




Bayesian Statistics and Hierarchical Bayesian Modeling for Psychological Science

Lecture 01

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https://github.com/lei-zhang/BayesCog_Wien

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wien
Fakultät für Psychologie

**What comes to your mind when
talking about **Statistics**?**

Goal of this course

- Practical **R** programming
- Practical model-building in **Stan**, model diagnostics
- (Enough) theory to ground you
- Be comfortable to use R/Stan for your own work + very basic knowledge of **GitHub**



A clear goal depends on knowledge & expectations

Pre-course survey

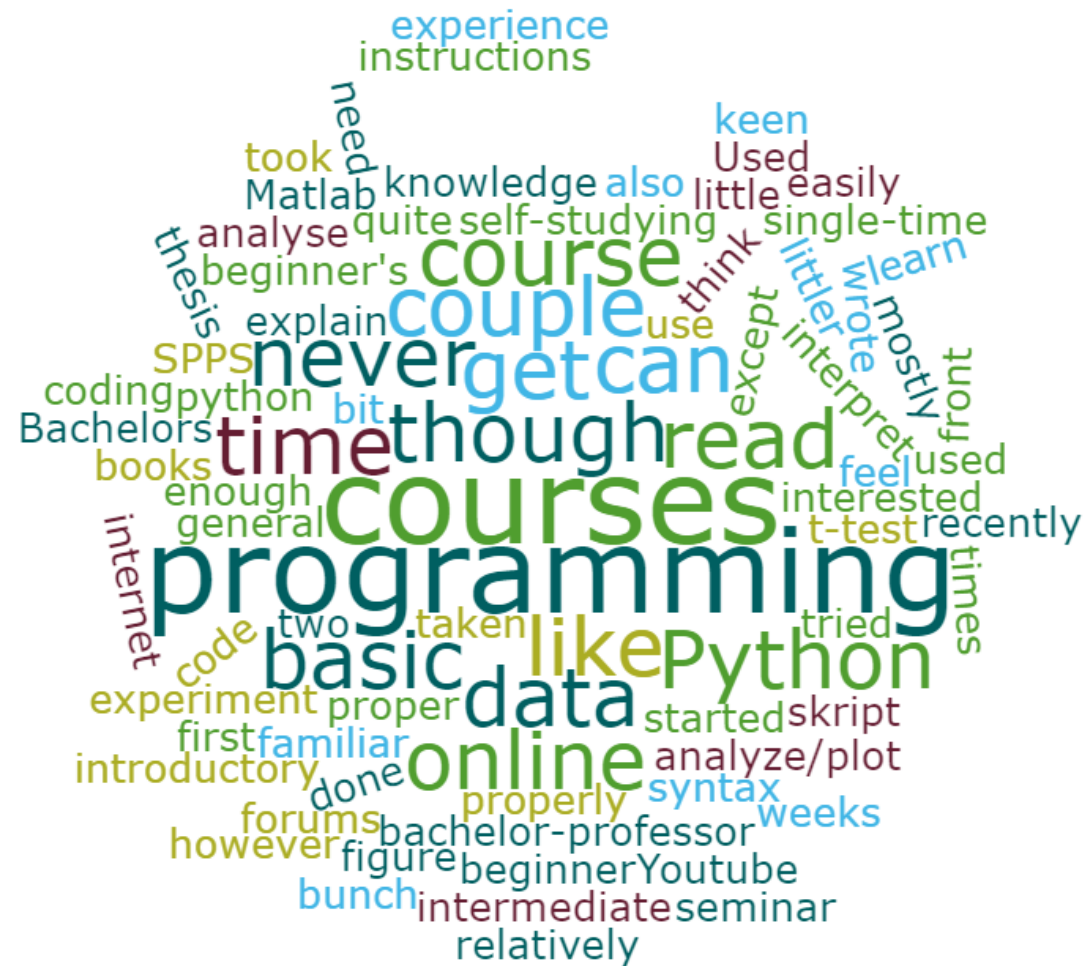
- sent to 9 registered students
- received 8
- 89% return rate, many thanks!

spontaneous feedback are still welcome at any time!

