock provides a mechanism to support this known as *command type*.

last-command-type [*Function*]

This returns the command type of the last command invoked. If this is set with **setf**, the supplied value becomes the value of **last-command-type** until the next command completes. If the previous command did not set **last-command-type**, then its value is **nil**. Normally a command type is a keyword. The command type is not cleared after a command is invoked due to a transparent key binding.

7.4. Command Arguments

There are three ways in which a command may be invoked: It may be bound to a key which has been typed, it may be invoked as an extended command, or it may be called as a Lisp function. Ideally commands should be written in such a way that they will behave sensibly no matter which way they are invoked. The functions which implement commands must obey certain conventions about argument passing if the command is to function properly.

7.4.1. The Prefix Argument

Whenever a command is invoked it is passed as its first argument what is known as the *prefix argument*. The prefix argument is always either an integer or **nil**. When a command uses this value it is usually as a repeat count, or some conceptually similar function.

prefix-argument [*Function*]

This function returns the current value of the prefix argument. When set with **setf**, the new value becomes the prefix argument for the next command.

If the prefix argument is not set by the previous command then the prefix argument for a command is **nil**. The prefix argument is not cleared after a command is invoked due to a transparent key binding.

7.4.2. Lisp Arguments

It is often desirable to call commands from Lisp code, in which case arguments which would otherwise be prompted for are passed as optional arguments following the prefix argument. A command should prompt for any arguments not supplied.

7.5. Recursive Edits

use-buffer *buffer* {*form*}* [*Macro*]

The effect of this is similar to setting the current-buffer to *buffer* during the evaluation of *forms*. There are restrictions placed on what the code can expect about its environment. In particular, the value of any global binding of a Hemlock variable which is also a mode local variable of some mode is ill-defined; if the variable has a global binding it will be bound, but the value may not be the global value. It is also impossible to nest **use-buffer**'s in different buffers. The reason for using **use-buffer** is that it may be significantly faster than changing **current-buffer** to *buffer* and back.

recursive-edit &optional *handle-abort* [*Function*]
Enter Recursive Edit Hook [Hemlock *Variable*]

recursive-edit invokes the command interpreter. The command interpreter will read from the keyboard and invoke commands until it is terminated with either **exit-recursive-edit** or **abort-recursive-edit**.

Normally, an editor-error or **C-g** aborts the command in progress and returns control to the top-level command loop. If **recursive-edit** is used with *handle-abort* true, then **editor-error** or **C-g** will only abort back to the recursive command loop.

Before the command interpreter is entered the hook Enter Recursive Edit Hook is invoked.

in-recursive-edit [*Function*]

This returns whether the calling point is dynamically within a recursive edit context.

exit-recursive-edit &optional *values-list* [*Function*]
Exit Recursive Edit Hook [Hemlock *Variable*]

exit-recursive-edit exits a recursive edit returning as multiple values each element of *values-list*, which defaults to **nil**. This invokes Exit Recursive Edit Hook after exiting the command interpreter. If no recursive edit is in progress, then this signals an error.

abort-recursive-edit &rest *args* [*Function*]
Abort Recursive Edit Hook [Hemlock *Variable*]

abort-recursive-edit terminates a recursive edit by applying **editor-error** (page 57) to *args* after exiting the command interpreter. This invokes Abort Recursive Edit Hook with *args* before aborting the recursive edit . If no recursive edit is in progress, then this signals an error.

Chapter 8

Modes

A mode is a collection of Hemlock values which may be present in the current environment (page 21) depending on the editing task at hand. Examples of typical modes are Lisp, for editing Lisp code, and Echo Area, for prompting in the echo area.

8.1. Mode Hooks

When a mode is added to or removed from a buffer, its *mode hook* is invoked. The hook functions take two arguments, the buffer involved and `t` if the mode is being added or `nil` if it is being removed.

Mode hooks are typically used to make a mode do something additional to what it usually does. One might, for example, make a text mode hook that turned on auto-fill mode when you entered.

8.2. Major and Minor Modes

There are two kinds of modes, *major* modes and *minor* modes. A buffer always has exactly one major mode, but it may have any number of minor modes. Major modes may have mode character attributes while minor modes may not.

A major mode is usually used to change the environment in some major way, such as to install special commands for editing some language. Minor modes generally change some small attribute of the environment, such as whether lines are automatically broken when they get too long. A minor mode should work regardless of what major mode and minor modes are in effect.

Default Modes (initial value `("Fundamental" "Save")`) [Hemlock *Variable*]
This variable contains a list of mode names which are instantiated in a buffer when no other information is available.

`*mode-names*` [*Variable*]
Holds a string-table of the names of all the modes.

Illegal [*Command*]
This is a useful command to bind in modes that wish to shadow global bindings by making them effectively illegal. Also, although less likely, minor modes may shadow major mode bindings with this. This command calls `editor-error`.

8.3. Mode Functions

`defmode` *name* `&key :setup-function :cleanup-function :major-p :precedence :transparent-p` [*Function*]

This function defines a new mode named *name*, and enters it in `*mode-names*` (page 33). If *major-p* is supplied and is not `nil` then the mode is a major mode; otherwise it is a minor mode.

Setup-function and *cleanup-function* are functions which are invoked with the buffer affected, after the mode is turned on, and before it is turned off, respectively. These functions typically are used to make buffer-local key or variable bindings and to remove them when the mode is turned off.

Precedence is only meaningful for a minor mode. The precedence of a minor mode determines the order in which it in a buffer's list of modes. When searching for values in the current environment, minor modes are searched in order, so the precedence of a minor mode determines which value is found when there are several definitions.

Transparent-p determines whether key bindings local to the defined mode are transparent. Transparent key bindings are invoked in addition to the first normal key binding found rather than shadowing less local key bindings.

`buffer-major-mode` *buffer* [*Function*]
Buffer Major Mode Hook [Hemlock *Variable*]

`buffer-major-mode` returns the name of *buffer*'s major mode. The major mode may be changed with `setf`; then Buffer Major Mode Hook is invoked with *buffer* and the new mode.

`buffer-minor-mode` *buffer name* [*Function*]
Buffer Minor Mode Hook [Hemlock *Variable*]

`buffer-minor-mode` returns `t` if the minor mode *name* is active in *buffer*, `nil` otherwise. A minor mode may be turned on or off by using `setf`; then Buffer Minor Mode Hook is invoked with *buffer*, *name* and the new value.

`mode-variables` *name* [*Function*]

Returns the string-table of mode local variables.

`mode-major-p` *name* [*Function*]

Returns `t` if *name* is the name of a major mode, or `nil` if it is the name of a minor mode. It is an error for *name* not to be the name of a mode.

Chapter 9

Character Attributes

9.1. Introduction

Character attributes provide a global database of information about characters. This facility is similar to, but more general than, the *syntax tables* of other editors such as **EMACS**. For example, you should use character attributes for commands that need information regarding whether a character is *whitespace* or not. Use character attributes for these reasons:

1. If this information is all in one place, then it is easy the change the behavior of the editor by changing the syntax table, much easier than it would be if character constants were wired into commands.
2. This centralization of information avoids needless duplication of effort.
3. The syntax table primitives are probably faster than anything that can be written above the primitive level.

Note that an essential part of the character attribute scheme is that *character attributes are global and are there for the user to change*. Information about characters which is internal to some set of commands (and which the user should not know about) should not be maintained as a character attribute. For such uses various character searching abilities are provided by the function **find-pattern** (page 20).

syntax-char-code-limit [*Constant*]

The exclusive upper bound on character codes which are significant in the character attribute functions. Font and bits are always ignored.

9.2. Character Attribute Names

As for Hemlock variables, character attributes have a user visible string name, but are referred to in Lisp code as a symbol. The string name, which is typically composed of capitalized words separated by spaces, is translated into a keyword by replacing all spaces with hyphens and interning this string in the keyword package. The attribute named Ada Syntax would thus become **:ada-syntax**.

character-attribute-names [*Variable*]

Whenever a character attribute is defined, its name is entered in this string table (page 67), with the corresponding keyword as the value.

9.3. Character Attribute Functions

defattribute *name documentation* **&optional** *type initial-value* [*Function*]

This function defines a new character attribute with string name *name*. *Documentation* describes the uses of the character attribute.

Type, which defaults to **(mod 2)**, specifies what type the values of the character attribute are. Values of a character attribute may be of any type which may be specified to **make-array**. *Initial-value* (default **0**) is the value which all characters will initially have for this attribute.

character-attribute-name *attribute* [*Function*]
character-attribute-documentation *attribute* [*Function*]

These functions return the name or documentation for *attribute*.

character-attribute *attribute character* [*Function*]
Character Attribute Hook [Hemlock *Variable*]

character-attribute returns the value of *attribute* for *character*. This signals an error if *attribute* is undefined.

setf will set a character's attributes. This **setf** method invokes the functions in Character Attribute Hook on the attribute and character before it makes the change.

If *character* is **nil**, then the value of the attribute for the beginning or end of the buffer can be accessed or set. The buffer beginning and end thus become a sort of fictitious character, which simplifies the use of character attributes in many cases.

character-attribute-p *symbol* [*Function*]

This function returns **t** if *symbol* is the name of a character attribute, **nil** otherwise.

shadow-attribute *attribute character value mode* [*Function*]
Shadow Attribute Hook [Hemlock *Variable*]

This function establishes *value* as the value of *character*'s *attribute* attribute when in the mode *mode*. *Mode* must be the name of a major mode. Shadow Attribute Hook is invoked with the same arguments when this function is called. If the value for an attribute is set while the value is shadowed, then only the shadowed value is affected, not the global one.

unshadow-attribute *attribute character mode* [*Function*]
Unshadow Attribute Hook [Hemlock *Variable*]

Make the value of *attribute* for *character* no longer be shadowed in *mode*. Unshadow Attribute Hook is invoked with the same arguments when this function is called.

find-attribute *mark attribute* **&optional** *test* [*Function*]
reverse-find-attribute *mark attribute* **&optional** *test* [*Function*]

These functions find the next (or previous) character with some value for the character attribute *attribute* starting at *mark*. They pass *Test* one argument, the value of *attribute* for the character tested. If the test succeeds, then these routines modify *mark* to point before (after for **reverse-find-attribute**) the character which satisfied the test. If no characters satisfy the test, then these return **nil**, and *mark* remains unmodified. *Test* defaults to **not zerop**. There is no guarantee that the test is applied in any particular fashion, so it should have no side effects and depend only on its argument.

9.4. Character Attribute Hooks

It is often useful to use the character attribute mechanism as an abstract interface to other information about characters which in fact is stored elsewhere. For example, some implementation of Hemlock might decide to define a Print Representation attribute which controls how a character is displayed on the screen.

To make this easy to do, each attribute has a list of hook functions which are invoked with the attribute, character and new value whenever the current value changes for any reason.

