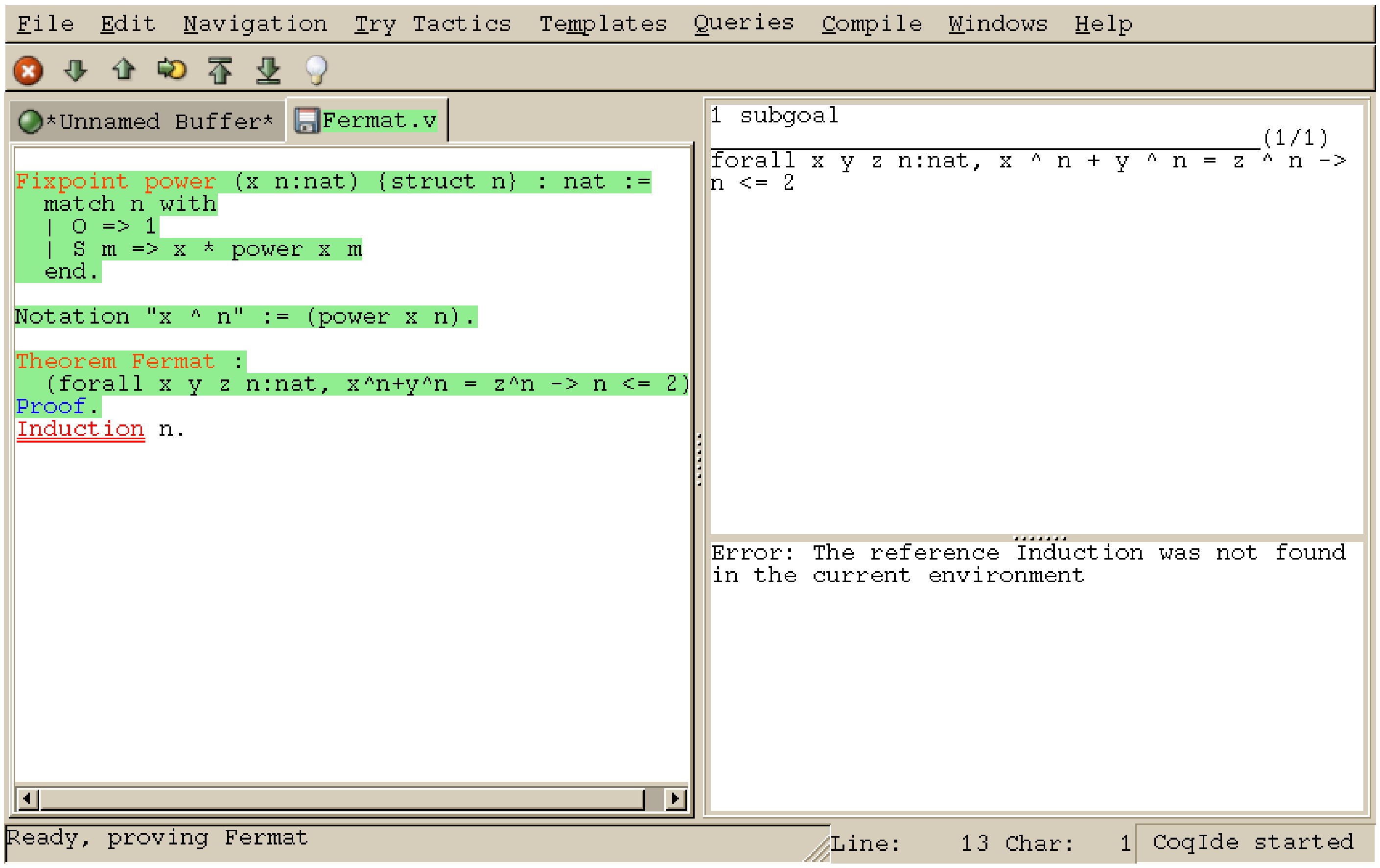
Chapter 14 Coq Integrated Development Environment

The Coq Integrated Development Environment is a graphical tool, to be used as a user-friendly replacement to `coqtop`. Its main purpose is to allow the user to navigate forward and backward into a Coq vernacular file, executing corresponding commands or undoing them respectively.

CoqIDE is run by typing the command `coqide` on the command line. Without argument, the main screen is displayed with an ``unnamed buffer'', and with a file name as argument, another buffer displaying the contents of that file. Additionally, coqide accepts the same options as coqtop, given in Chapter 12, the ones having obviously no meaning for CoqIDE being ignored.


