

# SICP in Emacs

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I recently began reading the notorious “Structure and Interpretation of Computer Programs” [1], a.k.a. the *Wizard book*. I’m only on the first chapter, but I can already see its value and why it gets recommended so much.

From Wikipedia:

Structure and Interpretation of Computer Programs (SICP) is a computer science textbook by Massachusetts Institute of Technology professors Harold Abelson and Gerald Jay Sussman with Julie Sussman. [...] It teaches fundamental principles of computer programming, including recursion, abstraction, modularity, and programming language design and implementation. [...] The book describes computer science concepts using Scheme, a dialect of Lisp. It also uses a virtual register machine and assembler to implement Lisp interpreters and compilers.

In this post, I aim to showcase my workflow for studying the book using Emacs [2]. Also, I will provide any resources that helped me get going. To study SICP, we need two things: The book and a Scheme implementation for the examples and exercises.

# 1 Getting the book

Lucky for us, the book is freely distributed from MIT itself. It is available in [HTML](#) and [PDF](#). But, there is also a third format option and it is the one we're going to choose: the Texinfo format.

From the official GNU site<sup>1</sup>:

Texinfo uses a single source file to produce output in a number of formats, both online and printed (HTML, PDF, DVI, Info, DocBook, LaTeX, EPUB 3). This means that instead of writing different documents for online information and another for a printed manual, you need write only one document.

The Texinfo system is well-integrated with GNU Emacs.

That last line is what's important here. info files are essentially manuals in plain text. Emacs has a built-in mode for rendering such documents. By using the info format, we can read SICP from inside Emacs.

## 1.1 Obtaining the info file

The info file can be retrieved in two methods:

1. By installing the sicp MELPA package<sup>2</sup>
2. By downloading the info file directly from [neilvandyke.org](#) and installing it.
  1. Download the `sicp.info.gz` file ([link](#)) in your home directory.
  2. Execute the following commands

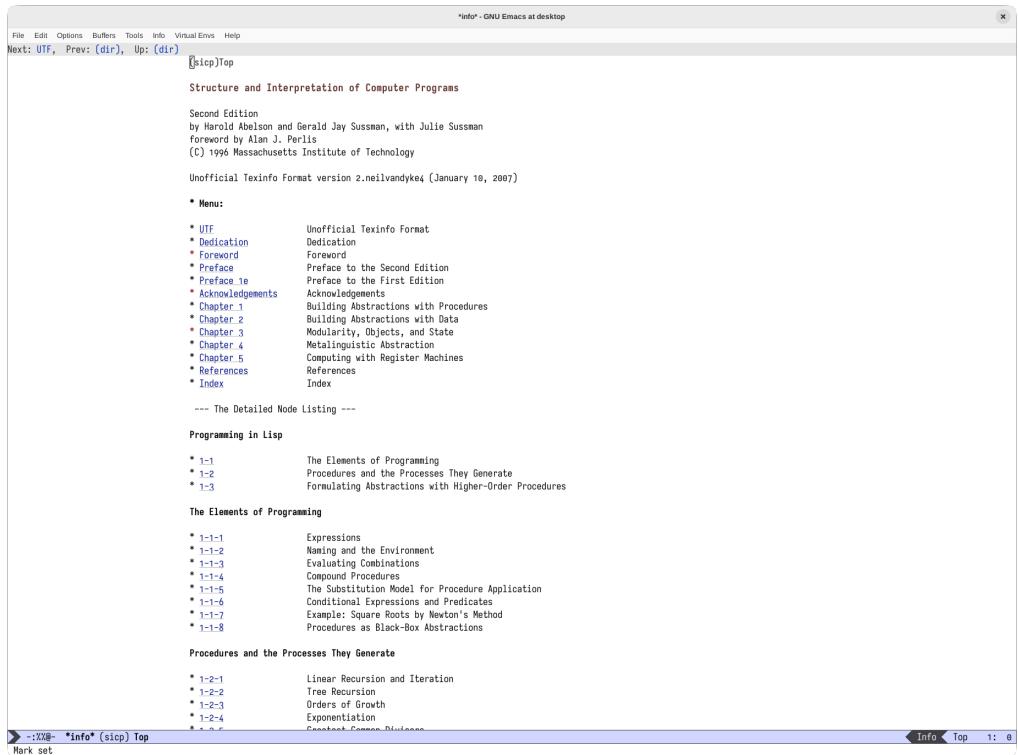
```
1 $ sudo cp ~/sicp.info.gz /usr/local/share/info/
2 $ sudo chmod 644 /usr/local/share/info/sicp.info.gz
3 $ sudo install-info /usr/local/share/info/sicp.info.gz
   ↳ /usr/local/share/info/dir
```

