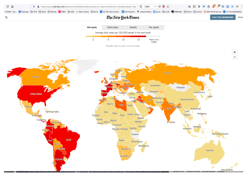
STA141B
Data and Web Technologies for Data Analysis
Spring 2023

Instructor: Duncan Temple Lang

Quick Links: Canvas Piazza

Github: https://github.com/duncantl/ST141B_S23

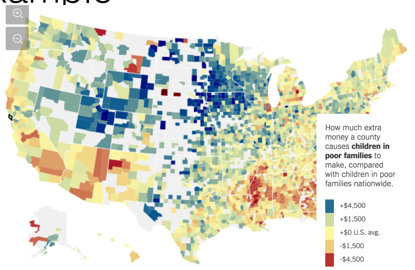
Motivation



- So much more data available today
  - Online and from digital devices
- We want to be able to integrate datasets to
  - explore new questions
  - verify other people's claims and conclusions
  - provide different views & insights.

Example

- Income Mobility
- Income disparity by county
- How do we get the data?
- How to integrate other data?
  - Demographics
  - Education
  - Migration
  - Employment
  - More recent data…

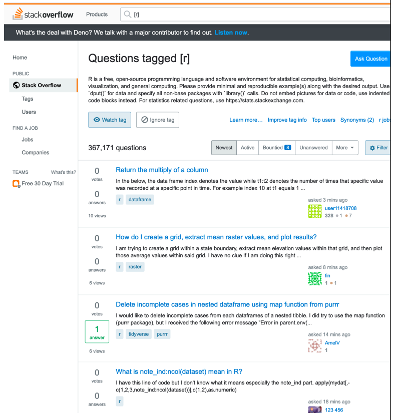

How much extra money a county causes **children in poor families** to make, compared with children in poor families nationwide.
+$4,500
+$1,500
+$0 U.S. avg.
-$1,500
-$4,500

https://www.nytimes.com/interactive/2015/05/03/upshot/the-best-and-worst-places-to-grow-up-how-your-area-compares.html

StackOverflow - R Questions and Answers

https://stackoverflow.com/questions/tagged/r

- How do we programatically mine this for interesting information
  - Names of popular functions
  - People who provide good answers
  - How to write good questions
- How do we get the data?



What's the deal with Deno? We talk with a major contributor to find out. Listen now.

Questions tagged [r]

R is a free, open-source programming language and software environment for statistical computing, bioinformatics, visualization, and general computing. Please provide minimal and reproducible example(s) along with the desired output. Use `dput()` for data and specify all non-base packages with `library()` calls. Do not embed pictures for data or code, use indented code blocks instead. For statistics related questions, use https://stats.stackexchange.com.

367,171 questions

0 votes, 0 answers, 10 views
Return the multiply of a column
In the below, the data frame index denotes the value while t1:t2 denotes the number of times that specific value was recorded at a specific point in time. For example index 10 at t1 equals 1 ...
r dataframe
asked 3 mins ago user11418708 328 ●1 ●7

0 votes, 0 answers, 6 views
How do I create a grid, extract mean raster values, and plot results?
I am trying to create a grid within a state boundary, extract mean elevation values within that grid, and then plot those average values within said grid. I have no clue if I am doing this right ...
r raster
asked 8 mins ago fin 1 ●1

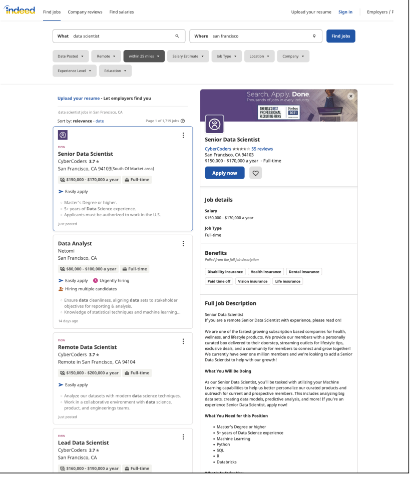
0 votes, 1 answer, 6 views
Delete incomplete cases in nested dataframe using map function from purrr
I would like to delete incomplete cases from each dataframes of a nested tibble. I did try to use the map function (purrr package), but I received the following error message "Error in parent.env(...
r tidyverse purrr
asked 14 mins ago AmelV 1

0 votes, 0 answers
What is note_ind:ncol(dataset) mean in R?
I have this line of code but I don't know what it means especially the note_ind part. apply(mydat[,-c(1,2,3,note_ind:ncol(dataset))],c(1,2),as.numeric)
r
asked 18 mins ago 123 456

Job Postings

https://www.indeed.com/jobs?q=data+scientist&l=san+francisco

- Look at job postings for different types of jobs
  - Salary distribution
  - What are typical required skills
  - Level of education.
- Integrate with cost of living of cities.
- How do we get the data?



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What data scientist

Where san francisco

Find jobs

Date Posted ▾ Remote ▾ within 25 miles ▾ Salary Estimate ▾ Job Type ▾ Location ▾ Company ▾ Experience Level ▾ Education ▾

Upload your resume - Let employers find you

data scientist jobs in San Francisco, CA

Sort by: relevance - date

Page 1 of 1,719 jobs

new
Senior Data Scientist
CyberCoders 3.7 ★
San Francisco, CA 94103(South Of Market area)
$150,000 - $170,000 a year Full-time
Easily apply
- Master's Degree or higher.
- 5+ years of Data Science experience.
- Applicants must be authorized to work in the U.S.

Just posted

Data Analyst
Netomi
San Francisco, CA
$80,000 - $100,000 a year Full-time
Easily apply Urgently hiring
Hiring multiple candidates
- Ensure data cleanliness, aligning data sets to stakeholder objectives for reporting & analysis.
- Knowledge of statistical techniques and machine learning...