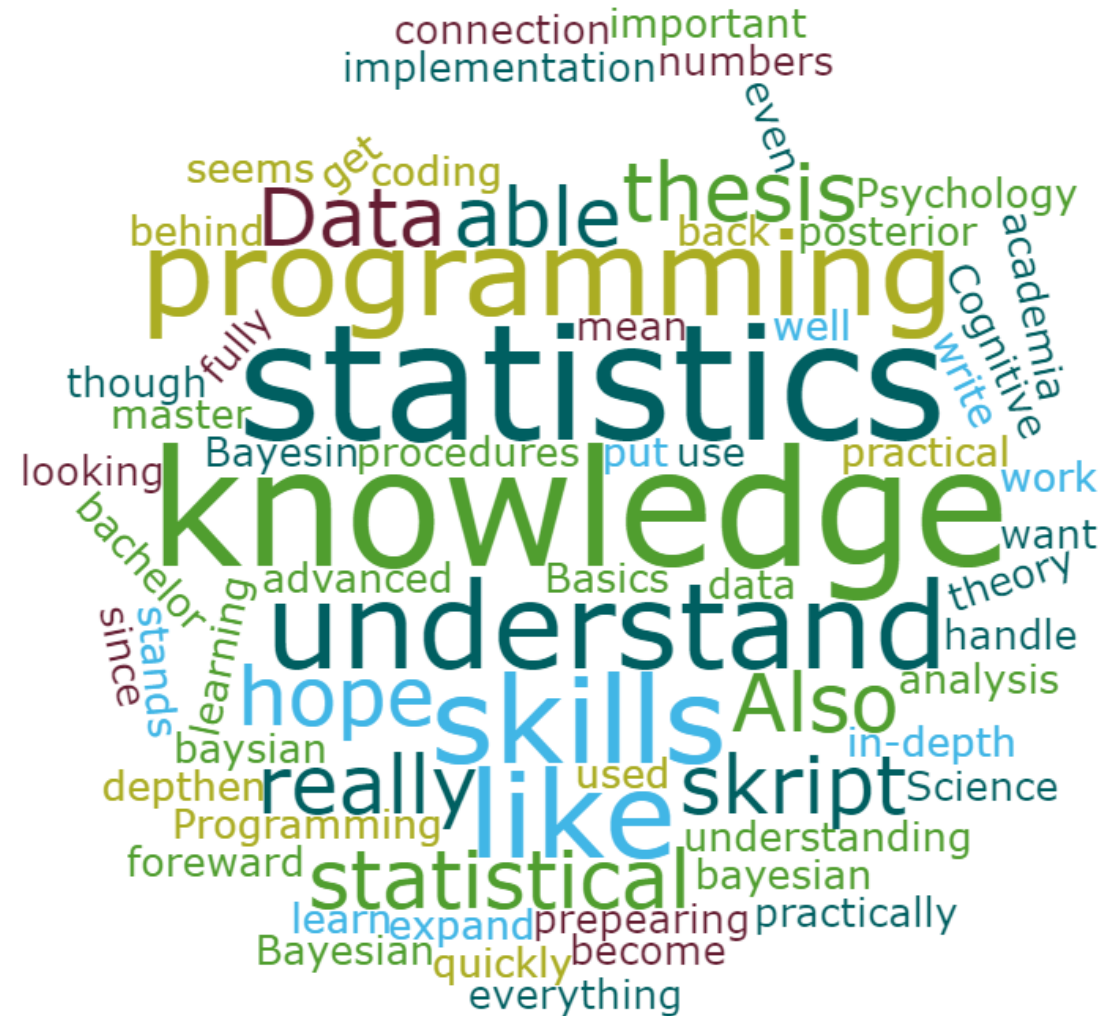
Your knowledge of stats



Your knowledge of programming



Your expectations



Schedule of Lectures

09.10	L01	Introduction and overview	
16.10	L02	Introduction to R	
23.10	L03	Probability; Bayes' Theorem	
30.10	L04	Binomial model; MCMC & Stan	
06.11	L05	Simple linear model	
13.11	L06	Cognitive Modeling; Reinforcement learning model	Review a paper #1
20.11	L07	More on RL model	
27.11	L08	Hierarchical modeling	
04.12	L09	More on hierarchical modeling	
11.12	L10	Optimizing Stan codes	
08.01	L11	PRL task & model comparison	Review a paper #2
??(15.01)	L12	Introduction to model-based fMRI	
22.01	L13	Stan style tip & debugging	
29.01	L14	Programming project + summary + HPC demo	

