Getting Help in R/Stats/Computing

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So you need some help…

Your code produced an error?

- Debug it yourself
  - Google error messages!
- Ask colleagues/local resources
  - Lab mates!
  - CSCU!
  - Other Cornell resources like CISER, RDMSG
- Ask strangers
  - Stackexchange stackoverflow
  - Listservs (R-SIG-xxx) (https://www.r-project.org/mail.html)
  - Twitter (?)

So you need some help…

- Where to start with some data?
- Teach yourself
  - – CRAN Task Views: https://cran.r-project.org/web/views/
  - – Package Vignettes: `vignette()`

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Break it down

- Works for any of the avenues above.
- Break down big problem into small problems
- Isolate the error or issue
- Determine cases when the issue occurs, but also maybe cases when things go well.

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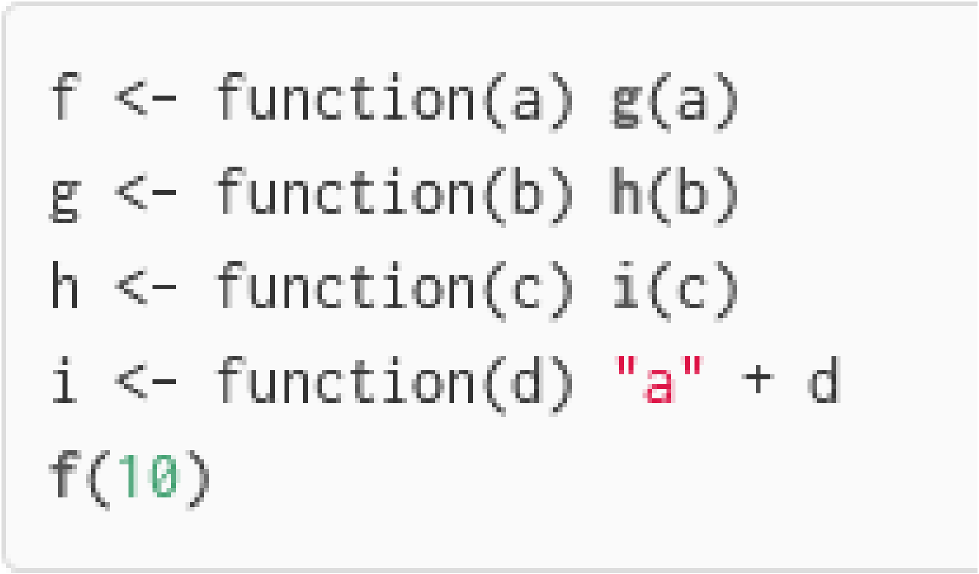
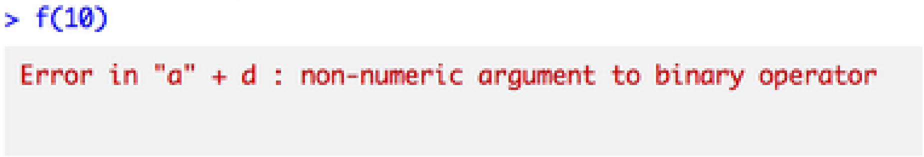
Debugging

- Messages from R
  - Errors, warnings and messages
  - Could come from the function you called
  - Could come from a function called by a function you called.
  - Could come from a function called by a function called by a function you called.
  - …



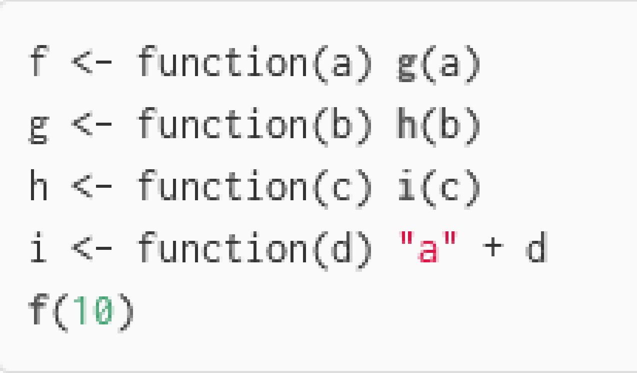
```
f <- function(a) g(a)
g <- function(b) h(b)
h <- function(c) i(c)
i <- function(d) "a" + d
f(10)
```



```
> f(10)
Error in "a" + d : non-numeric argument to binary operator
```