`character-attribute-hooks` *attribute* [*Function*]
Return the current hook list for *attribute*. This may be set with **`setf`**. The **`add-hook`** and **`remove-hook`** (page 25) macros should be used to manipulate these lists.

9.5. System Defined Character Attributes

These are predefined in Hemlock:

Whitespace — A value of `1` indicates the character is whitespace.

Word Delimiter — A value of `1` indicates the character separates words (see section 15.3).

Digit — A value of `1` indicates the character is a base ten digit. This may be shadowed in modes or buffers to mean something else.

Space — This is like Whitespace, but it should not include **Newline**. Hemlock uses this primarily for handling indentation on a line.

Sentence Terminator — A value of `1` indicates these characters terminate sentences (see section 15.3).

Sentence Closing Char — A value of `1` indicates these delimiting characters, such as " or), may follow a Sentence Terminator (see section 15.3).

Paragraph Delimiter — A value of `1` indicates these characters delimit paragraphs when they begin a line (see section 15.3).

Page Delimiter — A value of `1` indicates this character separates logical pages (see section 15.4) when it begins a line.

Scribe Syntax — This uses the following symbol values:

`nil`	These characters have no interesting properties.
`:escape`	This is @ for the Scribe formatting language.
`:open-paren`	These characters begin delimited text.
`:close-paren`	These characters end delimited text.
`:space`	These characters can terminate the name of a formatting command.
`:newline`	These characters can terminate the name of a formatting command.

Lisp Syntax — This uses symbol values from the following:

`nil`	These characters have no interesting properties.
`:space`	These characters act like whitespace and should not include **Newline**.
`:newline`	This is the **Newline** character.
`:open-paren`	This is (character.
`:close-paren`	This is) character.

`:prefix`	This is a character that is a part of any form it precedes — for example, the single quote, '.
`:string-quote`	This is the character that quotes a string literal, ".
`:char-quote`	This is the character that escapes a single character, \.
`:comment`	This is the character that makes a comment with the rest of the line, ;.
`:constituent`	These characters are constitute symbol names.

Chapter 10

Controlling the Display

10.1. Windows

A window is a mechanism for displaying part of a buffer on some physical device. A window is a way to view a buffer but is not synonymous with one; a buffer may be viewed in any number of windows. A window may have a *modeline* which is a line of text displayed across the bottom of a window to indicate status information, typically related to the buffer displayed.

10.2. The Current Window

current-window [*Function*]
Set Window Hook [Hemlock *Variable*]

current-window returns the window in which the cursor is currently displayed. The cursor always tracks the buffer-point of the corresponding buffer. If the point is moved to a position which would be off the screen the recentering process is invoked. Recentering shifts the starting point of the window so that the point is once again displayed. The current window may be changed with **setf**. Before the current window is changed, the hook Set Window Hook is invoked with the new value.

window-list [*Variable*]

Holds a list of all the window objects made with **make-window** (page 39).

10.3. Window Functions

make-window *mark* **&key :modelinep :window :ask-user :x :y :width :height** [*Function*]
Default Window Width [Hemlock *Variable*]
Default Window Height [Hemlock *Variable*]
Make Window Hook [Hemlock *Variable*]

make-window returns a window displaying text starting at *mark*, which must point into a buffer. If it could not make a window on the device, it returns nil.

Modelinep specifies whether the window should display buffer modelines.

Window is a device dependent window to be used for the Hemlock window. The device may not support this argument.

If *ask-user* is **t**, then the user will be prompted for the missing dimensions (*x*, *y*, *width*, and *height*) when the device supports prompting. If *ask-user* is false, then prompting will never be done. Non-null values

other than `t` may have device dependent meanings. *X* and *y* are supplied in pixels, but *width* and *height* are supplied in characters. Default Window Width and Default Window Height are the default values for the *width* and *height* arguments.

This invokes Make Window Hook with the new window.

`windowp` *window* [*Function*]

This function returns `t` if *window* is a **`window`** object, otherwise `nil`.

`delete-window` *window* [*Function*]

Delete Window Hook [Hemlock *Variable*]

`delete-window` makes *window* go away, first invoking Delete Window Hook with the hapless window.

`window-buffer` *window* [*Function*]

Window Buffer Hook [Hemlock *Variable*]

`window-buffer` returns the buffer from which the window displays text. This may be changed with **`setf`**, in which case the hook Window Buffer Hook is invoked beforehand with the window and the new buffer.

`window-display-start` *window* [*Function*]

`window-display-end` *window* [*Function*]

`window-display-start` returns the mark that points before the first character displayed in *window*. Note that if *window* is the current window, then moving the start may not prove much, since recentering may move it back to approximately where it was originally.

`window-display-end` is similar, but points after the last character displayed. Moving the end is meaningless, since redisplay always moves it to after the last character.

`window-point` *window* [*Function*]

This function returns as a mark the position in the buffer where the cursor is displayed. This may be set with **`setf`**. If *window* is the current window, then setting the point will have little effect; it is forced to track the buffer point. When the window is not current, the window point is the position that the buffer point will be moved to when the window becomes current.

`center-window` *window mark* [*Function*]

This function attempts to adjust window's display start so the that *mark* is vertically centered within the window.

`scroll-window` *window n* [*Function*]

This function scrolls the window down *n* display lines; if *n* is negative scroll up. Leave the cursor at the same text position unless we scroll it off the screen, in which case the cursor is moved to the end of the window closest to its old position.

`displayed-p` *mark window* [*Function*]

Returns `t` if either the character before or the character after *mark* is being displayed in *window*, or `nil` otherwise.

window-height *window* [*Function*]
window-width *window* [*Function*]
Height or width of the area of the window used for displaying the buffer, in character positions. These values may be changed with **setf**, but the setting attempt may fail, in which case nothing is done.

next-window *window* [*Function*]
previous-window *window* [*Function*]
Return the next or previous window of *window*. The exact meaning of next and previous depends on the device displaying the window. It should be possible to cycle through all the windows displayed on a device using either next or previous (implying that these functions wrap around.)

10.4. Cursor Positions

A cursor position is an absolute position within a window's coordinate system. The origin is in the upper-left-hand corner and the unit is character positions.

mark-to-cursorpos *mark window* [*Function*]
Returns as multiple values the **x** and **y** position on which *mark* is being displayed in *window*, or **nil** if it is not within the bounds displayed.

cursorpos-to-mark *X Y window* [*Function*]
Returns as a mark the text position which corresponds to the given (*X*, *Y*) position within window, or **nil** if that position does not correspond to any text within *window*.

last-key-event-cursorpos [*Function*]
Interprets mouse input. It returns as multiple values the (*X*, *Y*) position and the window where the pointing device was the last time some key event happened. If the information is unavailable, this returns **nil**.

mark-column *mark* [*Function*]
This function returns the *X* position at which *mark* would be displayed, supposing its line was displayed on an infinitely wide screen. This takes into consideration strange characters such as tabs.

move-to-column *mark column* **&optional** *line* [*Function*]
This function is analogous to **move-to-position** (page 5), except that it moves *mark* to the position on *line* which corresponds to the specified *column*. *Line* defaults to the line that *mark* is currently on. If the line would not reach to the specified column, then **nil** is returned and *mark* is not modified. Note that since a character may be displayed on more than one column on the screen, several different values of *column* may cause *mark* to be moved to the same position.

show-mark *mark window time* [*Function*]
This function highlights the position of *mark* within *window* for *time* seconds, possibly by moving the cursor there. The wait may be aborted if there is pending input. If *mark* is positioned outside the text displayed by *window*, then this returns **nil**, otherwise **t**.

10.5. Redisplay

Redisplay is the process by which the editor translates changes in the internal representation of text into changes on the screen. Ideally this process finds the minimal transformation of the screen that brings it into correspondence with the text, in order to maximize the speed of redisplay.

redisplay [*Function*]
Redisplay Hook [Hemlock *Variable*]

redisplay invokes the redisplay process, and the command interpreter typically causes this after the completion of each command. The redisplay process repeatedly checks for input, and if any is detected, redisplay aborts. This function invokes the functions in Redisplay Hook on the current window after completely preparing for but not executing redisplay. After invoking the hook, it recomputes the redisplay again and then finally executes it on the current window.

redisplay-all [*Function*]

This causes all editor windows to be completely redisplayed.

editor-finish-output *window* [*Function*]

This makes sure the editor is synchronized with respect to redisplay output to *window*. This may do nothing on some devices.

Chapter 11

Logical Characters

11.1. Introduction

Some primitives such as **prompt-for-key** (page 47), and commands such as EMACS query replace, read characters directly from they keyboard instead of using the command interpreter. In order to encourage consistency between these commands and make them portable and easy to customize, there is a mechanism for defining *logical characters.*

A logical character is a keyword which stands for some set of characters which are globally used to mean a certain thing, for example, the **:help** logical character stands for whatever set of characters is used to ask for help in a given implementation. It is important to note that this mapping is not a one-to-one mapping, but rather a many-to-many mapping in that a given logical character may have several corresponding real characters, and each of those characters may have several logical characters.

11.2. Logical Character Functions

logical-character-names [*Variable*]
This variable holds a string-table of all the logical characters string-names, with the values of each entry being the actual logical-character keyword.

define-logical-character *string-name documentation* [*Function*]
Takes *string-name* and converts it into a keyword by replacing spaces with hyphens, as with **defattribute** (page 36), and then defines the keyword to be a logical character having the given *documentation.*

logical-character-characters *keyword* [*Function*]
Returns the list of characters that are equivalent to the logical character *keyword.*

logical-character-name *keyword* [*Function*]
logical-character-documentation *keyword* [*Function*]
Return the string name and documentation given to **define-logical-character** when the logical character *keyword* was defined.

logical-char= *character keyword* [*Function*]
Returns true if the specified *character* has *keyword* as a corresponding logical character. The value that is returned for any *character/keyword* pair may be set by using **setf**; this is how a real character and a logical character are associated. It is a error for *keyword* not to be a defined logical character. *Character*

is case-folded, thus comparisons are case insensitive, but bits and font are significant.

11.3. System Defined Logical Characters

There a number of standard logical characters defined, some of which are used by functions documented in this manual, and others defined simply so that commands can use them. If a command wants to read a single character command that fits one of these descriptions then the character read should be compared to the corresponding logical character instead of wiring the actual character into the code. In many cases the **command-case** (page 46) macro can be used. This makes using logical characters easy, and takes care of prompting and displaying help messages.

:yes Indicates that that some action, such as doing a replacement should be taken.

:no Analogous to **:yes**, but it indicates that the action should not be taken.

:do-all Indicates that the action under consideration should be repeated as many times as possible.

:exit Tells the command to terminate in a normal fashion.

:help Instructs the command to display some help information.

:confirm Confirms any input, or if none, indicates that the default should be taken.

:quote Indicates that the following character is not to be treated as a command, regardless of what it is, but rather simply stands for itself.

:recursive-edit
Indicates that the command should enter a recursive edit in the current context.