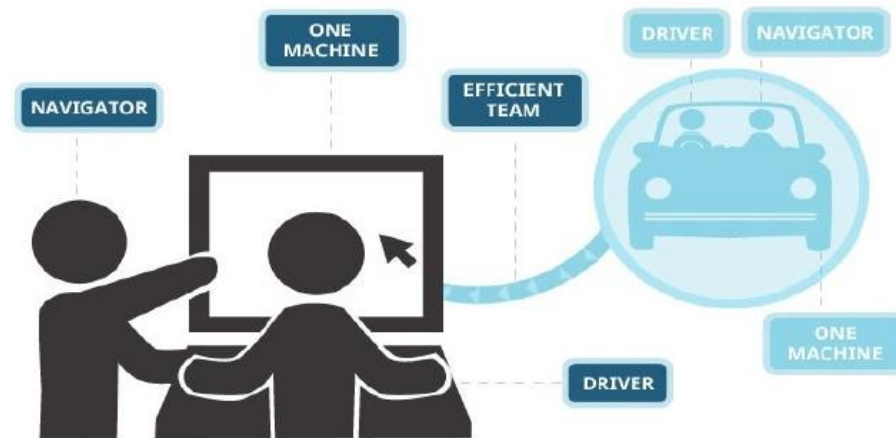
Course structure (from L02)

90 min

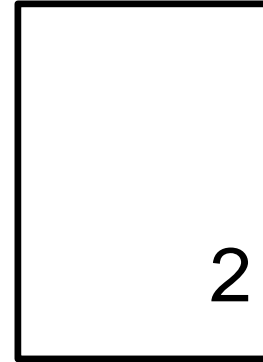
80-85 min (intermixed)
Lecture + Programming

5-10 min
Discussion & feedback

PAIR PROGRAMMING



Review of a paper?



After L06

students 1:5

students 6:9

After L11

students 6:9

students 1:5

How to review a paper?

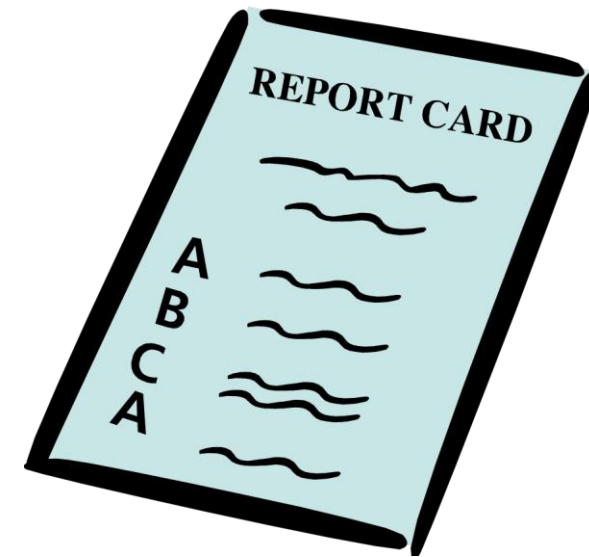
- Suppose you are invited by a journal editor to review a paper
- Of course, you have to read it 😊, carefully and critically
- Then write a review report to the editor
 - (1) Make a summary. What is this paper about? What was done? What was the conclusion?
 - (2) List your concerns. Is the design appropriate? Are the analyses sound? Do their data support the conclusion? What can be done better?
- For this course:
 - up to 3 pages (11pt, 1.5 space)
 - be independent: okay to discuss HOW to review, but do NOT discuss WHAT to review

Programming project

- will be announced after L03
- can be submitted at any time before end of semester (23.02.2020)
- use R and RStan
- will be a real-world cognitive modeling problem
- hand in the *.R and *.stan files in a ZIP file
- name as: lastname_matriculatenummer_200140.ZIP
- no need to write a report

Gradings

- Regular participation (30%; 3 lectures are allowed to miss)
 - Review of paper#1, 10 (25%), due on [20.11.2019](#)*
 - Review of paper#2, 10 (25%), due on [15.01.2020](#)*
 - Programming work, 10 (20%), due on [23.02.2020](#)*
-
- Grades: >87% 1, >75% 2, >63% 3, >50% 4, <=50% 5
 - At least 51% to obtain 4 ECTS



*0.5 point deduction per day for overdue submission

Overview

What is your experience with...