Now SICP will be available through Emacs! To access it, you need to open Emacs, type `C-h i` to go to the `*info*` top directory, type `m` to search and type `sicp` to find the book. If everything went correctly, you should be greeted with something like this:

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<sup>1</sup><https://www.gnu.org/software/texinfo/>

<sup>2</sup><https://melpa.org/#/sicp>



**Figure 1:** SICP’s table of contents in ‘info’ format, viewed from within Emacs

## 2 Setting up Scheme

SICP’s examples and exercises are all implemented in Scheme. Scheme is a Lisp dialect with many implementations. SICP uses the [MIT-Scheme implementation](#). Turns out GNU/MIT-Scheme is **not** fully compatible with the code in SICP ([source](#)). Instead, we will use [Racket](#). Racket offers the [SICP collection](#), a Racket #lang that makes it fully compatible with the SICP code.

First, we need to install racket through our package manager. After that, the sicp collection can be downloaded like this:

```
1 $ raco pkg install sicp
```

That’s it! Now, when we write a .rkt file that needs to be compatible with SICP all we need to do is add `#lang sicp` at the top of the file<sup>3</sup>.

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<sup>3</sup>when using the REPL, we need to first evaluate `(require sicp)` before evaluating anything else.

## 2.1 Racket in Emacs

Personally, I recommend [racket-mode](#) for working with Racket in Emacs. Another popular choice is [geiser](#), but its geiser-racket module seems to be unmaintained<sup>4</sup>.

To install racket-mode using [elpaca](#), add the following to your config file:

```
1 (use-package racket-mode  
2   :elpaca t)
```

## 2.2 Racket in Org-Babel

In case you choose to go the literate programming route (as I have) using Org-Mode, you will need to enable support for racket in org-babel. To do this, use the [emacs-ob-racket](#) package. Add the following to your config:

```
1 (use-package ob-racket  
2   :elpaca (:type git :host github :repo "hasu/emacs-ob-racket"))
```

and then enable racket in your org-babel configuration.

```
1 (org-babel-do-load-languages  
2  'org-babel-load-languages  
3  '((emacs-lisp :tangle ./init.el . t)  
4    (C . t)  
5    (python . t)  
6    ...  
7    (racket . t)))
```

To be able to use the sicp package in org-babel code blocks, you need to add :lang sicp in the Org block, like so:

```
1 #+begin_src racket :lang sicp  
2 "Hello World!"  
3 #+end_src
```

Instead of adding that to every code block, you can add `#+property: header-args :lang sicp` to the start of your Org file. This will be applied to *all* code blocks in the file, so make sure you include only racket code blocks. This can be mitigated by specifying that these header-args are to be applied only to racket blocks, like so: `#+property: header-args:racket :lang sicp`.

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<sup>4</sup><https://lists.nongnu.org/archive/html/geiser-users/2022-06/msg00004.html>