Debugging

- Messages from R
  - If these are functions you wrote:
    - take a step backwards in writing process until you solve it
    - or start over with defensive programming
  - If these are functions from a package- good luck!
    - Check that all objects passed to the function are as you intend
    - Google/forum/stackoverflow
    - traceback()
    - RStudio debug mode.
      - https://support.rstudio.com/hc/en-us/articles/205612627-Debugging-with-RStudio
      - https://adv-r.hadley.nz/debugging.html



```
f <- function(a) g(a)
g <- function(b) h(b)
h <- function(c) i(c)
i <- function(d) "a" + d
f(10)
```

Debugging

- Start with whole block of code, whittle down until you find the smallest piece that creates the error.
- Check intermediate steps as you go

Debugging

- Quick tip: name your variables unique things
  - i.e not “data’, “prob”, “mean”
  - These words may be used in deep functions and cause conflicts
  - Rename “gunnisondata”, “hatchprob”, “meanDON”

Defensive Coding

- Avoid difficult debugging situations
- Fail fast and often
- Program in small steps, check each step of the way.
- Spot check your intuition each step of the way.

Defensive Coding - Example

- Qualtrics survey
  - 30 possible scenarios
  - Each participant was assigned three scenarios
  - Answer a set of 22 questions for assigned scenarios