- Statistics?
- R? (and / or Matlab?)
- Cognitive Modeling?

You would like to...

- gain knowledge of Bayesian stats?
- be able to read “computational modeling” section in papers?
- write your own model?

More survey results.

More Qs about the course

NA

Is there a way of checking if my R skills are sophisticated enough? And will there be a tutorial or some explanations around it?

Not yet

If I have learned some R before, but never actually used it, will I be able to follow the course, if I study hard?

Q regarding the instructor

NA

Not yet

What are your research interests?

Further questions

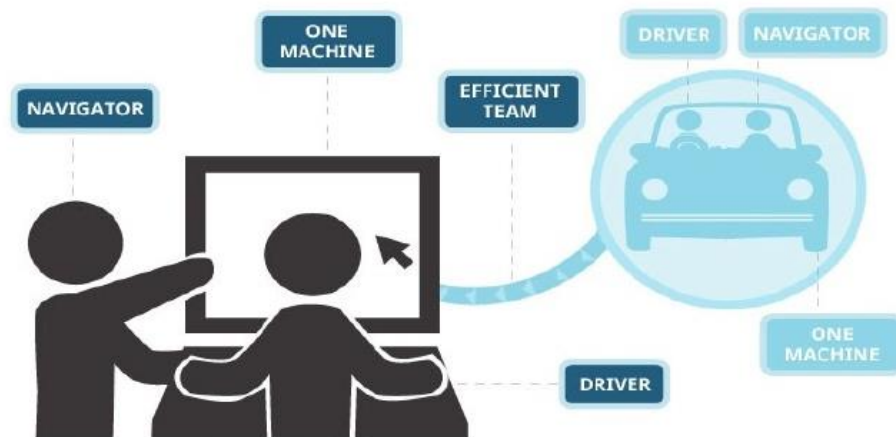
- What knowledge is expected as a prerequisite?
 - some stats, some programming, but I'll start from the beginning
- How many R skills will we get taught?
 - As much as I could, but fit everything in 13 lectures is difficult

Anything else?

How to Get the Most out of the course

- Lecture structure: 60min theory + demo, 20-30min exercise + discussion
- Work in pairs: Talk to each other & help each other
- Ask questions
- Try the exercises

PAIR PROGRAMMING



A quick at GitHub

lei-zhang / BayesCog_Wien

Unwatch

2

Star

1

Fork

0

Code

Issues 0

Pull requests 0

Projects 0

Wiki

Security

Insights

Settings

teaching materials univie 200075

Edit

Manage topics

46 commits

1 branch

0 releases

1 contributor

MIT

Branch: master

New pull request

Create new file

Upload files

Find file

Clone or download

lei-zhang update

Latest commit 4eaf283 on Jun 18

00_R_cheatsheet	R	7 months ago
01.R_basics	update	6 months ago
02.binomial_globe	update	6 months ago
03.bernoulli_coin	update	6 months ago
04.regression_height	update	5 months ago
05.regression_height_poly	update	5 months ago
06.reinforcement_learning	update	5 months ago
07.optm_rl	update	5 months ago
08.compare_models	update	4 months ago
09.debugging	update	4 months ago
Programing_project	update	4 months ago
review_a_paper	update	6 months ago
slides	update	4 months ago



Richard McElreath

@r1mcelreath



I say this a lot, bc I am also confused quite often.



Anna Jacobson @AnnaChingChing · Feb 21

"If you are confused, it is only because you are trying to understand." -
@r1mcelreath in Statistical Rethinking

Now let's begin!

Overview

This course is NOT about...

