The Guess-My-Number Game[1]

Eric Bailey

January 14, 2017 [2]

[1] Conrad Barski. *Land of Lisp: Learn to Program in Lisp, One Game at a Time!*, chapter 2, pages 21–30. No Starch Press, 2010. ISBN 9781593273491. URL http://landoflisp.com

[2] Last updated October 11, 2017

In this game, you pick a number from 1 to 100, and the computer has to guess it.

Outline

⟨*src/guess.lisp* 1⟩≡
  ⟨*reset the global state* 3⟩

  ⟨*define the* `guess-my-number` *function* 5⟩

  ⟨*define the* `smaller` *function* 9⟩

  ⟨*define the* `bigger` *function* 12⟩

  ⟨*define the* `start-over` *function* 13⟩
Root chunk (not used in this document).

As the name suggests, this chunk gets tangled into `src/guess.lisp`.

Example Session

After loading ⟨*src/guess.lisp* 1⟩, you might have ⟨*a session* 2⟩ like this:

```
$ rlwrap sbcl --load src/guess.lisp
```

⟨*a session* 2⟩≡
```
> (start-over)
50
> (smaller)
25
> (bigger)
37
> (bigger)
43
> (smaller)
40
> (bigger)
41
> (bigger)
42
```
Root chunk (not used in this document).
Uses `bigger` 12, `smaller` 9, and `start-over` 13.

Defining the Small and Big Variables

To give the computer a range of numbers in which to guess, we define the lower and upper limits, `*small*` and `*big*`, respectively. We'll need to ⟨*reset the global state* 3⟩ as such whenever we want to restart the game,

⟨*reset the global state* 3⟩≡
```
(defparameter *small* 1)
(defparameter *big* 100)
```
This code is used in chunks 1 and 13.
Defines:
big, used in chunks 4 and 8.
small, used in chunks 4 and 11.

"Global variable names should start and end with asterisks (also known in this context as earmuffs)" [Brown and Rideau, 2017].

Defining the Guess-My-Number Function

With `*small*` and `*big*` defined, we can tell the computer how to guess a number (`guess-my-number`) within those limits.

The basic algorithm is to ⟨*halve the sum of the limits and shorten the result* 4⟩. To achieve that, we use Common Lisp's `ash` function to perform an *arithmetic right shift* by 1, i.e. $\lfloor \texttt{sum} \times 2^{-1} \rfloor$.

To ⟨*define the* `guess-my-number` *function* 5⟩, we simply implement the algorithm described in pseudocode in Figure 1.

Figure 1: The guessing algorithm

```
sum ← small + big
right shift sum by 1
return sum
```

⟨*halve the sum of the limits and shorten the result* 4⟩≡
```
(ash (+ *small* *big*) -1)
```
This code is used in chunk 5.
Uses *big* 3 and *small* 3.

⟨*define the* `guess-my-number` *function* 5⟩≡
```
(defun guess-my-number ()
  ⟨halve the sum of the limits and shorten the result 4⟩)
```
This code is used in chunk 1.
Defines:
guess-my-number, used in chunk 6.

Now, when we want to ⟨*have the computer guess a number* 6⟩, we simply call `guess-my-number` as follows.

⟨*have the computer guess a number* 6⟩≡
```
(guess-my-number)
```
This code is used in chunks 7, 9, 10, 12, and 13.
Uses guess-my-number 5.

Defining the Smaller and Bigger Functions

To ⟨*define the* `smaller` *function* 9⟩, we need to update the global state such that the next guess is *smaller* than the last, i.e. ⟨*set* `*big*` *to one less than the last guess* 8⟩ then ⟨*have the computer guess a number* 6⟩.

⟨*set* `*big*` *to one less than the last guess* 8⟩≡
```
(setf *big* ⟨subtract one from the most recent guess 7⟩)
```
This code is used in chunk 9.
Uses `*big*` 3.

⟨*define the* `smaller` *function* 9⟩≡
```
(defun smaller ()
  ⟨set *big* to one less than the last guess 8⟩
  ⟨have the computer guess a number 6⟩)
```
This code is used in chunk 1.
Defines:
`smaller`, used in chunk 2.

To appropriately adjust `*big*`, ⟨*subtract one from the most recent guess* 7⟩.

⟨*subtract one from the most recent guess* 7⟩≡
```
(1- ⟨have the computer guess a number 6⟩)
```
This code is used in chunk 8.

To ⟨*define the* `bigger` *function* 12⟩, we need to update the global state such that the next guess is *bigger* than the last, i.e. ⟨*set* `*small*` *to one greater than the last guess* 11⟩ then ⟨*have the computer guess a number* 6⟩.

⟨*set* `*small*` *to one greater than the last guess* 11⟩≡
```
(setq *small* ⟨add one to the most recent guess 10⟩)
```
This code is used in chunk 12.
Uses `*small*` 3.

⟨*define the* `bigger` *function* 12⟩≡
```
(defun bigger ()
  ⟨set *small* to one greater than the last guess 11⟩
  ⟨have the computer guess a number 6⟩)
```
This code is used in chunk 1.
Defines:
`bigger`, used in chunk 2.

To appropriately adjust `*small*`, ⟨*add one to the most recent guess* 10⟩.

⟨*add one to the most recent guess* 10⟩≡
```
(1+ ⟨have the computer guess a number 6⟩)
```
This code is used in chunk 11.

Defining the Start-Over Function

At this point, to ⟨*define the* `start-over` *function* 13⟩ is trivial: we simply ⟨*reset the global state* 3⟩ then ⟨*have the computer guess a number* 6⟩.

⟨*define the* `start-over` *function* 13⟩≡
```
(defun start-over ()
  ⟨reset the global state 3⟩
  ⟨have the computer guess a number 6⟩)
```
This code is used in chunk 1.
Defines:
`start-over`, used in chunk 2.

Full Listing

⟨*src/guess.lisp* 1⟩:

```
(defparameter *small* 1)
(defparameter *big* 100)


(defun guess-my-number ()
  (ash (+ *small* *big*) -1))


(defun smaller ()
  (setf *big* (1- (guess-my-number)))
  (guess-my-number))


(defun bigger ()
  (setq *small* (1+ (guess-my-number)))
  (guess-my-number))


(defun start-over ()
  (defparameter *small* 1)
  (defparameter *big* 100)
  (guess-my-number))
```

Index

Chunks

References

Conrad Barski. *Land of Lisp: Learn to Program in Lisp, One Game at a Time!*, chapter 2, pages 21–30. No Starch Press, 2010. ISBN 9781593273491. URL http://landoflisp.com.

Robert Brown and François-René Rideau. Google Common Lisp Style Guide: Global variables and constants. https://google.github.io/styleguide/lispguide.xml?showone=Global_variables_and_constants#Global_variables_and_constants, September 2017. Accessed: 2017-10-08.