Define a new logical character whenever:

1. The character concerned represents a general class of actions, and thus might want to be known about by several commands.
2. The exact character chosen to invoke the action concerned is likely to be a matter of violent dispute, and thus should be easy to change.
3. The character concerned is not **standard-char-p**, and thus cannot be specified in a implementation independent fashion.

Chapter 12

The Echo Area

Hemlock provides a number of facilities for displaying information and prompting the user for it. Most of these work through a small window displayed at the bottom of the screen. This is called the echo area and is supported by a buffer and a window. This buffer's modeline (see section 3.3) is referred to as the status line, which, unlike other buffers' modelines, is used to show general status about the editor, Lisp, or world.

Default Status Line Fields [Hemlock *Variable*]
: This is the initial list of modeline-field objects stored in the echo area buffer.

Echo Area Height (initial value 3) [Hemlock *Variable*]
: This variable determines the initial height in lines of the echo area window.

12.1. Echo Area Functions

It is considered poor taste to perform text operations on the echo area buffer to display messages; the **message** function should be used instead. A command must use this function or set **buffer-modified** (page 11) for the Echo Area buffer to **nil** to cause Hemlock to leave text in the echo area after the command's execution.

clear-echo-area [*Function*]
: Clears the echo area.

message *control-string* **&rest** *format-arguments* [*Function*]
Message Pause (initial value 0.5) [Hemlock *Variable*]
: Displays a message in the echo area. The message is always displayed on a fresh line. **message** pauses for Message Pause seconds before returning to assure that messages are not displayed too briefly to be seen. Because of this, **message** is the best way to display text in the echo area.

echo-area-window [*Variable*]
echo-area-buffer [*Variable*]
: **echo-area-buffer** contains the buffer object for the echo area, which is named Echo Area. This buffer is usually in Echo Area mode. **echo-area-window** contains a window displaying **echo-area-buffer**. Its modeline is the status line, see the beginning of this chapter.

echo-area-stream [*Variable*]

This is a buffered Hemlock output stream (56) which inserts text written to it at the point of the echo area buffer. Since this stream is buffered a **force-output** must be done when output is complete to assure that it is displayed.

12.2. Prompting Functions

Most of the prompting functions accept the following keyword arguments:

:must-exist If **:must-exist** has a non-**nil** value then the user is prompted until a valid response is obtained. If **:must-exist** is **nil** then return as a string whatever is input. The default is **t**.

:default If null input is given when the user is prompted then this value is returned. If no default is given then some input must be given before anything interesting will happen.

:default-string
If a **:default** is given then this is a string to be printed to indicate what the default is. The default is some representation of the value for **:default**, for example for a buffer it is the name of the buffer.

:prompt This is the prompt string to display.

:help This is similar to **:prompt**, except that it is displayed when the help command is typed during input.

This may also be a function. When called with no arguments, it should either return a string which is the help text or perform some action to help the user, returning **nil**.

prompt-for-buffer &key :prompt :help :must-exist :default :default-string [*Function*]

Prompts with completion for a buffer name and returns the corresponding buffer. If *must-exist* is **nil**, then it returns the input string if it is not a buffer name. This refuses to accept the empty string as input when **:default** and **:default-string** are **nil**. **:default-string** may be used to supply a default buffer name when **:default** is **nil**, but when **:must-exist** is non-**nil**, it must name an already existing buffer.

command-case ({*key value*}*) {({({*tag*}*) | *tag*} *help* {*form*}*)}* [*Macro*]

This macro is analogous to the Common Lisp **case** macro. It is intended to be used by commands such as Query Replace which read single-character commands and dispatch from them. Since the description of this is rather complex, here is an example:

```
(defcommand "Save All Buffers" (p)
  "Give the User a chance to save each modified buffer."
  "Give the User a chance to save each modified buffer."
  (dolist (b *buffer-list*)
    (select-buffer-command () b)
    (when (buffer-modified b)
      (command-case (:prompt "Save this buffer: [Y] "
                     :help "Save buffer, or do something else:")
        ((:yes :confirm)
         "Save this buffer and go on to the next."
         (save-file-command () b))
        (:no "Skip saving this buffer, and go on to the next.")
        (:recursive-edit
         "Go into a recursive edit in this buffer."
         (do-recursive-edit) (reprompt))
        ((:exit #\P) "Punt this silly loop."
         (return nil))))))
```

Normally **command-case** prompts for a character and then evaluates the first option in the body with a tag equivalent to the character read. Each *tag* is either a *logical character* (page 43) or a standard character, one that satisfies the Common Lisp **standard-char-p** predicate. If the tag is a logical character keyword, then the search for an appropriate case compares the character read with the tag using **logical-char=**. If the tag is a character, then this case-folds it and compares it to the character read using **char=**.

The keyword arguments are used to specify how the prompting is done. The following values for a *key* are defined:

:help This string is displayed by the default **:help** option before each possibility is described.

:prompt This is the prompt used when reading the character.

:change-window
If this is true (the default), then the echo area window is made the current window while the character is read. Sometimes it is desirable not to change the window since the user may want to answer the question on the basis of where the point is in the current buffer.

:bind The argument to this keyword is a variable which is to be bound to the character read.

:character If this is specified, then no character is read initially, and processing proceeds as though the character of the corresponding *value* had been read.

There are default options for two logical characters: **:help** and **:abort**. If a help character is read, then a help message is displayed. The message is created out of the string given to the **:help** *key* and the *help* strings specified for each option. After the help message is displayed the prompting is repeated. If an abort character is read then an editor error is signalled. Either of these actions may be overridden by explicitly specifying some option that subsumes these.

Instead of specifying a tag or tag list, **t** may be used -- this becomes the default option, and is evaluated only if no other option, including the default ones can be. This option has no help string, and is not mentioned in any help message. The default default option **beep**s and then does a **reprompt**.

Within the body of **command-case**, the **reprompt** macro is defined. Use of this macro causes the prompting and option selection process to be immediately restarted.

prompt-for-character &key :prompt :change-window [*Function*]
Prompts for a character and does not wait for confirmation before returning. **command-case** (page 46) is more useful for most purposes. When appropriate use logical characters (page 43).

prompt-for-key &key :prompt :help :must-exist :default :default-string [*Function*]
Prompts for *key*, a vector of characters, suitable for being passed to any of the functions that manipulate key bindings (page 28). If *must-exist* is true then the key must be bound in the current environment and the command currently bound is returned as the second value.

prompt-for-file &key :prompt :help :must-exist :default :default-string [*Function*]
Prompts for an acceptable filename in some system dependent fashion. Acceptable means that it is a legal filename and it exists if *must-exist* is not **nil**. **prompt-for-file** returns a Common Lisp pathname.

If the file exists as entered then it is returned, otherwise it is merged with *default* as by **merge-pathnames**.

prompt-for-integer &key :prompt :help :must-exist :default :default-string [*Function*]

Prompts for a possibly signed integer. If *must-exist* is **nil** then **prompt-for-integer** returns the input as a string if it is not a valid integer.

prompt-for-keyword *string-tables* **&key :prompt :help :must-exist :default :default-string** [*Function*]

Prompts for a keyword with completion using the string tables in the list *string-tables*. If *must-exist* is **nil** then the result must be an unambiguous prefix of a string in one of the *string-tables*, and the complete string is returned even if only a prefix of the full string was typed. In addition, the value of the corresponding entry in the string table is returned as the second value.

If *must-exist* is **nil** then the string is returned exactly as entered. The difference between **prompt-for-keyword** with *must-exist* **nil**, and **prompt-for-string**, is that completion may be done using the Complete Parse and Complete Field commands.

prompt-for-expression &key :prompt :help :must-exist :default :default-string [*Function*]

Reads a Lisp expression. If *must-exist* is **nil** and a read error occurs then the string typed is returned.

prompt-for-string &key :prompt :help :default :default-string [*Function*]

Prompts for a string; this cannot fail.

prompt-for-variable &key :prompt :help :must-exist :default :default-string [*Function*]

Prompts for a variable name. If *must-exist* is non-**nil** then the string must be a variable *defined in the current environment*, in which case the symbol name of the variable found is returned as the second value.

prompt-for-y-or-n &key :prompt :help :must-exist :default :default-string [*Function*]

Prompts for "y" or "n" (or "Y" or "N" naturally), and returns **t** or **nil** without waiting for confirmation. When a confirming key is typed, return the default if there is one. If *must-exist* is **nil** then return whatever character was first typed if it was not "y" or "n". This is analogous to the Common Lisp function **y-or-n-p**.

prompt-for-yes-or-no &key :prompt :help :must-exist :default :default-string [*Function*]

This function is to **prompt-for-y-or-n** as **yes-or-no-p** is to **y-or-n-p**. "Yes" or "No" must be typed out in full and confirmation must be given.

12.3. Control of Parsing Behavior

The behavior of the parsing routines is parameterized by a variable and a character attribute.

The character attribute Parse Field Separator, is a boolean attribute, a value of one indicating that that character is considered to be a field separator by the Complete Field command.

Beep On Ambiguity (initial value `t`) [Hemlock *Variable*]
If this variable is true, then an attempt to complete a parse which is ambiguous will result in a "beep".

12.4. Defining New Prompting Functions

Prompting functions are implemented as a recursive edit in the Echo Area buffer. Completion, help, and other parsing features are implemented by commands which are bound in Echo Area Mode.

A prompting function passes information down into the recursive edit by binding a collection of special variables.

`*parse-verification-function*` [*Variable*]
The system binds this to a function that Confirm Parse (page 50) calls. It does most of the work when parsing prompted input. Confirm Parse (page 50) passes one argument, which is the string that was in **`*parse-input-region*`** when the user invokes the command. The function should return a list of values which are to be the result of the recursive edit, or **`nil`** indicating that the parse failed. In order to return zero values, a non-**`nil`** second value may be returned along with a **`nil`** first value.

`*parse-string-tables*` [*Variable*]
This is the list of **`string-table`**s, if any, that pertain to this parse.

`*parse-value-must-exist*` [*Variable*]
This is bound to the value of the **`:must-exist`** argument, and is referred to by the verification function, and possibly some of the commands.

`*parse-default*` [*Variable*]
When prompting the user, this is bound to a string representing the default object, the value supplied as the **`:default`** argument. Confirm Parse supplies this to the parse verification function when the **`*parse-input-region*`** is empty.

`*parse-default-string*` [*Variable*]
When prompting the user, if **`*parse-default*`** is **`nil`**, Hemlock displays this string as a representation of the default object; for example, when prompting for a buffer, this variable would be bound to the buffer name.

`*parse-type*` [*Variable*]
The kind of parse in progress, one of **`:file`**, **`:keyword`** or **`:string`**. This tells the completion commands how to do completion, with **`:string`** disabling completion.

`*parse-prompt*` [*Variable*]
The prompt being used for the current parse.

`*parse-help*` [*Variable*]
The help string or function being used for the current parse.