Defensive Coding - Example

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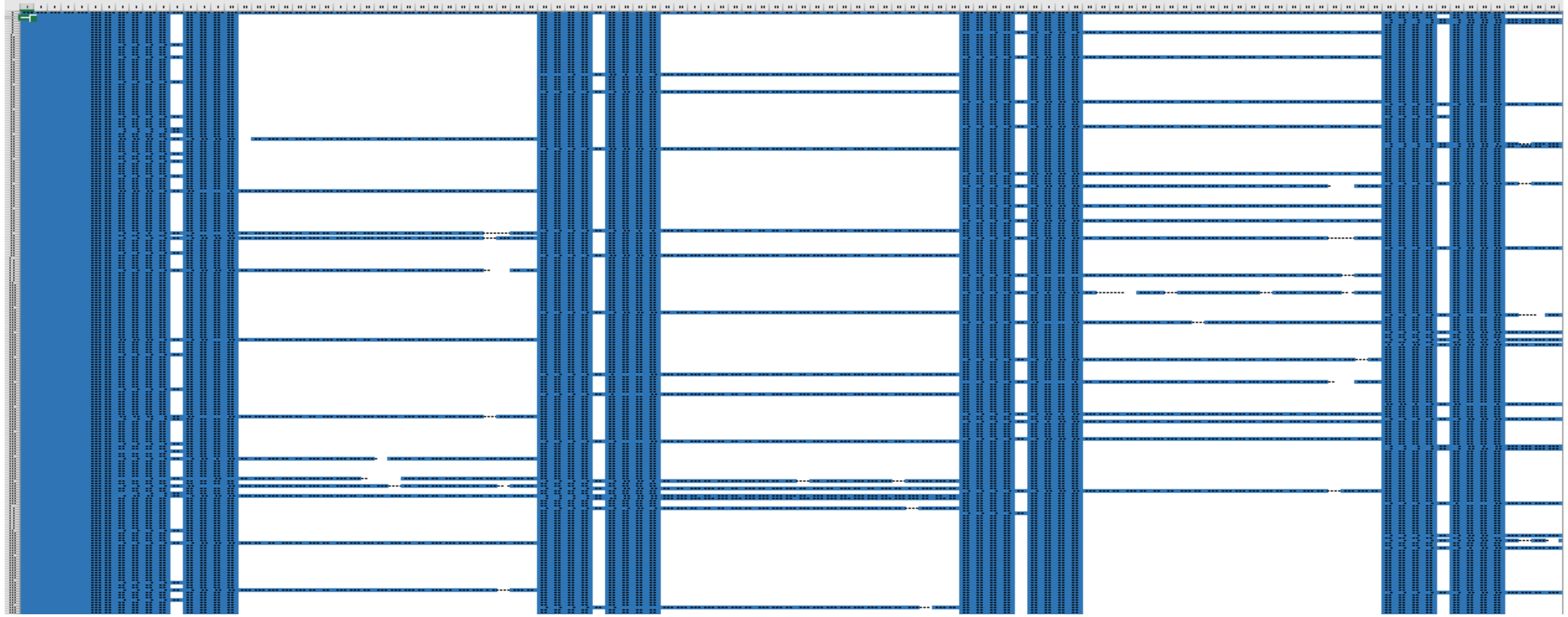
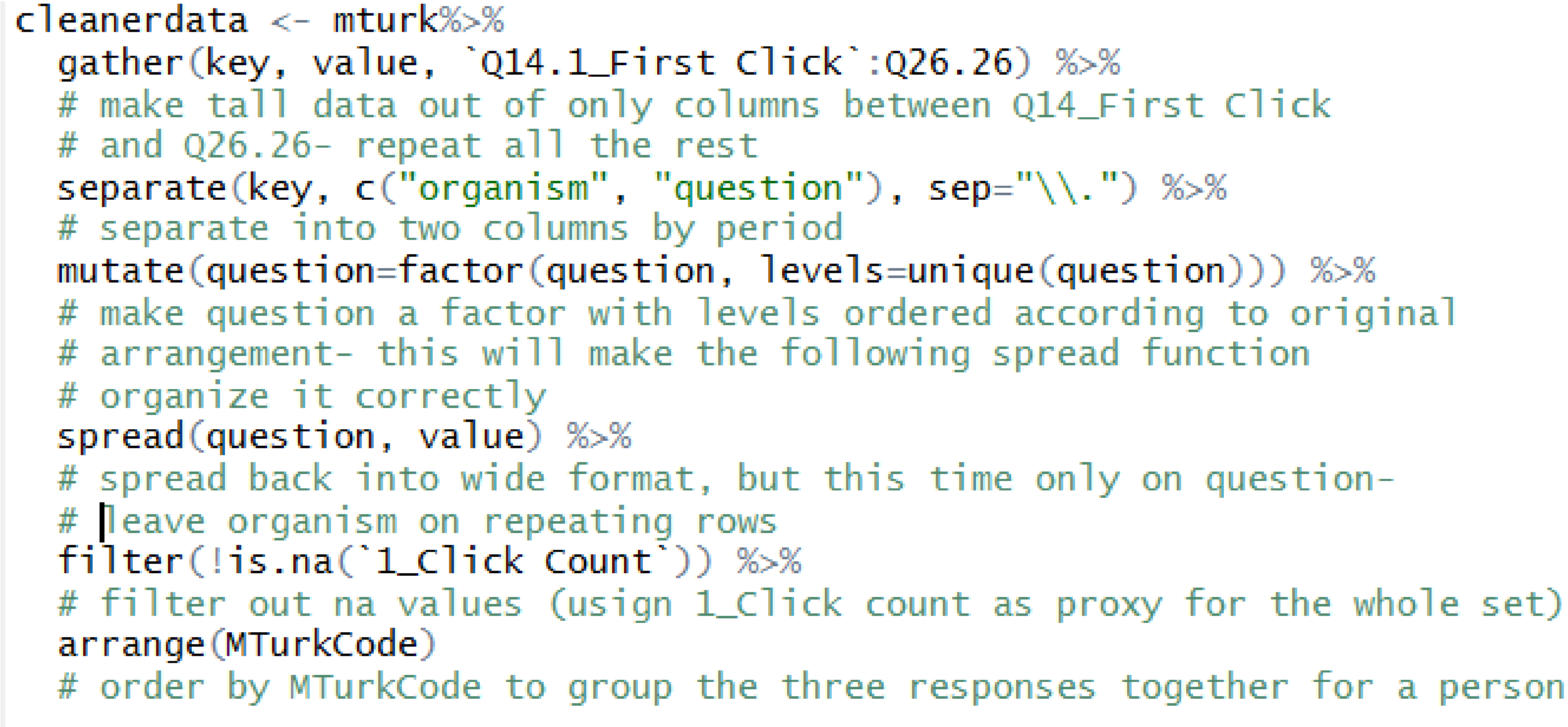


