

Debugging R code

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Using R's tools

- Call `traceback()` after error to print the sequence of calls that lead to the error.
- Use `debug(faultyFunction)` to register `faultyFunction` for debugging, so that `browser()` will be called on entry. In browser mode, the execution of an expression is interrupted and it is possible to inspect the environment (with `ls()`). Use `undebug(faultyFunction)` to revert to normal usage.
- Use `trace()` to insert code into functions, start the browser or `recover()` from error.
- Set `options(error=recover)` to get the call stack and browse in any of the function calls.
- RStudio has build-in debugging facilities.

Good reference: *An Introduction to the Interactive Debugging Tools in R*^a

^a<http://www.biostat.jhsph.edu/~rpeng/docs/R-debug-tools.pdf>

Debugging example (1)

Let's walk through an example¹. The buggy setp is:

```
e <- function(i) {  
  x <- 1:4  
  if (i < 5) x[1:2]  
  else x[-1:2] # oops! x[-(1:2)]  
}  
f <- function() sapply(1:10, e)  
g <- function() f()
```

¹credit Martin Morgan and Robert Gentleman

Debugging example (2)

```
> g()
```

```
Error in x[-1:2] (from #3) : only 0 s may be mixed with negative
```

```
> traceback()
```

```
5: FUN(1:10[[5L]], ...)
```

```
4: lapply(X = X, FUN = FUN, ...)
```

```
3: sapply(1:10, e) at #1
```

```
2: f() at #1
```

```
1: g()
```

Debugging example (3)

Using `options(error=recover)`, we are given a list of frames to debug. Once inside a frame, one can view and modify variables.

```
> g()
```

```
Error in x[-1:2] (from #3) : only 0 s may be mixed with negati
```

```
Enter a frame number, or 0 to exit
```

```
1: g()
2: #1: f()
3: #1: sapply(1:10, e)
4: lapply(X = X, FUN = FUN, ...)
5: FUN(1:10[[5]], ...)
```

```
Selection:
```

Debugging example (4)

Selection: 5

[...]

Browse[1]> ls()

[1] "i" "x"

Browse[1]> c

Enter a frame number, or 0 to exit

1: g()

2: #1: f()

3: #1: sapply(1:10, e)

4: lapply(X = X, FUN = FUN, ...)

5: FUN(1:10[[5]], ...)

Selection: 0

options(error = NULL)

Using the debugger directly

```
> debug(e)
> g()
debugging in: FUN(1:10[[1L]], ...)
debug at #1: {
  x <- 1:4
  if (i < 5)
    x[1:2]
  else x[-1:2]
}
Browse[2]> debug at #2: x <- 1:4
Browse[2]> Q
> undebug(e)
```

Using trace

```
## Report whenever e invoked  
trace(e)  
## Evaluate arbitrary code whenever e invoked  
trace(e, quote(cat("i am", i, "\n")))   
## Another way to enter browser whenever e invoked  
trace(e, browser)  
## stop tracing  
untrace(e)
```

```
require("stats4")  
## Debug S4 methods with signature argument  
trace("plot", browser, exit = browser,  
      signature = c("track", "missing"))
```


Calling with custom handlers (1)

The `withCallingHandlers` function allows to defined special behaviour in case of /unusual conditions/, including warnings and errors. In the example below, we start a browser in case of (obscure) warnings.

```
f <- function(x = 10) {  
  lapply(seq_len(x), function(i) {  
    ## make an example 2x2 contingency table  
    d = matrix(sample(4:10, 4), nrow=2, ncol=2)  
    ## will produce warning if there is a 5 or less  
    ## in the contingency table  
    chisq.test(d)  
  })  
}
```

Calling with custom handlers (2)

```
set.seed(1)
f()
set.seed(1)
withCallingHandlers(f(), warning=function(e) recover())
```

Exercise

The `readFasta2` function is similar to `readFasta`, but reads multiple sequences in a fasta file and returns a list of `DnaSeq` instances... at least, that's what it is supposed to do.

- 1 Get `readFasta2.R` file with `sequences::debugme()`, and try the function with the `moreDnaSeqs.fasta` file
`dir(system.file("extdata", package = "sequences"), full.names=TRUE).`
- 2 Prepare for debugging: `debug(readFasta2).`
- 3 Debug!
- 4 fix the function.

Hint: when debugging, use `n` (or an empty line) to advance to the next step, `c` to continue to the end of the current context (to the end of a loop for instance), `w` to print the stack trace of all active function calls and `Q` to exit the browser.

Other hint: use `ls(all.names=TRUE)` to see all objects, also those that start with a `'.'`.