`*parse-starting-mark*` [*Variable*]
This variable holds a mark in the **`*echo-area-buffer*`** (page 45) which is the position at which the parse began.

parse-input-region [*Variable*]
This variable holds a region with ***parse-starting-mark*** as its start and the end of the echo-area buffer as its end. When Confirm Parse is called, the text in this region is the text that will be parsed.

12.5. Some Echo Area Commands

These are some of the Echo Area commands that coordinate with the prompting routines. Hemlock binds other commands specific to the Echo Area, but they are uninteresting to mention here, such as deleting to the beginning of the line or deleting backwards a word.

Help On Parse (bound to **Home, C-_** in Echo Area mode) [*Command*]
Display the help text for the parse currently in progress.

Complete Keyword (bound to **Escape** in Echo Area mode) [*Command*]
This attempts to complete the current region as a keyword in ***string-tables***. It signals an editor-error if the input is ambiguous or incorrect.

Complete Field (bound to **Space** in Echo Area mode) [*Command*]
Similar to Complete Keyword, but only attempts to complete up to and including the first character in the keyword with a non-zero **:parse-field-separator** attribute. If there is no field separator then attempt to complete the entire keyword. If it is not a keyword parse then just self-insert.

Confirm Parse (bound to **Return** in Echo Area mode) [*Command*]
If ***string-tables*** is non-**nil** find the string in the region in them. Call ***parse-verification-function*** with the current input. If it returns a non-**nil** value then that is returned as the value of the parse. A parse may return a **nil** value if the verification function returns a non-**nil** second value.

Chapter 13

Files

This chapter discusses ways to read and write files at various levels — at marks, into regions, and into buffers. This also treats automatic mechanisms that affect the state of buffers in which files are read.

13.1. File Options and Type Hooks

The user specifies file options with a special syntax on the first line of a file. If the first line contains the string "`-*-`", then Hemlock interprets the text between the first such occurrence and the second, which must be contained in one line , as a list of "*option*: *value*" pairs separated by semicolons. The following is a typical example:

```
;;; -*- Mode: Lisp, Editor; Package: Hemlock -*-
```

See the *Hemlock User's Manual* for more details and predefined options.

File type hooks are executed when Hemlock reads a file into a buffer based on the type of the pathname. When the user specifies a Mode file option that turns on a major mode, Hemlock ignores type hooks. This mechanism is mostly used as a simple means for turning on some appropriate default major mode.

`define-file-option` *name* (*buffer value*) {*declaration*}* {*form*}* [*Macro*]
This defines a new file option with the string name *name*. *Buffer* and *value* specify variable names for the buffer and the option value string, and *form*'s are evaluated with these bound.

`define-file-type-hook` *type-list* (*buffer type*) {*declaration*}* {*form*}* [*Macro*]
This defines some code that **`process-file-options`** (below) executes when the file options fail to set a major mode. This associates each type, a **`simple-string`**, in *type-list* with a routine that binds *buffer* to the buffer the file is in and *type* to the type of the pathname.

`process-file-options` *buffer* **`&optional`** *pathname* [*Function*]
This checks for file options in buffer and invokes handlers if there are any. *Pathname* defaults to *buffer*'s pathname but may be **`nil`**. If there is no Mode file option that specifies a major mode, and *pathname* has a type, then this tries to invoke the appropriate file type hook. **`read-buffer-file`** calls this.

13.2. Pathnames and Buffers

There is no good way to uniquely identify buffer names and pathnames. However, Hemlock has one way of mapping pathnames to buffer names that should be used for consistency among customizations and primitives. Independent of this, Hemlock provides a means for consistently generating prompting defaults when asking the user for pathnames.

pathname-to-buffer-name *pathname* [*Function*]
name/type-separator-character [*Variable*]

This returns a string of the form "*Name Type Directory*" using components of *pathname*. If the pathname contains no name field, but it does contain a type, then the type is preceded by ***name/type-separator-character*** (defaults to a period). The file system may not support file types, and Hemlock cannot know what the name/type separator is anyway. This is mostly a visual convenience for listing buffers for the user. It is an error for this character to be anything but a graphical character, not including space.

Pathname Defaults (initial value **(pathname "gazonk.del")**) [Hemlock *Variable*]
Last Resort Pathname Defaults Function [Hemlock *Variable*]
Last Resort Pathname Defaults (initial value **(pathname "gazonk")**) [Hemlock *Variable*]

These variables control the computation of default pathnames when needed for promting the user. Pathname Defaults is a *sticky* default. See the *Hemlock User's Manual* for more details.

buffer-default-pathname *buffer* [*Function*]

This returns Buffer Pathname if it is bound. If it is not bound, and *buffer*'s name is composed solely of alphnumeric characters, then return a pathname formed from *buffer*'s name. If *buffer*'s name has other characters in it, then return the value of Last Resort Pathname Defaults Function called on *buffer*.

13.3. File Groups

File groups provide a simple way of collecting the files that compose a system and naming that collection. Hemlock supports commands for searching, replacing, and compiling groups.

active-file-group [*Variable*]

This is the list of files that constitute the currently selected file group. If this is **nil**, then there is no current group.

do-active-group {*form*}* [*Macro*]
Group Find File (initial value **nil**) [Hemlock *Variable*]
Group Save File Confirm (initial value **t**) [Hemlock *Variable*]

do-active-group iterates over ***active-file-group*** executing the forms once for each file. While the forms are executing, the file is in the current buffer, and the point is at the beginning. If there is no active group, this signals an editor-error.

This reads each file into its own buffer using **find-file-buffer**. Since unwanted buffers may consume large amounts of memory, Group Find File controls whether to delete the buffer after executing the forms. When the variable is false, this deletes the buffer if it did not previously exist; however, regardless of this variable, if the user leaves the buffer modified, the buffer persists after the forms have completed. Whenever this processes a buffer that already existed, it saves the location of the buffer's point before and restores it afterwards.

After processing a buffer, if it is modified, **do-active-group** tries to save it. If Group Save File Confirm is non-**nil**, it asks for confirmation.

13.4. File Reading and Writing

Common Lisp pathnames are used by the file primitives. For probing, checking write dates, and so forth, all of the Common Lisp file functions are available.

read-file *pathname mark* [*Function*]

This inserts the file named by *pathname* at *mark*.

write-file *region pathname* **&key :keep-backup :access** [*Function*]
Keep Backup Files (initial value **nil**) [Hemlock *Variable*]

write-file writes the contents of *region* to the file named by *pathname*. This writes *region* using a stream as if it were opened with **:if-exists** supplied as **:rename-and-delete**. When *keep-backup*, which defaults to the value of Keep Backup Files, is non-nil, it is as if the stream were opened with **:if-exists** supplied as **:rename**. *Access* is an implementation dependent value that is suitable for setting *pathname*'s access or protection bits.

write-buffer-file *buffer pathname* [*Function*]
Write File Hook [Hemlock *Variable*]
Add Newline at EOF on Writing File (initial value **:ask-user**) [Hemlock *Variable*]

write-buffer-file writes *buffer* to the file named by *pathname* including the following:

- It assumes pathname is somehow related to *buffer*'s pathname: if the *buffer*'s write date is not the same as *pathname*'s, then this prompts the user for confirmation before overwriting the file.
- It consults Add Newline at EOF on Writing File (see *Hemlock User's Manual* for possible values) and interacts with the user if necessary.
- It sets Pathname Defaults, and after using **write-file**, marks *buffer* unmodified.
- It updates *Buffer*'s pathname and write date.
- It renames the buffer according to the new pathname if possible.
- It invokes Write File Hook.

Write File Hook is a list of functions that take the newly written buffer as an argument.

read-buffer-file *pathname buffer* [*Function*]
Read File Hook [Hemlock *Variable*]

read-buffer-file deletes *buffer*'s region and uses **read-file** to read *pathname* into it, including the following:

- It sets *buffer*'s write date to the file's write date if the file exists; otherwise, it **message**'s that this is a new file and sets *buffer*'s write date to **nil**.
- It moves *buffer*'s point to the beginning.
- It sets *buffer*'s unmodified status.
- It sets *buffer*'s pathname to the result of probing *pathname* if the file exists; otherwise, this function sets *buffer*'s pathname to the result of merging *pathname* with **default-directory**.
- It sets Pathname Defaults to the result of the previous item.
- It processes the file options.
- It invokes Read File Hook.

Read File Hook is a list functions that take two arguments — the buffer read into and whether the file existed, `t` if so.

`find-file-buffer` *pathname* [*Function*]

This returns a buffer assoicated with the *pathname*, reading the file into a new buffer if necessary. This returns a second value indicating whether a new buffer was created, `t` if so. If the file has already been read, this checks to see if the file has been modified on disk since it was read, giving the user various recovery options. This is the basis of the Find File command.

Chapter 14

Hemlock's Lisp Environment

This chapter is sort of a catch all for any functions and variables which concern Hemlock's interaction with the outside world.

14.1. Entering and Leaving the Editor

ed &optional *x* [*Function*]
Entry Hook [Hemlock *Variable*]

ed enters the editor. It is basically as specified in Common Lisp. If *x* is supplied and is a symbol, the definition of *x* is put into a buffer, and that buffer is selected. If *x* is a pathname, the file specified by *x* is visited in a new buffer. If *x* is not supplied or **nil**, the editor is entered in the same state as when last exited.

The Entry Hook is invoked each time the editor is entered.

exit-hemlock &optional *value* [*Function*]
Exit Hook [Hemlock *Variable*]

exit-hemlock leaves Hemlock and return to Lisp; *value* is the value to return, which defaults to **t**. The hook Exit Hook (page 55) is invoked before this is done.

pause-hemlock [*Function*]

pause-hemlock suspends the editor process and returns control to the shell. When the process is resumed, it will still be running Hemlock.

14.2. Keyboard Input

Keyboard input interacts with a number of other parts of the editor. Since the command loop works by reading from the keyboard, keyboard input is the initial cause of everything that happens. Redisplay is also normally done as a side-effect of keyboard input. If someone tries to read from the keyboard and there is no pending input, then redisplay is invoked.

editor-input [*Variable*]
real-editor-input [*Variable*]
Input Hook [Hemlock *Variable*]
Abort Hook [Hemlock *Variable*]

editor-input is an input stream which reads characters from the keyboard immediately and without echoing.

If the *eof-errorp* argument to the reading function is **nil** then input is quoted as far as possible to enable the reading of interrupt characters and similar things.

real-editor-input holds the initial value of ***editor-input***. This is useful for reading from the terminal when ***editor-input*** is rebound (such as within a keyboard macro.)

Hemlock invokes the functions in Input Hook each time someone reads a character from ***real-editor-input***. These take no arguments.