Defensive Coding - Example



```
cleanerdata <- mturk%>%
  gather(key, value, `Q14.1_First Click`:Q26.26) %>%
  # make tall data out of only columns between Q14_First Click
  # and Q26.26- repeat all the rest
  separate(key, c("organism", "question"), sep="\\.") %>%
  # separate into two columns by period
  mutate(question=factor(question, levels=unique(question))) %>%
  # make question a factor with levels ordered according to original
  # arrangement- this will make the following spread function
  # organize it correctly
  spread(question, value) %>%
  # spread back into wide format, but this time only on question-
  # leave organism on repeating rows
  filter(!is.na(`1_Click Count`)) %>%
  # filter out na values (usign 1_Click count as proxy for the whole set)
  arrange(MTurkCode)
  # order by MTurkCode to group the three responses together for a person
```

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Sending code to colleagues

- Small questions (“help me debug…”)
- Big questions (“how should I approach this data set?”)

Sending code to colleagues - debug

- Save current version of the data so we don’t have to re-process it all
- Supply only needed code

Sending code to colleagues - debug

- Load packages at top of script
  - (report package versions with `sessionInfo()` – copy results to script)
- Save current version of the data so we don’t have to re-process it all
  - `write.csv(mydataframe, “mydataframe.csv”)`
  - `save(currentdata, file=“currentdata.R")`
- Remove everything unrelated to problem
  - Long codes get ignored until the perceived amount of free time
- Use nice formatting, commenting
- Well-named variables (concise and informative)
- Use commenting to indicate where the issue is

Sending code to colleagues

- Small questions (“help me debug…”)
- Big questions (“how should I approach this data set?”)

Sending code to colleagues – big questions

- The raw data.
- A tidy data set and code book
- An explicit and exact recipe you used to go from 1 -> 2,3

https://github.com/jtleek/datasharing

Sending code to colleagues – big questions

- The raw data.
  - Ran no software on the data
  - Did not modify any of the data values
  - You did not remove any data from the data set
  - You did not summarize the data in any way

https://github.com/jtleek/datasharing

Sending code to colleagues – big questions

- A tidy data set and code book
  - Each variable you measure should be in one column
  - Each different observation of that variable should be in a different row
  - There should be one table for each "kind" or “level” of observation
  - If you have multiple tables, they should include a column in the table that allows them to be joined or merged

https://github.com/jtleek/datasharing

Sending code to colleagues – big questions

- A tidy data set and code book
  - Information about the experimental study design or sampling method
  - Information about the variables
    - Data type
    - units
  - Information about the summary choices you made

https://github.com/jtleek/datasharing

Sending code to colleagues – big questions

- An explicit and exact recipe you used to go from 1 -> 2,3
  - Pseudocode
  - Readme file showing how all files are related.

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Asking strangers

- Minimum reproducible example (“reprex”)
  - a minimal dataset, necessary to reproduce the error
  - the minimal runnable code necessary to reproduce the error, which can be run on the given dataset.
  - the necessary information on the used packages, R version, and system it is run on.
  - in the case of random processes, a seed (set by `set.seed()`) for reproducibility

https://stackoverflow.com/questions/5963269/how-to-make-a-great-r-reproducible-example

Asking strangers

- Minimum reproducible example (reprex)
  - Use existing data included in packages
    - `iris, mtcars, OrchardSprays, chickwts, npk`
  - Generate fake data that illustrates your question/issue/problem
  - `dput()` to get your data in an easily loadable form
    - No attachments/links to websites…