### 3 Result

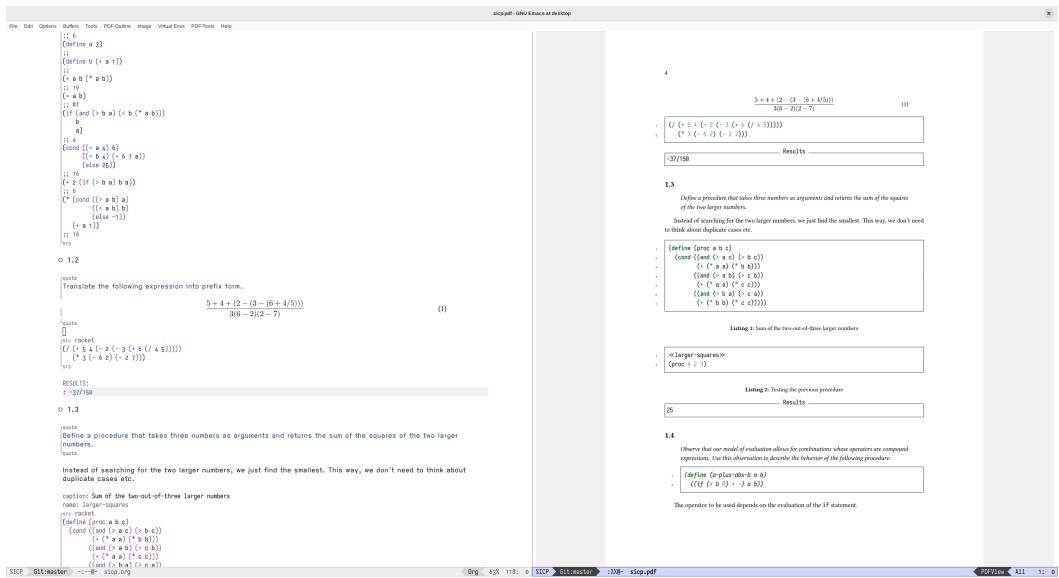
After all this work, now we can finally start reading SICP. My so-far workflow consists of the book in the left window, a racket REPL in the top-right corner and my Org-Roam notes in the bottom-right corner.

The screenshot shows three windows arranged horizontally:

- Racket REPL (top-right):** A terminal window titled "Racket REPL ->". It contains Racket code related to the exercise 1.1.5, specifically the definition of the `if` and `cond` procedures.
- Org-Roam notes (bottom-right):** An Org-Roam note titled "SICP ->". It includes a section titled "1.1.5" with a detailed explanation of the applicative order of evaluation. It also contains a block of Racket code for the `if` and `cond` procedures.
- SICP Book (left):** A screenshot of the "Structure and Interpretation of Computer Programs" book, showing page 131 with the text for exercise 1.1.5.

Figure 2: My SICP studying workflow

When it comes to the exercises, I use Org-Mode and Org-Babel to write the solutions in a literate programming style. The file is divided by chapter. Each exercise is included followed by its (hopefully correct) solution. (So far) I use a single .org file and export it to PDF. Also, all of the code blocks are exported to a .rkt file, with links to the corresponding position in the org file. All of these files can be found at [this repo](#).



**Figure 3:** My SICP solutions in literate programming

## 4 Miscellaneous tips

- **Update 07/06/2023:** As [u/jherrlin](#) on Reddit pointed out, the fact that SICP is in text format gives us the ability to leverage Emacs' built-in bookmarks feature. When you arrive to the end of your study session, just type `C-x r m` and a bookmark will be placed on the current line. You can search your bookmarks with `C-x r b` or list them with `C-x r l`.

My tip is to name the bookmark the same each time (e.g. `sicp`). That way, when you re-create it in a later position, the old bookmark is discarded automatically. Also, if you run Emacs in daemon mode, I suggest to run `M-x bookmark-save` after adding a bookmark, to make sure it has been saved.

## References

- [1] H. Abelson, G. J. Sussman, and J. Sussman, *Structure and Interpretation of Computer Programs* (Electrical Engineering and Computer Science Series), 2. ed., 7. [pr.] Cambridge, Mass.: MIT Press [u.a.], 2002, 657 pp., ISBN: 978-0-07-000484-9.
  - [2] R. M. Stallman, “EMACS the extensible, customizable self-documenting display editor,” *ACM SIGPLAN Notices*, vol. 16, no. 6, pp. 147–156, Jun. 1981, ISSN: 0362-1340, 1558-1160. doi: [10.1145/872730.806466](https://doi.org/10.1145/872730.806466). [Online]. Available: <https://dl.acm.org/doi/10.1145/872730.806466>.