When the user aborts, as by typing **C-g**, Hemlock invokes the functions in Abort Hook. These take no arguments. When aborting, Hemlock ignores the Input Hook.

editor-sleep *time* [*Function*]

Return either after *time* seconds have elapsed or when input is available on ***editor-input***.

character-history [*Variable*]

This is a Hemlock ring buffer (see page 68) that holds the last 60 characters read from the keyboard.

last-character-typed [*Variable*]

This variable should be used by commands that want to know the character that invoked them. If no character has yet been typed, then the value is **nil**. This variable usually holds the last character read from the keyboard, but it is also maintained within keyboard macros.

input-transcript [*Variable*]

If this is non-**nil** then it should be an adjustable vector with a fill-pointer. When it is non-**nil** all input read is also pushed onto this vector.

text-character *character* [*Function*]

When given a character as returned by reading from ***editor-input***, this returns a character suitable for inserting in text, or **nil** if *character* doesn't have a text representation.

Exactly what this does is implementation dependent, but on ASCII implementations which support bits this might turn characters with the control bit on into the corresponding ASCII control character.

print-pretty-character *character stream* [*Function*]

This prints *character* to *stream* suitably for documentation, data displays, etc. Control, meta, super, and hyper bits are shown as C-, M-, S-, and H-, respectively. If *character* is not a standard character other than space or newline, and it has a name, then the name is printed.

14.3. Hemlock Streams

It is possible to create streams which output to or get input from a buffer. This mechanism is quite powerful and permits easy interfacing of Hemlock to Lisp.

make-hemlock-output-stream *mark* **&optional** *buffered* [*Function*]
hemlock-output-stream-p *object* [*Function*]

make-hemlock-output-stream returns a stream that inserts at the permanent mark *mark* all output directed to it. *Buffered* controls whether the stream is buffered or not, and its valid values are the following keywords:

:none No buffering is done. This is the default.

`:line` The buffer is flushed whenever a newline is written or when it is explicitly done with `force-output`.

`:full` The screen is only brought up to date when it is explicitly done with `force-output`

`hemlock-output-stream-p` returns `t` if *object* is a `hemlock-output-stream` object.

`make-hemlock-region-stream` *region* [*Function*]
`hemlock-region-stream-p` *object* [*Function*]
`make-hemlock-region-stream` returns a stream from which the text in *region* can be read. `hemlock-region-stream-p` returns `t` if *object* is a `hemlock-region-stream` object.

`with-input-from-region` (*var region*) {*declaration*}* {*form*}* [*Macro*]
While evaluating *forms*, binds *var* to a stream which returns input from *region*.

`with-output-to-mark` (*var mark* [*buffered*]) {*declaration*}* {*form*}* [*Macro*]
During the evaluation of the *forms*, binds *var* to a stream which inserts output at the permanent *mark*. *Buffered* has the same meaning as for `make-hemlock-output-stream`.

`with-random-typeout` (*var n*) {*declaration*}* {*form*}* [*Macro*]
Bind *var* to a stream which, when output to, displays the output on the screen in some aesthetic fashion. *n* is an estimate of the number of lines that the output will take to display. Typically what this will do is make a window *n* lines high on the screen, display the output in it in more-mode, and then pause at then end until a character is typed to indicate that the input has been read. This is useful for displaying information of temporary interest such as buffer lists.

14.4. Interface to the Error System

The error system interface is minimal. There is a simple editor-error condition which is a subtype of error and a convenient means for signaling them. Hemlock also provides a standard handler for error conditions while in the editor.

`editor-error-format-string` *condition* [*Function*]
`editor-error-format-arguments` *condition* [*Function*]
Handlers for editor-error conditions can access the condition object with these.

`editor-error &rest` *args* [*Function*]
This function is called to signal minor errors within Hemlock; these are errors that a normal user could encounter in the course of editing such as a search failing or an attempt to delete past the end of the buffer. This function `signal`'s an editor-error condition formed from *args*, which are `nil` or a `format` string possibly followed by `format` arguments. Hemlock invokes commands in a dynamic context with an editor-error condition handler bound. This default handler beeps or flashes (or both) the display. If the condition passed to the handler has a non-`nil` string slot, the handler also invokes `message` on it. The command in progress is always aborted, and this function never returns.

`handle-lisp-errors` {*form*}* [*Macro*]
Within the body of this macro any Lisp errors that occur are handled in some fashion more gracefully than simply dumping the user in the debugger. This macro should be wrapped around code which may get an error due to some action of the user — for example, evaluating code fragments on the behalf of and

supplied by the user. Using this in a command allows the established handler to shadow the default editor-error handler, so commands should take care to signal user errors (calls to **editor-errors**) outside of this context.

14.5. Definition Editing

Hemlock provides commands for finding the definition of a function, macro, or command and placing the user at the definition in a buffer. This, of course, is implementation dependent, and if an implementation does not associate a source file with a routine, or if Hemlock cannot get at the information, then these commands do not work. If the Lisp system does not store an absolute pathname, independent of the machine on which the maintainer built the system, then users need a way of translating a source pathname to one that will be able to locate the source.

add-definition-dir-translation *dir1 dir2* [*Function*]

This maps directory pathname *dir1* to *dir2*. Successive invocations using the same *dir1* push into a translation list. When Hemlock seeks a definition source file, and it has a translation, then it tries the translations in order. This is useful if your sources are on various machines, some of which may be down. When Hemlock tries to find a translation, it first looks for translations of longer directory pathnames, finding more specific translations before shorter, more general ones.

delete-definition-dir-translation *dir* [*Function*]

This deletes the mapping of *dir* to all directories to which it has been mapped.

14.6. Event Scheduling

The mechanism described in this chapter is only operative when the Lisp process is actually running inside of Hemlock, within the **ed** function. The designers intended its use to be associated with the editor, such as with auto-saving files, reminding the user, etc.

schedule-event *time function* **&optional** *repeat* [*Function*]

This causes Hemlock to call *function* after *time* seconds have passed, optionally repeating every *time* seconds. *Repeat* defaults to **t**. This is a rough mechanism since commands can take an arbitrary amount of time to run; Hemlock invokes *function* at the first possible moment after *time* has elapsed. *Function* takes the time in seconds that has elapsed since the last time it was called (or since it was scheduled for the first invocation).

remove-scheduled-event *function* [*Function*]

This removes *function* from the scheduling queue. *Function* does not have to be in the queue.

14.7. Miscellaneous

in-lisp {*form*}* [*Function*]

This evaluates *form*'s inside **handle-lisp-errors**. It also binds ***package*** to the package named by Current Package if it is non-**nil**. Use this when evaluating Lisp code on behalf of the user.

do-alpha-chars (*var kind* [*result*] {*form*}*) [*Macro*]

This iterates over alphabetic characters in Common Lisp binding *var* to each character in order as specified under character relations in *Common Lisp the Language*. *Kind* is one of **:lower**, **:upper**, or **:both**. When the user supplies **:both**, lowercase characters are processed first.

Chapter 15

High-Level Text Primitives

This chapter discusses primitives that operate on higher level text forms than characters and words. For English text, there are functions that know about sentence and paragraph structures, and for Lisp sources, there are functions that understand this language. This chapter also describes mechanisms for organizing file sections into *logical pages* and for formatting text forms.

15.1. Indenting Text

Indent Function (initial value **tab-to-tab-stop**) [Hemlock *Variable*]
: The value of this variable determines how indentation is done, and it is a function which is passed a mark as its argument. The function should indent the line that the mark points to. The function may move the mark around on the line. The mark will be **:left-inserting**. The default simply inserts a **tab** character at the mark. A function for Lisp mode probably moves the mark to the beginning of the line, deletes horizontal whitespace, and computes some appropriate indentation for Lisp code.

Indent with Tabs (initial value **indent-using-tabs**) [Hemlock *Variable*]
Spaces per Tab (initial value **8**) [Hemlock *Variable*]
: Indent with Tabs holds a function that takes a mark and a number of spaces. The function will insert a maximum number of tabs and a minimum number of spaces at mark to move the specified number of columns. The default definition uses Spaces per Tab to determine the size of a tab. *Note,* Spaces per Tab *is not used everywhere in* Hemlock *yet, so changing this variable could have unexpected results.*

indent-region *region* [*Function*]
indent-region-for-commands *region* [*Function*]
: **indent-region** invokes the value of Indent Function on every line of region. **indent-region-for-commands** uses **indent-region** but first saves the region for the Undo command.

delete-horizontal-space *mark* [*Function*]
: This deletes all characters with a Space attribute (see section 9.5) of **1**.

15.2. Lisp Text Buffers

Hemlock bases its Lisp primitives on parsing a block of the buffer and annotating lines as to what kind of Lisp syntax occurs on the line or what kind of form a mark might be in (for example, string, comment, list, etc.). These

do not work well if the block of parsed forms is exceeded when moving marks around these forms, but the block that gets parsed is somewhat programmable.

There is also a notion of a *top level form* which this documentation often uses synonymously with *defun*, meaning a Lisp form occurring in a source file delimited by parentheses with the opening parenthesis at the beginning of some line. The names of the functions include this inconsistency.

pre-command-parse-check *mark for-sure* [*Function*]
Parse Start Function (initial value **start-of-parse-block**) [Hemlock *Variable*]
Parse End Function (initial value **end-of-parse-block**) [Hemlock *Variable*]
Minimum Lines Parsed (initial value **50**) [Hemlock *Variable*]
Maximum Lines Parsed (initial value **500**) [Hemlock *Variable*]
Defun Parse Goal (initial value **2**) [Hemlock *Variable*]

pre-command-parse-check calls Parse Start Function and Parse End Function on *mark* to get two marks. It then parses all the lines between the marks including the complete lines they point into. When *for-sure* is non-**nil**, this parses the area regardless of any cached information about the lines. Every command that uses the following routines calls this before doing so.