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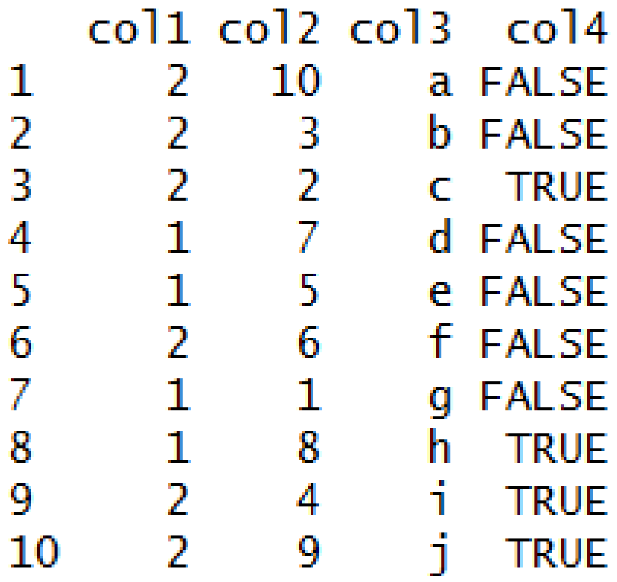
Asking strangers

- Minimum reproducible example (reprex)
  - Generate fake data that illustrates your question/issue/problem

```
my.df <- data.frame(
        col1 = sample(c(1,2), 10, replace = TRUE),
         col2 = as.factor(sample(10)), col3 = letters[1:10],
         col4 = sample(c(TRUE, FALSE), 10, replace = TRUE))
```



```
   col1 col2 col3  col4
1     2   10    a FALSE
2     2    3    b FALSE
3     2    2    c  TRUE
4     1    7    d FALSE
5     1    5    e FALSE
6     2    6    f FALSE
7     1    1    g FALSE
8     1    8    h  TRUE
9     2    4    i  TRUE
10    2    9    j  TRUE
```

https://stackoverflow.com/questions/5963269/how-to-make-a-great-r-reproducible-example

Asking strangers

- Minimum reproducible example (reprex)
  - `dput()` to get your data in an easily loadable form

```
dput(chickwts)
structure(list(weight = c(179, 160, 136, 227, 217, 168, 108, 124, 143, 140, 309,
229, 181, 141, 260, 203, 148, 169, 213, 257, 244, 271, 243, 230, 248, 327, 329, 250,
193, 271, 316, 267, 199, 171, 158, 248, 423, 340, 392, 339, 341, 226, 320, 295, 334,
322, 297, 318, 325, 257, 303, 315, 380, 153, 263, 242, 206, 344, 258, 368, 390, 379,
260, 404, 318, 352, 359, 216, 222, 283, 332), feed = structure(c(2L, 2L, 2L, 2L, 2L,
2L, 2L, 2L, 2L, 2L, 3L, 3L, 3L, 3L, 3L, 3L, 3L, 3L, 3L, 3L, 3L, 3L, 5L, 5L, 5L, 5L,
5L, 5L, 5L, 5L, 5L, 5L, 5L, 5L, 5L, 5L, 6L, 6L, 6L, 6L, 6L, 6L, 6L, 6L, 6L, 6L, 6L,
6L, 4L, 4L, 4L, 4L, 4L, 4L, 4L, 4L, 4L, 4L, 4L, 1L, 1L, 1L, 1L, 1L, 1L, 1L, 1L, 1L,
1L, 1L, 1L), .Label = c("casein", "horsebean", "linseed", "meatmeal", "soybean",
"sunflower"), class = "factor")), class = "data.frame", row.names = c(NA, -71L))
```

Asking strangers

- Minimum reproducible example (reprex)
  - Make sure users have all the info they need to run your reprex
  - reprex package in R (https://reprex.tidyverse.org/)
    - Will generate error if your code is not self-contained
    - Creates markdown for use on different venues (Stack Overflow, Github, HTML…)

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Visit cscu.cornell.edu
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- Schedule an appointment
  - Remote appointments available (Zoom, Skype, phone)
- Zoom Walk-in consulting hours:
  - M-F, 11am, 12pm, 1pm
  - https://cscu.cornell.edu/consulting/walkin.php