File Edit Navigation Try Tactics Templates Queries Compile Windows Help
Unnamed Buffer
Fermat.v

```
Fixpoint power (x n:nat) {struct n} : nat :=
  match n with
  | O => 1
  | S m => x * power x m
  end.

Notation "x ^ n" := (power x n).

Theorem Fermat :
  (forall x y z n:nat, x^n+y^n = z^n -> n <= 2)
Proof.
Induction n.
```

```
1 subgoal
                                                  (1/1)
forall x y z n:nat, x ^ n + y ^ n = z ^ n ->
n <= 2
```

```
Error: The reference Induction was not found
in the current environment
```

```
Ready, proving Fermat          Line:    13 Char:    1  CoqIde started
```

Figure 14.1: CoqIDE main screen

A sample CoqIDE main screen, while navigating into a file `Fermat.v`, is shown on Figure 14.1. At the top is a menu bar, and a tool bar below it. The large window on the left is displaying the various *script buffers*. The upper right window is the *goal window*, where goals to prove are displayed. The lower right window is the *message window*, where various messages resulting from commands are displayed. At the bottom is the status bar.

14.1 Managing files and buffers, basic edition

In the script window, you may open arbitrarily many buffers to edit. The *File* menu allows you to open files or create some, save them, print or export them into various formats. Among all these buffers, there is always one which is the current *running buffer*, whose name is displayed on a green background, which is the one where Coq commands are currently executed.

Buffers may be edited as in any text editor, and classical basic editing commands (Copy/Paste, ...) are available in the *Edit* menu. CoqIDE offers only basic editing commands, so if you need more complex editing commands, you may launch your favorite text editor on the current buffer, using the *Edit/External Editor* menu.

14.2 Interactive navigation into Coq scripts

The running buffer is the one where navigation takes place. The toolbar proposes five basic commands for this. The first one, represented by a down arrow icon, is for going forward executing one command. If that command is successful, the part of the script that has been executed is displayed on a green background. If that command fails, the error message is displayed in the message window, and the location of the error is emphasized by a red underline.

On Figure 14.1, the running buffer is `Fermat.v`, all commands until the `Theorem` have been already executed, and the user tried to go forward executing `Induction n`. That command failed because no such tactic exist (tactics are now in lowercase...), and the wrong word is underlined.

Notice that the green part of the running buffer is not editable. If you ever want to modify something you have to go backward using the up arrow tool, or even better, put the cursor where you want to go back and use the goto button. Unlike with `coqtop`, you should never use `Undo` to go backward.

Two additional tool buttons exist, one to go directly to the end and one to go back to the beginning. If you try to go to the end, or in general to run several commands using the goto button, the execution will stop whenever an error is found.

If you ever try to execute a command which happens to run during a long time, and would like to abort it before its termination, you may use the interrupt button (the white cross on a red circle).

Finally, notice that these navigation buttons are also available in the menu, where their keyboard shortcuts are given.

14.3 Try tactics automatically

The menu `Try Tactics` provides some features for automatically trying to solve the current goal using simple tactics. If such a tactic succeeds in solving the goal, then its text is automatically inserted into the script. There is finally a combination of these tactics, called the *proof wizard* which will try each of them in turn. This wizard is also available as a tool button (the light bulb). The set of tactics tried by the wizard is customizable in the preferences.