- ... Bayes in the brain (e.g. predictive coding)
- ... Bayesian statistics to supersede classic statistics

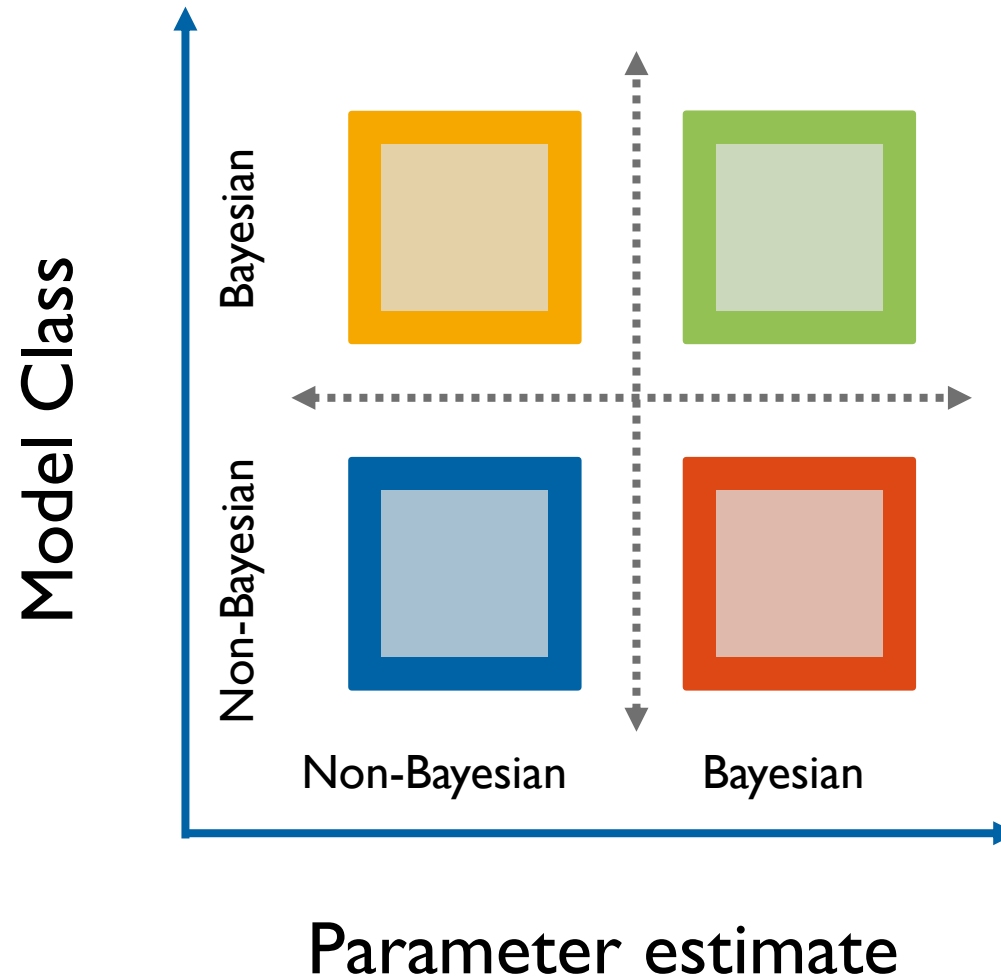


However, Bayesian statistics offer great tools to analyze **cognitive processes**!

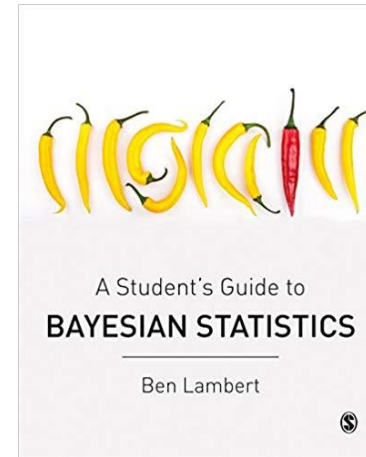
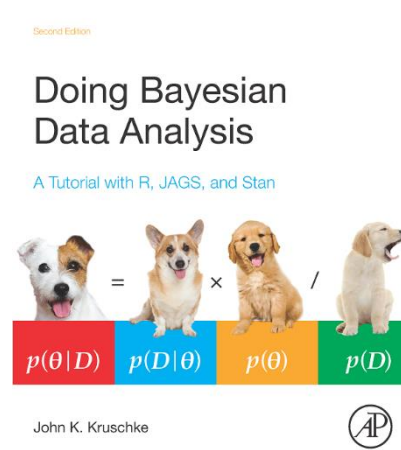
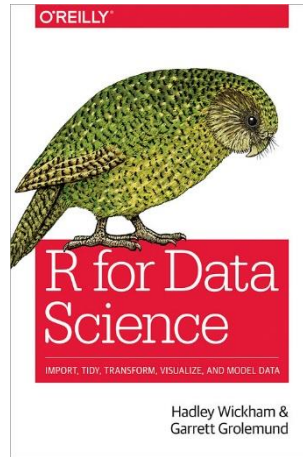
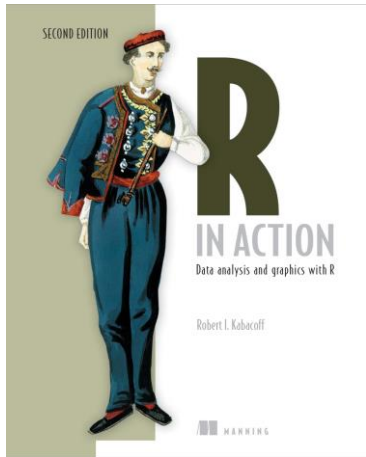
- Construct cognitive models
- Estimate posterior distributions of parameters
- Compare models: which is the best one, given the data
- Perform model-based analysis, e.g. model-based fMRI/EEG/eye-movement

