

literate clojure

a literate programming tool to write clojure codes in org mode.

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1 Introduction

This is a clojure library to show a way how to use [literate programming](#) in clojure.

It extends the clojure read syntax so clojure can load org file as source file directly.

[literate programming examples](#) show the reason why use org mode,

By using clojure package [literate-clojure](#) , emacs [org mode](#) and elisp library [polymode](#), literate programming can be easy in one org file containing both documentation and source codes, and this org file works well with [cider](#).

2 how to do it?

In org mode, the comment line start with character # (see [org manual](#)), and the lisp codes exists between `#+begin_src lisp` and `#+end_src` (see [org manual](#)).

```
#+BEGIN_SRC clojure :tangle no
(ns literate-clojure.example (:use [clojure.string] [clojure.pprint]))
(defn test []
  (cl-format true "This is a test function.~%"))
#+END_SRC
```

So to let clojure can rean an org file directly, all lines out of surrounding by `#+begin_src clojure` and `#+end_src` should mean nothing, and even codes surrounding by them should mean nothing if the [header arguments](#) in a code block request such behavior.

Here is a trick, a new clojure [dispatch](#) syntax `"# "` (sharpsign whitespace) will be defined to make clojure reader enter into org mode syntax, then ignore all lines after that until it meet `#+begin_src clojure`.

When `#+begin_src lisp` occurs, org [header arguments](#) for this code block give us a chance to switch back to normal clojure reader or not.

And if it switch back to normal clojure reader, the end line `#+END_SRC` should mean the end of current code block, so a new clojure [dispatch](#) syntax for `"#+"` (sharp plus) will have an additional meaning to determine if it is `#+END_SRC`, if it is, then clojure reader will switch back to org mode syntax, if it is not, clojure reader will continue to read subsequent stream as like the original clojure reader.

This workflow restricts the org file starting with a comment character and a space character (`"# "`), but it should not be a problem but indeed a convenient way for us to specify some local variables, for example I often put them in the first line of an org file:

```
# -*- encoding:utf-8 Mode: POLY-ORG; -*- ---
```

Which make emacs open file with utf-8 encoding and [poly-org-mode](#).

3 Implementation

3.1 Preparation

Let's create a new namespace for this library.

We use logging library [timbre](#) because it is very convenient.

```
(ns literate-clojure.core
  (:require
```

```
[taoensso.timbre :as timbre
  :refer [log trace debug info warn error fatal report
          logf tracef debugf infof warnf errorf fatalf reportf
          spy get-env]]
[clojure.pprint :refer [cl-format]]
[clojure.string :refer [starts-with? lower-case trim]]
)
(:import (clojure.lang LispReader
                    LispReader$WrappingReader)))
```

3.2 stream read operations

The reader class used by clojure to parse source forms is [Pushback-Reader](#), but it don't provide a read line operation, let's implement it.

Before reading a line, let's define a function to determine whether a character is line terminator.

```
(defn- line-terminator? [c]
  (or (= c (int \return)) (= c (int \newline))))
```

Now let's implement the operation read line.

```
(defn- literate-read-line [reader]
  (let [c (.read reader)]
    (cond (= c -1) nil
          (line-terminator? c) ""
          :else (with-out-str
                  (do (cl-format *out* "~c" (char c))
                      (loop [c (.read reader)]
                        (when (and (not (= c -1))
                                   (not (line-terminator? c)))
                          (cl-format *out* "~c" (char c))
                          (recur (.read reader))))))))))
```

3.3 reader macros

Unlike Common Lisp, Clojure doesn't support user-defined reader macros.

Based on clojure's [LispReader](#), it is easy to define a dispatch reader macro (i.e. one starting with # and some specified second character):

```
(defn- dispatch-reader-macro [ch fun]
  (let [dm (.get (doto (.getDeclaredField clojure.lang.LispReader "dispatchMacros")
                    (.setAccessible true))
                nil)]
    (when (nil? (aget dm (int ch)))
      (debug (cl-format nil "install dispatch reader macro for character '~a'" ch))
      (aset dm (int ch) fun))))
```

3.4 handle org syntax

Let's define a new dispatch function for "# "(sharp space) to enter into org syntax, until it meet #+begin_src clojure. The reader is returned so `LispReader` will continue to read rest forms with clojure syntax.

```
(defn- dispatch-sharp-space [reader quote opts pending-forms]
  (debug "enter into org syntax.")
  (loop [line (literate-read-line reader)]
    (cond (nil? line) (debug "reach end of stream in org syntax.")
          (starts-with? (lower-case (trim line)) "#+begin_src clojure") (debug "reach
    ↪ begin of code block.")
          :else (do
                  (debug (cl-format nil "ignore line: ~a" line))
                  (recur (literate-read-line reader)))))

  (debug (cl-format nil "current line no:~s, column no:~s" (.getLineNumber reader) (.
    ↪ getColumnNumber reader)))
  (debug "enter into clojure syntax.")
  reader)
```

3.5 handle end of source code block

Let's define a new dispatch function for "#+" (sharp plus) to return back org syntax, until it meet #+begin_src clojure.

```
(defn- dispatch-sharp-plus [reader quote opts pending-forms]
  (let [line (literate-read-line reader)]
    (cond (nil? line) (debug "reach end of stream in org syntax.")
          (starts-with? (lower-case (trim line)) "end_src")
          (do (debug "reach begin of code block.")
              (debug "switch back from clojure syntax to org syntax.")
              (dispatch-sharp-space reader quote opts pending-forms))
          :else (throw (Exception. (cl-format nil "invalid syntax in line :~a" line)))))
    ↪ ))
```

3.6 install new dispatcher functions

```
(defn install-org-dispatcher []
  (dispatch-reader-macro \+ dispatch-sharp-plus)
  (dispatch-reader-macro \space dispatch-sharp-space))
```

4 References

- a reader macro library for clojure: <https://github.com/klutometis/reader-macros>
- org babel example: <https://github.com/lambdatronic/org-babel-example>

- clojure reader macros: <https://cdaddr.com/programming/clojure-reader-mac>
- literate lisp: <https://github.com/jingtaozf/literate-lisp>