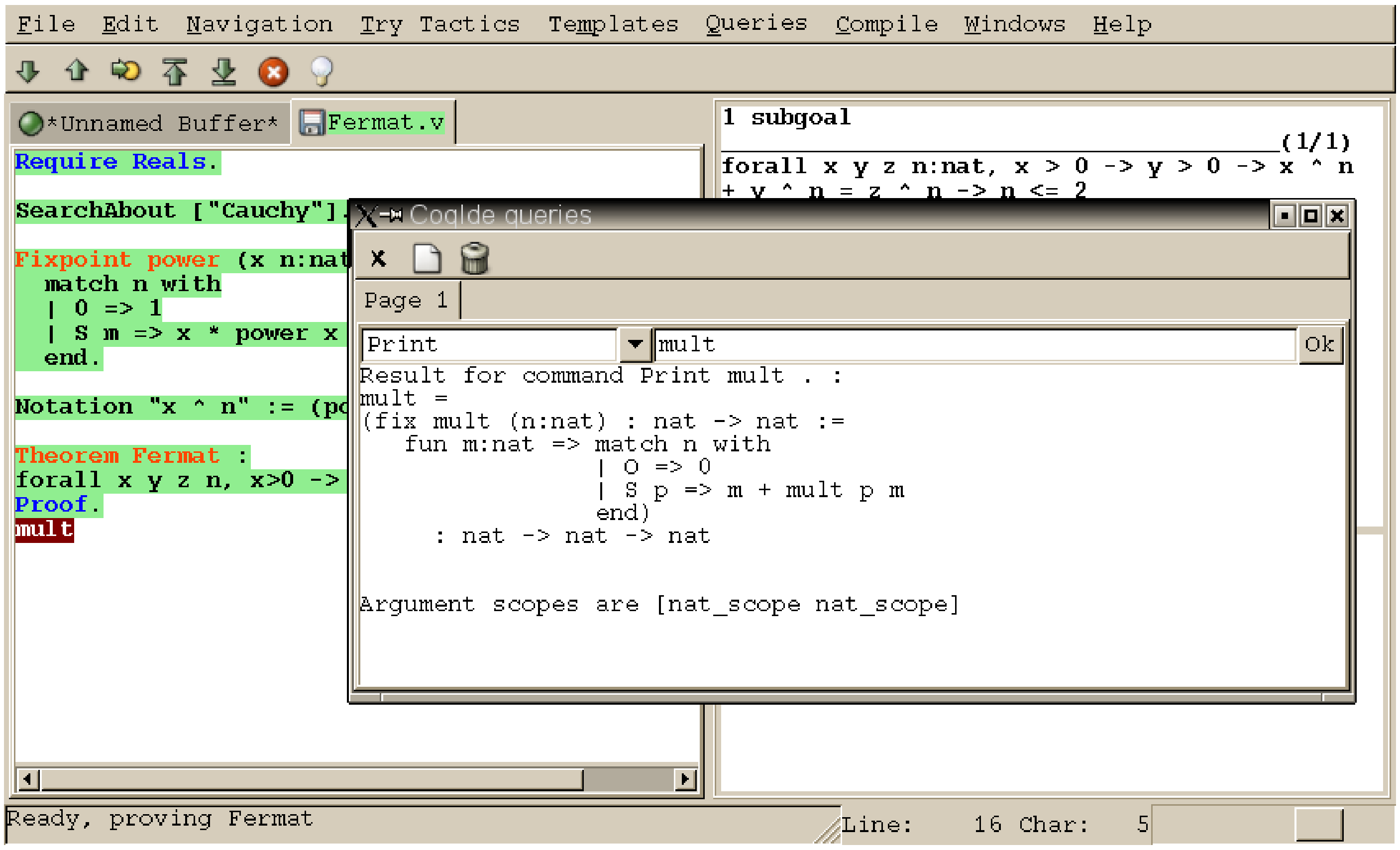
These tactics are general ones, in particular they do not refer to particular hypotheses. You may also try specific tactics related to the goal or one of the hypotheses, by clicking with the right mouse button one the goal or the considered hypothesis. This is the ``contextual menu on goals" feature, that may be disabled in the preferences if undesirable.

14.4 Vernacular commands, templates

The `Templates` menu allows to use shortcuts to insert vernacular commands. This is a nice way to proceed if you are not sure of the spelling of the command you want.

Moreover, this menu offers some *templates* which will automatic insert a complex command like Fixpoint with a convenient shape for its arguments.

14.5 Queries



```
Require Reals.

SearchAbout ["Cauchy"].

Fixpoint power (x n:nat
  match n with
  | 0 => 1
  | S m => x * power x
  end.

Notation "x ^ n" := (po

Theorem Fermat :
forall x y z n, x>0 ->
Proof.
mult
```

```
1 subgoal
______________________________________(1/1)
forall x y z n:nat, x > 0 -> y > 0 -> x ^ n
+ y ^ n = z ^ n -> n <= 2
```

```
Result for command Print mult . :
mult =
(fix mult (n:nat) : nat -> nat :=
   fun m:nat => match n with
                | O => 0
                | S p => m + mult p m
                end)
    : nat -> nat -> nat


Argument scopes are [nat_scope nat_scope]
```

Figure 14.2: CoqIDE: the query window

We call *query* any vernacular command that do not change the current state, such as `Check`, `SearchAbout`, etc. Those commands are of course useless during compilation of a file, hence should not be included in scripts. To run such commands without writing them in the script, CoqIDE offers another input window called the *query window*. This window can be displayed on demand, either by using the `Window` menu, or directly using shortcuts given in the `Queries` menu. Indeed, with CoqIDE the simplest way to perform a `SearchAbout` on some identifier is to select it using the mouse, and pressing `F2`. This will both make appear the query window and run the `SearchAbout` in it, displaying the result. Shortcuts `F3` and `F4` are for `Check` and `Print` respectively. Figure 14.2 displays the query window after selection of the word ``mult" in the script windows, and pressing `F4` to print its definition.