The default values of the start and end variables use Minimum Lines Parsed, Maximum Lines Parsed, and Defun Parse Goal to determine how big a region to parse. These two functions always include at least the minimum number of lines before and after the mark passed to them. They try to include Defun Parse Goal number of top level forms before and after the mark passed them, but these functions never return marks that include more than the maximum number of lines before or after the mark passed to them.

form-offset *mark count* [*Function*]

This tries to move *mark count* forms forward if positive or *-count* forms backwards if negative. *Mark* is always moved. If there were enough forms in the appropriate direction, this returns *mark*, otherwise nil.

top-level-offset *mark count* [*Function*]

This tries to move *mark count* top level forms forward if positive or *-count* top level forms backwards if negative. If there were enough top level forms in the appropriate direction, this returns *mark*, otherwise nil. *Mark* is moved only if this is successful.

mark-top-level-form *mark1 mark2* [*Function*]

This moves *mark1* and *mark2* to the beginning and end, respectively, of the current or next top level form. *Mark1* is used as a reference to start looking. The marks may be altered even if unsuccessful. If successful, return *mark2*, else nil. *Mark2* is left at the beginning of the line following the top level form if possible, but if the last line has text after the closing parenthesis, this leaves the mark immediately after the form.

defun-region *mark* [*Function*]

This returns a region around the current or next defun with respect to *mark*. *Mark* is not used to form the region. If there is no appropriate top level form, this signals an editor-error. This calls **pre-command-parse-check** first.

inside-defun-p *mark* [*Function*]
start-defun-p *mark* [*Function*]

These return, respectively, whether *mark* is inside a top level form or at the beginning of a line immediately before a character whose Lisp Syntax (see section 9.5) value is **:opening-paren**.

forward-up-list *mark* [*Function*]
backward-up-list *mark* [*Function*]

Respectively, these move *mark* immediately past a character whose Lisp Syntax (see section 9.5) value is **:closing-paren** or immediately before a character whose Lisp Syntax value is **:opening-paren**.

valid-spot *mark forwardp* [*Function*]

This returns **t** or **nil** depending on whether the character indicated by *mark* is a valid spot. When *forwardp* is set, use the character after mark and vice versa. Valid spots exclude commented text, inside strings, and character quoting.

defindent *name count* [*Function*]

This defines the function with *name* to have *count* special arguments. **indent-for-lisp**, the value of Indent Function (see section 15.1) in Lisp mode, uses this to specially indent these arguments. For example, **do** has two, **with-open-file** has one, etc. There are many of these defined by the system including definitions for special Hemlock forms. *Name* is a simple-string, case insensitive and purely textual (that is, not read by the Lisp reader); therefore, **"with-a-mumble"** is distinct from **"mumble:with-a-mumble"**.

15.3. English Text Buffers

This section describes some routines that understand basic English language forms.

word-offset *mark count* [*Function*]

This moves *mark count* words forward (if positive) or backwards (if negative). If *mark* is in the middle of a word, that counts as one. If there were *count* (*-count* if negative) words in the appropriate direction, this returns *mark*, otherwise nil. This always moves *mark*. A word lies between two characters whose Word Delimiter attribute value is **1** (see section 9.5).

sentence-offset *mark count* [*Function*]

This moves *mark count* sentences forward (if positive) or backwards (if negative). If *mark* is in the middle of a sentence, that counts as one. If there were *count* (*-count* if negative) sentences in the appropriate direction, this returns *mark*, otherwise nil. This always moves *mark*.

A sentence ends with a character whose Sentence Terminator attribute is **1** followed by two spaces, a newline, or the end of the buffer. The terminating character is optionally followed by any number of characters whose Sentence Closing Char attribute is **1**. A sentence begins after a previous sentence ends, at the beginning of a paragraph, or at the beginning of the buffer.

paragraph-offset *mark count* **&optional** *prefix* [*Function*]
Paragraph Delimiter Function [Hemlock *Variable*]

This moves *mark count* paragraphs forward (if positive) or backwards (if negative). If *mark* is in the middle of a paragraph, that counts as one. If there were *count* (*-count* if negative) paragraphs in the appropriate direction, this returns *mark*, otherwise nil. This only moves *mark* if there were enough paragraphs.

Paragraph Delimiter Function holds a function that takes a mark, typically at the beginning of a line, and returns whether or not the current line should break the paragraph. **default-para-delim-function** returns **t** if the next character, the first on the line, has a Paragraph Delimiter attribute value of **1**. This is typically a space, for an indented paragraph, or a

newline, for a block style. Some modes require a more complicated determinant; for example, Scribe modes adds some characters to the set and special cases certain formatting commands.

Prefix defaults to Fill Prefix (see section 15.5), and the right prefix is necessary to correctly skip paragraphs. If *prefix* is non-`nil`, and a line begins with *prefix*, then the scanning process skips the prefix before invoking the Paragraph Delimiter Function. Note, when scanning for paragraph bounds, and *prefix* is non-`nil`, lines are potentially part of the paragraph regardless of whether they contain the prefix; only the result of invoking the delimiter function matters.

The programmer should be aware of an idiom for finding the end of the current paragraph. Assume `paragraphp` is the result of moving `mark` one paragraph, then the following correctly determines whether there actually is a current paragraph:

```
(or paragraphp
    (and (last-line-p mark)
         (end-line-p mark)
         (not (blank-line-p (mark-line mark)))))
```

In this example `mark` is at the end of the last paragraph in the buffer, and there is no last newline character in the buffer. `paragraph-offset` would have returned `nil` since it could not skip any paragraphs since `mark` was at the end of the current and last paragraph. However, you still have found a current paragraph on which to operate. `mark-paragraph` understands this problem.

`mark-paragraph mark1 mark2` [*Function*]

This marks the next or current paragraph, setting *mark1* to the beginning and *mark2* to the end. This uses Fill Prefix (see section 15.5). *Mark1* is always on the first line of the paragraph, regardless of whether the previous line is blank. *Mark2* is typically at the beginning of the line after the line the paragraph ends on, this returns *mark2* on success. If this cannot find a paragraph, then the marks are left unmoved, and `nil` is returned.

15.4. Logical Pages

Logical pages are a way of dividing a file into coarse divisions. This is analogous to dividing a paper into sections, and Hemlock provides primitives for moving between the pages of a file and listing a directory of the page titles. Pages are separated by Page Delimiter characters (see section 9.5) that appear at the beginning of a line.

`goto-page` *mark n* [*Function*]

This moves *mark* to the absolute page numbered *n*. If there are less than *n* pages, it signals an editor-error. If it returns, it returns *mark*. Hemlock numbers pages starting with one for the page delimited by the beginning of the buffer and the first Page Delimiter (or the end of the buffer).

`page-offset` *mark n* [*Function*]

This moves mark forward *n* (-*n* backwards, if *n* is negative) Page Delimiter characters that are in the zero'th line position. If a Page Delimiter is the immediately next character after mark (or before mark, if *n* is negative), then skip it before starting. This always moves *mark*, and if there were enough pages to move over, it returns *mark*; otherwise, it returns `nil`.

`page-directory` *buffer* [*Function*]

This returns a list of each first non-blank line in *buffer* that follows a Page Delimiter character that is in the zero'th line position. This includes the first line of the *buffer* as the first page title. If a page is empty, then its title is the empty string.

display-page-directory *stream directory* [*Function*]

This writes the list of strings, *directory*, to *stream*, enumerating them in a field three wide. The number and string are separated by two spaces, and the first line contains headings for the page numbers and title strings.

15.5. Filling

Filling is an operation on text that breaks long lines at word boundaries before a given column and merges shorter lines together in an attempt to make each line roughly the specified length. This is different from justification which tries to add whitespace in awkward places to make each line exactly the same length. Hemlock's filling optionally inserts a specified string at the beginning of each line. Also, it eliminates extra whitespace between lines and words, but it knows two spaces follow sentences (see section 15.3).

Fill Column (initial value **75**) [Hemlock *Variable*]

Fill Prefix (initial value **nil**) [Hemlock *Variable*]

These variables hold the default values of the prefix and column arguments to Hemlock's filling primitives. If Fill Prefix is **nil**, then there is no fill prefix.

fill-region *region* **&optional** *prefix column* [*Function*]

This deletes any blank lines in region and fills it according to prefix and column. *Prefix* and *column* default to Fill Prefix and Fill Column.

fill-region-by-paragraphs *region* **&optional** *prefix column* [*Function*]

This finds paragraphs (see section 15.3) within region and fills them with **fill-region**. This ignores blank lines between paragraphs. *Prefix* and *column* default to Fill Prefix and Fill Column.

Chapter 16

Utilities

This chapter describes a number of utilities for manipulating some types of objects Hemlock uses to record information. String-tables are used to store names of variables, commands, modes, and buffers. Ring lists can be used to provide a kill ring, recent command history, or other user-visible features.

16.1. String-table Functions

String tables are similar to Common Lisp hash tables in that they associate a value with an object. There are a few useful differences: in a string table the key is always a case insensitive string, and primitives are provided to facilitate keyword completion and recognition. Any type of string may be added to a string table, but the string table functions always return **simple-string**'s.

A string entry in one of these tables may be thought of as being separated into fields or keywords. The interface provides keyword completion and recognition which is primarily used to implement some Echo Area commands. These routines perform a prefix match on a field-by-field basis allowing the ambiguous specification of earlier fields while going on to enter later fields. While string tables may use any **string-char** as a separator, the use of characters other than **space** may make the Echo Area commands fail or work unexpectedly.

make-string-table &key :separator :initial-contents [*Function*]

This function creates an empty string table that uses *separator* as the character, which must be a **string-char**, that distinguishes fields. *Initial-contents* specifies an initial set of strings and their values in the form of a dotted **a-list**, for example:

```
'(("Global" . t) ("Mode" . t) ("Buffer" . t))
```

string-table-p *string-table* [*Function*]

This function returns **t** if *string-table* is a **string-table** object, otherwise **nil**.

delete-string *string table* [*Function*]

clrstring *table* [*Function*]

delete-string removes any entry for *string* from the **string-table** *table*, returning **t** if there was an entry. **clrstring** removes all entries from *table*.

getstring *string table* [*Function*]

This function returns as multiple values, first the value corresponding to the string if it is found and **nil** if it isn't, and second **t** if it is found and **nil** if it isn't.

This may be set with **setf** to add a new entry or to store a new value for a string. It is an error to try to insert a string with more than one field separator character occurring contiguously.

complete-string *string tables* [*Function*]

This function completes *string* as far as possible over the list of *tables*, returning five values. It is an error for *tables* to have different separator characters. The five return values are as follows:

- The maximal completion of the string or **nil** if there is none.
- An indication of the usefulness of the returned string:

  :none There is no completion of *string*.

  :complete The completion is a valid entry, but other valid completions exist too. This occurs when the supplied string is an entry as well as initial substring of another entry.

  :unique The completion is a valid entry and unique.

  :ambiguous The completion is invalid; **get-string** would return **nil** and **nil** if given the returned string.

- The value of the string when the completion is **:unique** or **:complete**, otherwise **nil**.
- An index, or nil, into the completion returned, indicating where the addition of a single field to *string* ends. The command Complete Field uses this when the completion contains the addition to *string* of more than one field.
- An index to the separator following the first ambiguous field when the completion is **:ambiguous** or **:complete**, otherwise **nil**.

find-ambiguous *string table* [*Function*]
find-containing *string table* [*Function*]

find-ambiguous returns a list in alphabetical order of all the strings in *table* matching *string*. This considers an entry as matching if each field in *string*, taken in order, is an initial substring of the entry's fields; entry may have fields remaining.

find-containing is similar, but it ignores the order of the fields in *string*, returning all strings in *table* matching any permutation of the fields in *string*.

do-strings (*string-var value-var table* [*result*]) {*declaration*}* {*tag* | *statement*}* [*Macro*]

This macro iterates over the strings in *table* in alphabetical order. On each iteration, it binds *string-var* to an entry's string and *value-var* to an entry's value.