A photograph of a whiteboard with the Bayesian formula written in blue marker. The formula is
$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$
 The whiteboard is dark, and the blue marker is clearly visible. The background is slightly blurred, showing what appears to be a classroom or lecture hall setting.

What We Talk About When We Talk About “Bayesian” Models



Resources

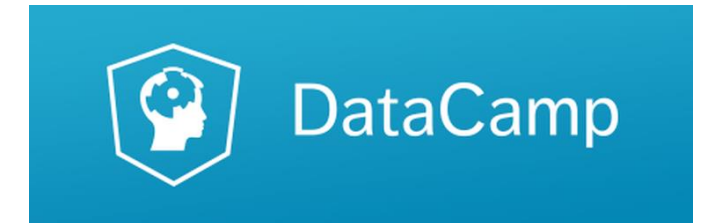


Statistical Thinking for the 21st Century

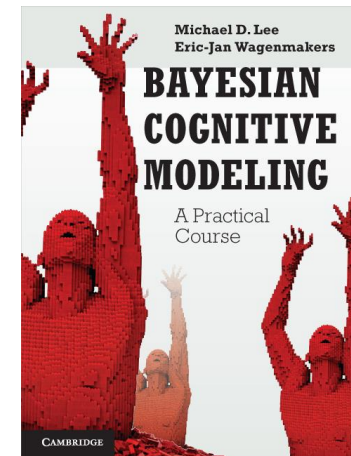
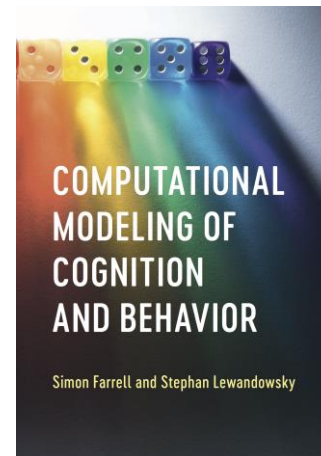
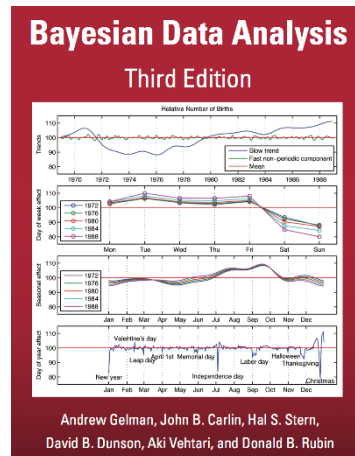
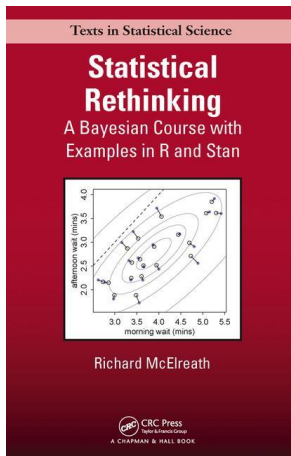
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Draft: 2018-11-22

<http://thinkstats.org/>



<https://www.datacamp.com/>



<https://jasp-stats.org/>

ANY
QUESTIONS
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