14.6 Compilation

The `Compile` menu offers direct commands to:

- compile the current buffer
- run a compilation using `make`
- go to the last compilation error
- create a `makefile` using `coq_makefile`.

14.7 Customizations

You may customize your environment using menu `Edit/Preferences`. A new window will be displayed, with several customization sections presented as a notebook.

The first section is for selecting the text font used for scripts, goal and message windows.

The second section is devoted to file management: you may configure automatic saving of files, by periodically saving the contents into files named `#f#` for each opened file `f`. You may also activate the *revert* feature: in case a opened file is modified on the disk by a third party, CoqIDE may read it again for you. Note that in the case you edited that same file, you will be prompt to choose to either discard your changes or not. The `File charset encoding` choice is described below in Section 14.8.3

The `Externals` section allows to customize the external commands for compilation, printing, web browsing. In the browser command, you may use `%s` to denote the URL to open, for example: `mozilla -remote "OpenURL(%s)"`.

The `Tactics Wizard` section allows to defined the set of tactics that should be tried, in sequence, to solve the current goal.

The last section is for miscellaneous boolean settings, such as the ``contextual menu on goals'' feature presented in Section 14.3.

Notice that these settings are saved in the file `.coqiderc` of your home directory.

A gtk2 accelerator keymap is saved under the name `.coqide.keys`. This file should not be edited manually: to modify a given menu shortcut, go to the corresponding menu item without releasing the mouse button, press the key you want for the new shortcut, and release the mouse button afterwards.

For experts: it is also possible to set up a specific gtk resource file, under the name `.coqide-gtk2rc`, following the gtk2 resources syntax `http://developer.gnome.org/doc/API/2.0/gtk/gtk-Resource-Files.html`. Such a default resource file exists in the Coq library, you may copy this file into your home directory, and edit it using any text editor, CoqIDE itself for example.

14.8 Using unicode symbols

CoqIDE supports unicode character encoding in its text windows, consequently a large set of symbols is available for notations.

14.8.1 Displaying unicode symbols

You just need to define suitable notations as described in Chapter 11. For example, to use the mathematical symbols for all and there exists, you may define

```
Notation "for all x : t, P" :=
    (forall x:t, P) (at level 200, x ident).
Notation "there exists x : t, P" :=
    (exists x:t, P) (at level 200, x ident).
```

There exists a small set of such notations already defined, in the file `utf8.v` of Coq library, so you may enable them just by `Require utf8` inside CoqIDE, or equivalently, by starting CoqIDE with `coqide -l utf8`.

However, there are some issues when using such unicode symbols: you of course need to use a character font which supports them. In the Fonts section of the preferences, the Preview line displays some unicode symbols, so you could figure out if the selected font is OK. Related to this, one thing you may need to do is choose whether Gtk should use antialiased fonts or not, by setting the environment variable `GDK_USE_XFT` to 1 or 0 respectively.

14.8.2 Defining an input method for non ASCII symbols

To input an Unicode symbol, a general method is to press both the CONTROL and the SHIFT keys, and type the hexadecimal code of the symbol required, for example `2200` for the for all symbol. A list of symbol codes is available at `http://www.unicode.org`.

Of course, this method is painful for symbols you use often. There is always the possibility to copy-paste a symbol already typed in. Another method is to bind some key combinations for frequently used symbols. For example, to bind keys `F11` and `F12` to for all and there exists respectively, you may add

```
bind "F11" "insert-at-cursor" ("for all")
bind "F12" "insert-at-cursor" ("there exists")
```

to your `binding "text"` section in `.coqiderc-gtk2rc`.

14.8.3 Character encoding for saved files

In the `Files` section of the preferences, the encoding option is related to the way files are saved.

If you have no need to exchange files with non UTF-8 aware applications, it is better to choose the UTF-8 encoding, since it guarantees that your files will be read again without problems. (This is because when CoqIDE reads a file, it tries to automatically detect its character encoding.)

If you choose something else than UTF-8, then missing characters will be written encoded by `\x{....}` or `\x{........}` where each dot is an hexadecimal digit: the number between braces is the hexadecimal UNICODE index for the missing character.

14.9 Building a custom CoqIDE with user ML code

You can do this as described in Section 13.1 for a custom coq text toplevel, simply by adding option `-ide` to `coqmktop`, that is something like

```
coqmktop -ide -byte m1.cmo ... mn.cmo
```

or

```
coqmktop -ide -opt m1.cmx ... mn.cmx
```