16.2. Ring Functions

There are various purposes in an editor for which a ring of values can be used, so Hemlock provides a general ring buffer type. It is used for maintaining a ring of killed regions (see section 4.3), a ring of marks (see section 3.1), or a ring of command strings which various modes and commands maintain as a history mechanism.

make-ring *length* **&optional** *delete-function* [*Function*]

Makes an empty ring object capable of holding up to *length* Lisp objects. *Delete-function* is a function that each object is passed to before it falls off the end. *Length* must be greater than zero.

ringp *ring* [*Function*]

Returns **t** if *ring* is a **ring** object, otherwise **nil**.

ring-length *ring* [*Function*]

Returns as multiple-values the number of elements which *ring* currently holds and the maximum number of elements which it may hold.

ring-ref *ring index* [*Function*]

Returns the *index*'th item in the *ring*, where zero is the index of the most recently pushed. This may be set with **setf**.

ring-push *object ring* [*Function*]

Pushes *object* into *ring*, possibly causing the oldest item to go away.

ring-pop *ring* [*Function*]

Removes the most recently pushed object from *ring* and returns it. If the ring contains no elements then an error is signalled.

rotate-ring *ring offset* [*Function*]

With a positive *offset*, rotates *ring* forward that many times. In a forward rotation the index of each element is reduced by one, except the one which initially had a zero index, which is made the last element. A negative offset rotates the ring the other way.

16.3. Undoing commands

save-for-undo *name method* **&optional** *cleanup method-undo buffer* [*Function*]

This saves information to undo a command. *Name* is a string to display when prompting the user for confirmation when he invokes the Undo command (for example, "**kill**" or "**Fill Paragraph**"). *Method* is the function to invoke to undo the effect of the command. *Method-undo* is a function that undoes the undo function, or effectively re-establishes the state immediately after invoking the command. If there is any existing undo information, this invokes the *cleanup* function; typically *method* closes over or uses permanent marks into a buffer, and the *cleanup* function should delete such references. *Buffer* defaults to the **current-buffer**, and the Undo command only invokes undo methods when they were saved for the buffer that is current when the user invokes Undo.

make-region-undo *kind name region* **&optional** *mark-or-region* [*Function*]

This handles three common cases that commands fall into when setting up undo methods, including cleanup and method-undo functions (see **save-for-undo**). These cases are indicated by the *kind* argument:

:twiddle Use this kind when a command modifies a region, and the undo information indicates how to swap between two regions -- the one before any modification occurs and the resulting region. *Region* is the resulting region, and it has permanent marks into the buffer. *Mark-or-region* is a region without marks into the buffer (for example, the result of **copy-region**). As a result of calling this, a first invocation of Undo deletes *region*, saving it, and inserts *mark-or-region* where *region* used to be. The undo method sets up for a second invocation of Undo that will undo the effect of the undo; that is, after two calls, the buffer is exactly as it was after invoking the command. This activity is repeatable any number of times. This establishes a cleanup method that deletes the two permanent marks into the buffer used to locate the modified region.

:insert Use this kind when a command has deleted a region, and the undo information indicates how to re-insert the region. *Region* is the deleted and saved region, and it does not contain marks into any buffer. *Mark-or-region* is a permanent mark into the

buffer where the undo method should insert *region*. As a result of calling this, a first invocation of Undo inserts *region* at *mark-or-region* and forms a region around the inserted text with permanent marks into the buffer. This allows a second invocation of Undo to undo the effect of the undo; that is, after two calls, the buffer is exactly as it was after invoking the command. This activity is repeatable any number of times. This establishes a cleanup method that deletes either the permanent mark into the buffer or the two permanent marks of the region, depending on how many times the user used Undo.

`:delete` Use this kind when a command has inserted a block of text, and the undo information indicates how to delete the region. *Region* has permanent marks into the buffer and surrounds the inserted text. Leave *Mark-or-region* unspecified. As a result of calling this, a first invocation of Undo deletes *region*, saving it, and establishes a permanent mark into the buffer to remember where the *region* was. This allows a second invocation of Undo to undo the effect of the undo; that is, after two calls, the buffer is exactly as it was after invoking the command. This activity is repeatable any number of times. This establishes a cleanup method that deletes either the permanent mark into the buffer or the two permanent marks of the region, depending on how many times the user used Undo.

Name in all cases is an appropriate string indicating what the command did. This is used by Undo when prompting the user for confirmation before calling the undo method. The string used by Undo alternates between this argument and something to indicate that the user is undoing an undo.

Chapter 17

Auxiliary Systems

This chapter describes utilities that some implementations of Hemlock may leave unprovided or unsupported.

17.1. CLX Interface

17.1.1. Keyboard and Mouse Input

These routines are defined in the "**EXTENSIONS**" package since other projects have often used Hemlock's input translations for interfacing to CLX.

translate-character *display scan-code bits* [*Function*]

This translates *scan-code* and modifier *bits* to a Lisp character. This first maps *scan-code* to a keysym with index 0 (see **xlib:keycode->keysym** in the CLX documentation); however, if *bits* include the **:shift** bit (see **define-keyboard-modifier**), then first map with index 1. The keysym is then mapped to a character as determined by **define-keysym**.

If this first mapping of the keysym does not result in a character, and the keysym does not represent a modifier key (shift, ctrl, etc.), then this signals an error. If the keysym does represent a modifier key, then this returns **nil**. The theory is that the user's pressing modifier keys is uninteresting, and, therefore, these key presses are ignored.

When the first mapping of keysym does result in a character, the translation gets more complicated. If *bits* exclude the **:shift** bit but include the **:lock** bit, and the character is alphabetic, then this maps *scan-code* again with an index of 1 this time to a possibly different keysym. Then this keysym is mapped to a character. If this does not result in a character, an error is signaled. The first character found is invalid if the **:lock** bit is on, and the second keysym must be defined.

Given the first mapping of the first keysym results in a character, and *bits* include the **:shift** bit, then this tries to map that keysym again to a special character defined as the shifted character with **define-keysym**. This allows *scan-code*'s that map to the same keysym, shifted or unshifted, to map to distinct characters. For example, the number pad, arrow keys, and other special keys, map to the same keysym regardless of modifier bits, and this translation mechanism provides a simple way to make use of shifting these keys. Hemlock's default mappings return characters with the **:super** bit on when shifting these keys. This may seem perverse, but an editor has much more interesting demands on the keyboard than standard window clients.

define-keysym *keysym char* **&optional** *shifted-char* [*Function*]

This causes the X *keysym* to map to *char*. If the user supplies *shifted-char*, it is a character to use when the incoming keysym's **:shift** modifier (see **define-keyboard-modifier** below) is set. If the user does not supply *shifted-char*, and the incoming keysym's **:shift** modifier is set, then **translate-character** calls **xlib:keycode->keysym** with an index of **1** instead of **0**. If the incoming keysym's **:lock** modifier is set, **translate-character** treats it as a caps-lock, not a shift-lock.

define-keyboard-modifier *clx-mask modifier-name* [*Function*]

This causes **translate-character** to interpret *clx-mask* (see **xlib:make-state-mask** in the CLX documentation) as modifier *modifier-name*, which must be one of **:control**, **:meta**, **:super**, **:hyper**, **:shift**, or **:lock**.

translate-mouse-character *scan-code bits event-key* [*Function*]

This translates button code, *scan-code*, and modifier bits, *bits*, for *event-key* to a Lisp character. *Event-key* must be one of **:button-press** or **:button-release**. When *bits* include the **:shift** bit, this returns the character defined as the shifted character by **define-mouse-code**. Since the characters that represent mouse button presses and releases cannot be uppercased, Hemlock provides a simple means for making use of the **:shift** bit; the default mappings return mouse button characters with the **:super** bit set. When translating mouse characters, the **:lock** modifier is treated the same as the **:shift** modifier.

define-mouse-code *button char shifted-char event-key* [*Function*]

This causes the X button code to map to *char*. When **translate-mouse-character** sees **:shift** and **:lock** modifiers, it returns *shifted-char*. For the same button code, *event-key* may be **:button-press** and **:button-release** on separate calls since button presses and releases are not distinguished by modifier bits but by completely distinct characters

17.1.2. Graphics Window Hooks

This section describes a few hooks used by Hemlock's internals to handle graphics windows that manifest Hemlock windows. Some heavy users of Hemlock as a tool have needed these in the past, but typically functions that replace the default values of these hooks must be written in the "**HEMLOCK-INTERNALS**" or "**HI**" package. All of these symbols are internal to this package.

If you need this level of control for your application, consult the current implementation for code fragments that will be useful in correctly writing your own window hook functions.

create-window-hook [*Variable*]

This holds a function that Hemlock calls when **make-window** executes under CLX. Hemlock passes the CLX display and the following arguments from **make-window**: starting mark, ask-user, x, y, width, height, and modelinep. The function returns a CLX window or nil indicating one could not be made.

delete-window-hook [*Variable*]

This holds a function that Hemlock calls when **delete-window** executes under CLX. Hemlock passes the CLX window and the Hemlock window to this function.

random-typeout-hook [*Variable*]

This holds a function that Hemlock calls when random typeout occurs under CLX. Hemlock passes it a Hemlock device, a pre-existing CLX window or **nil**, and the number of pixels needed to display the number of lines requested in the **with-random-typeout** form. It should return a window, and if a new window is created, then a CLX gcontext must be the second value.

create-initial-windows-hook [*Variable*]

This holds a function that Hemlock calls when it initializes the screen manager and makes the first windows, typically windows for the Main and Echo Area buffers. Hemlock passes the function a Hemlock device.

17.1.3. Entering and Leaving Windows

Enter Window Hook [Hemlock *Variable*]

When the mouse enters an editor window, Hemlock invokes the functions in this hook. These functions take a Hemlock window as an argument.

Exit Window Hook [Hemlock *Variable*]

When the mouse exits an editor window, Hemlock invokes the functions in this hook. These functions take a Hemlock window as an argument.

17.1.4. How to Lose Up-Events

Often the only useful activity user's design for the mouse is to click on something. Hemlock sees a character representing the down event, but what do you do with the up event character that you know must follow? Having the command eat it would be tasteless, and would inhibit later customizations that make use of it, possibly adding on to the down click command's functionality. Bind the corresponding up character to the command described here.

Do Nothing [*Command*]

This does nothing as many times as you tell it.

17.2. Slave Lisps

Some implementations of Hemlock feature the ability to manage multiple slave Lisps, each connected to one editor Lisp. The routines discussed here spawn slaves, send evaluation and compilation requests, return the current server, etc. This is very powerful because without it you can lose your editing state when code you are developing causes a fatal error in Lisp.

17.2.1. The Current Slave

There is a slave-information structure that these return which is suitable for passing to the routines described in the following subsections.

create-slave &optional *name* [*Function*]

This creates a slave that tries to connect to the editor. When the slave connects to the editor, this returns a slave-information structure, and the interactive buffer is the buffer named *name*. This generates a name if *name* is **nil**. In case the slave never connects, this will eventually timeout and signal an editor-error.

get-current-server &optional *errorp* [*Function*]
Current Eval Server [Hemlock *Variable*]

This returns the server-information for the Current Eval Server after making sure it is valid. Of course, a slave Lisp can die at anytime. If this variable is **nil**, and *errorp* is non-**nil**, then this signals an editor-error; otherwise, it tries to make a new slave. If there is no current eval server, then this tries to make a new slave, prompting the user based on a few variables (see the *Hemlock User's Manual*).

get-current-compile-server [*Function*]
Current Compile Server [Hemlock *Variable*]

This returns the server-information for the Current Compile Server after making sure it is valid. This may return nil. Since multiple slaves may exist, it is convenient to use one for developing code and one for compiling files. The compilation commands that use slave Lisps prefer to use the current compile server but will fall back on the current eval server when necessary. Typically, users only have separate compile servers when the slave Lisp can live on a separate workstation to save cycles on the editor machine, and the Hemlock commands only use this for compiling files.

17.2.2. Asynchronous Operation Queuing

The routines in this section queue requests with an eval server. Requests are always satisfied in order, but these do not wait for notification that the operation actually happened. Because of this, the user can continue editing while his evaluation or compilation occurs. Note, these usually execute in the slave immediately, but if the interactive buffer connected to the slave is waiting for a form to return a value, the operation requested must wait until the slave is free again.

string-eval *string* **&key :server :package :context** [*Function*]
region-eval *region* **&key :server :package :context** [*Function*]
region-compile *region* **&key :server :package** [*Function*]

string-eval queues the evaluation of the form read from *string* on eval server *server*. *Server* defaults to the result of **get-current-server**, and *string* is a simple-string. The evaluation occurs with ***package*** bound in the slave to the package named by *package*, which defaults to Current Package or the empty string; the empty string indicates that the slave should evaluate the form in its current package. The slave reads the form in *string* within this context as well. *Context* is a string to use when reporting start and end notifications in the Echo Area buffer; it defaults to the concatenation of **"evaluation of "** and *string*.

region-eval is the same as **string-eval**, but *context* defaults differently. If the user leaves this unsupplied, then it becomes a string involving part of the first line of region.

region-compile is the same as the above. *Server* defaults the same; it does not default to **get-current-compile-server** since this compiles the region into the slave Lisp's environment, to affect what you are currently working on.

file-compile *file* **&key :output-file :error-file :load :server :package** [*Function*]
Remote Compile File (initial value **t**) [Hemlock *Variable*]

This compiles *file* in a slave Lisp. When *output-file* is **t** (the default), this uses a temporary output file that is publicly writable in case the client is on another machine, which allows for file systems that do not permit remote write access. This renames the temporary file to the appropriate binary name or deletes it after compilation. Setting Remote Compile File to **nil**, inhibits this. If *output-file* is non-**nil** and not **t**, then it is the name of the binary file to write. The compilation occurs with ***package*** bound in the slave to the package named by *package*, which defaults to Current Package or the empty string; the

empty string indicates that the slave should evaluate the form in its current package. *Error-file* is the file in which to record compiler output, and a **nil** value inhibits this file's creation. *Load* indicates whether to load the resulting binary file, defaults to **nil**. *Server* defaults to **get-current-compile-server**, but if this returns nil, then *server* defaults to **get-current-server**.

17.2.3. Synchronous Operation Queuing

The routines in this section queue requests with an eval server and wait for confirmation that the evaluation actually occurred. Because of this, the user cannot continue editing while the slave executes the request. Note, these usually execute in the slave immediately, but if the interactive buffer connected to the slave is waiting for a form to return a value, the operation requested must wait until the slave is free again.

eval_form-in-client *string* [*Function*]

This queues the evaluation of the form read from *string* in the current slave Lisp and waits for the results. This returns the results from the slave Lisp in a list of string values. These can be read or simply displayed depending on the **print**'ing of the evaluation results. The slave reads the form from *string* and evaluates it with the slave's ***package*** bound to the package named by Current Package. If this is **nil**, then the empty string is passed to the slave indicating it should use the current package. While the slave executes the form, it binds ***terminal-io*** to a stream that signals errors when read from and dumps output to a bit-bucket. This prevents the editor and slave from dead locking by waiting for each other to reply.

17.3. Spelling

Hemlock supports spelling checking and correcting commands based on the ITS Ispell dictionary. These commands use the following routines which include adding and deleting entries, reading the Ispell dictionary in a compiled binary format, reading user dictionary files in a text format, and checking and correcting possible spellings.

maybe-read-spell-dictionary [*Function*]

This reads the default binary Ispell dictionary. Users must call this before the following routines will work.

spell-read-dictionary *filename* [*Function*]

This adds entries to the dictionary from the lines in the file *filename*. Dictionary files contain line oriented records like the following:

```
entry1/flag1/flag2
entry2
entry3/flag1
```

The flags are the Ispell flags indicating which endings are appropriate for the given entry root, but these are unnecessary for user dictionary files. You can consult Ispell documentation if you want to know more about them.

spell-add-entry *line* **&optional** *word-end* [*Function*]

This takes a line from a dictionary file, and adds the entry described by *line* to the dictionary. *Word-end* defaults to the position of the first slash character or the length of the line. *Line* is destructively modified.

spell-remove-entry *entry* [*Function*]

This removes entry, a simple-string, from the dictionary, so it will be an unknown word. This destructively modifies *entry*. If it is a root word, then all words derived with *entry* and its flags will also be deleted. If *entry* is a word derived from some root word, then the root and any words derived from it remain known words.

correct-spelling *word* [*Function*]

This checks the spelling of *word* and outputs the results. If this finds *word* is correctly spelled due to some appropriate suffix on a root, it generates output indicating this. If this finds *word* as a root entry, it simply outputs that it found *word*. If this cannot find *word* at all, then it outputs possibly correct close spellings. This writes to ***standard-output***, and it calls **maybe-read-spell-dictionary** before attempting any lookups.

spell-try-word *word word-len* [*Function*]
max-entry-length [*Constant*]

This returns an index into the dictionary if it finds *word* or an appropriate root. *Word-len* must be inclusively in the range 2 through **max-entry-length**, and it is the length of *word*. *Word* must be uppercase. This returns a second value indicating whether it found *word* due to a suffix flag, **nil** if *word* is a root entry.

spell-root-word *index* [*Function*]

This returns a copy of the root word at dictionary entry *index*. This index is the same as returned by **spell-try-word**.

spell-collect-close-words *word* [*Function*]

This returns a list of words correctly spelled that are *close* to *word*. *Word* must be uppercase, and its length must be inclusively in the range 2 through **max-entry-length**. Close words are determined by the Ispell rules:

1. Two adjacent letters can be transposed to form a correct spelling.
2. One letter can be changed to form a correct spelling.
3. One letter can be added to form a correct spelling.
4. One letter can be removed to form a correct spelling.

spell-root-flags *index* [*Function*]

This returns a list of suffix flags as capital letters that apply to the dictionary root entry at *index*. This index is the same as returned by **spell-try-word**.

17.4. File Utilities

Some implementations of Hemlock provide extensive directory editing commands, Dired, including a single wildcard feature. These commands are based on the following interface exported from the "**DIRED**" package. An asterisk denotes a wildcard.

copy-file *spec1 spec2* **&key :update :clobber :directory** [*Function*]

This function copies *spec1* to *spec2*. It accepts a single wildcard in the filename portion of the specification, and it accepts directories. This copies files maintaining the source's write date.

If *spec1* and *spec2* are both directories, this recursively copies the files and subdirectory structure of

spec1; if *spec2* is in the subdirectory structure of *spec1*, the recursion will not descend into it. Use "**/spec1/***" to copy only the files from *spec1* to directory *spec2*.

If *spec2* is a directory, and *spec1* is a file, then this copies *spec1* into *spec2* with the same **pathname-name**.

When **:update** is non-**nil**, then the copying process only copies files if the source is newer than the destination.

When **:update** and **:clobber** are **nil**, and the destination exists, the copying process stops and asks the user whether the destination should be overwritten.

When the user supplies **:directory**, it is a list of pathnames, directories excluded, and *spec1* is a pattern containing one wildcard. This then copies each of the pathnames whose **pathname-name** matches the pattern. *Spec2* is either a directory or a pathname whose **pathname-name** contains a wildcard.

rename-file *spec1 spec2* **&key :clobber :directory** [*Function*]

This function renames *spec1* to *spec2*. It accepts a single wildcard in the filename portion of the specification, and *spec2* may be a directory with the destination specification resulting in the merging of *spec2* with *spec1*. If **:clobber** is **nil**, and *spec2* exists, then this asks the user to confirm the renaming. When renaming a directory, end the specification without the trailing slash.

When the user supplies **:directory**, it is a list of pathnames, directories excluded, and *spec1* is a pattern containing one wildcard. This then copies each of the pathnames whose **pathname-name** matches the pattern. *Spec2* is either a directory or a pathname whose **pathname-name** contains a wildcard.

delete-file *spec* **&key :recursive :clobber** [*Function*]

This function deletes *spec*. It accepts a single wildcard in the filename portion of the specification, and it asks for confirmation on each file if **:clobber** is **nil**. If **:recursive** is non-**nil**, then *spec* may be a directory to recursively delete the entirety of the directory and its subdirectory structure. An empty directory may be specified without **:recursive** being non-**nil**. Specify directories with the trailing slash.

find-file *name* **&optional** *directory find-all* [*Function*]

This function finds the file with **file-namestring** *name*, recursively looking in *directory*. If *find-all* is non-**nil** (defaults to **nil**), then this continues searching even after finding a first occurrence of file. *Name* may contain a single wildcard, which causes *find-all* to default to **t** instead of **nil**.

make-directory *name* [*Function*]

This function creates the directory with *name*. If it already exists, this signals an error.

pathnames-from-pattern *pattern files* [*Function*]

This function returns a list of pathnames from the list *files* whose **file-namestring**'s match *pattern*. *Pattern* must be a non-empty string and contain only one asterisk. *Files* contains no directories.

update-default [*Variable*]
clobber-default [*Variable*]
recursive-default [*Variable*]

These are the default values for the keyword arguments above with corresponding names. These default to **nil**, **t**, and **nil** respectively.

report-function [*Variable*]
error-function [*Variable*]
yesp-function [*Variable*]

These are the function the above routines call to report progress, signal errors, and prompt for *yes* or *no*. These all take format strings and arguments.

17.5. Beeping

hemlock-beep [*Function*]

Hemlock binds **system:*beep-function*** to this function to beep the device. It is different for different devices.

Bell Style (initial value **:border-flash**) [Hemlock *Variable*]
Beep Border Width (initial value **20**) [Hemlock *Variable*]

Bell Style determines what ***hemlock-beep*** does in Hemlock under CLX. Acceptable values are **:border-flash**, **:feep**, **:border-flash-and-feep**, **:flash**, **:flash-and-feep**, and **nil** (do nothing).

Beep Border Width is the width in pixels of the border flashed by border flash beep styles.

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