14 days ago

new
Remote Data Scientist
CyberCoders 3.7 ★
Remote in San Francisco, CA 94104
$150,000 - $200,000 a year Full-time
Easily apply
- Analyze our datasets with modern data science techniques.
- Work in a collaborative environment with data science, product, and engineerings teams.

Just posted

new
Lead Data Scientist
CyberCoders 3.7 ★
San Francisco, CA
$160,000 - $190,000 a year Full-time

Search. Apply. Done.
Thousands of jobs in every industry
AMERICA'S BEST PROFESSIONAL RECRUITING FIRMS Forbes 2021

Senior Data Scientist
CyberCoders ★★★★☆ 55 reviews
San Francisco, CA 94103
$150,000 - $170,000 a year - Full-time
Apply now ♡

Job details

Salary
$150,000 - $170,000 a year

Job Type
Full-time

Benefits
Pulled from the full job description
Disability insurance Health insurance Dental insurance Paid time off Vision insurance Life insurance

Full Job Description

Senior Data Scientist
If you are a remote Senior Data Scientist with experience, please read on!

We are one of the fastest growing subscription based companies for health, wellness, and lifestyle products. We provide our members with a personally curated box delivered to their doorstep, streaming outlets for lifestyle tips, exclusive deals, and a community for members to connect and grow together! We currently have over one million members and we're looking to add a Senior Data Scientist to help with our growth!

What You Will Be Doing

As our Senior Data Scientist, you'll be tasked with utilizing your Machine Learning capabilities to help us better personalize our curated products and outreach for current and prospective members. This includes analyzing big data sets, creating data models, predictive analysis, and more! If you're an experience Senior Data Scientist, apply now!

What You Need for this Position

- Master's Degree or higher
- 5+ years of Data Science experience
- Machine Learning
- Python
- SQL
- R
- Databricks

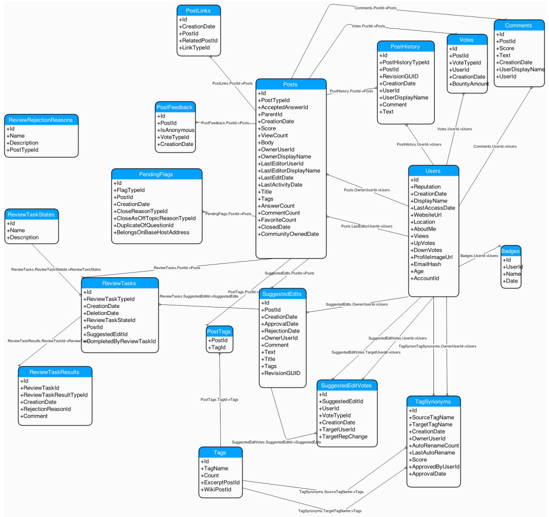
Non-standard Data Formats

```
# timestamp=2006-02-11 08:31:58
# usec=250
# minReadings=110
t=1139643118358;id=00:02:2D:21:0F:33;pos=0.0,0.0,0.0;degree=0.0;00:14:bf:b1:97:8a=-38,2437000
000,3;00:14:bf:b1:97:90=-56,2427000000,3;00:0f:a3:39:e1:c0=-53,2462000000,3;00:14:bf:b1:97:8d=-
65,2442000000,3;00:14:bf:b1:97:81=-65,2422000000,3;00:14:bf:3b:c7:c6=-66,2432000000,3;00:0f:a3:
39:dd:cd=-75,2412000000,3;00:0f:a3:39:e0:4b=-78,2462000000,3;00:0f:a3:39:e2:10=-87,2437000000
,3;02:64:fb:68:52:e6=-88,2447000000,1;02:00:42:55:31:00=-84,2457000000,1
t=1139643118744;id=00:02:2D:21:0F:33;pos=0.0,0.0,0.0;degree=0.0;00:14:bf:b1:97:8a=-38,2437000
000,3;00:0f:a3:39:e1:c0=-54,2462000000,3;00:14:bf:b1:97:90=-56,2427000000,3;00:14:bf:3b:c7:c6=-
67,2432000000,3;00:14:bf:b1:97:81=-66,2422000000,3;00:14:bf:b1:97:8d=-70,2442000000,3;00:0f:a3:
39:e0:4b=-79,2462000000,3;00:0f:a3:39:dd:cd=-73,2412000000,3;00:0f:a3:39:e2:10=-83,2437000000
,3;02:00:42:55:31:00=-85,2457000000,1
```

More Complex Formats

```
## Player version 2.1.3
## File version 0.3.0
## Format:
## - Messages are newline-separated
## - Common header to each message is:
##   time     host   robot  interface index  type   subtype
##   (double) (uint) (uint) (string)  (uint) (uint) (uint)
## - Following the common header is the message payload
0000000000.100 16777343 6668 laser 00 004 001  +0.000  +0.000   0.000   0.156   0.155
0000000000.200 16777343 6668 position2d 00 004 001 -00.040 +00.000 +0.000 +00.440 +00.380
0000000000.200 16777343 6668 position2d 00 001 001 -14.000 -07.000 +0.785 +00.000 +00.000 +00.000 0
0000000000.200 16777343 6668 laser 00 001 001 0001 -3.1416 +3.1416 +0.01740495 +2.0000 0361 1.838  0 1.807  0 1.778  0 1.749  0 1.723  0
1.697  0 1.673  0 1.650  0 1.628  0 1.607  0 1.587  0 1.568  0 1.550  0 1.533  0 1.517  0 1.501  0 1.486  0 1.472  0 1.459  0 1.446  0 1.434  0 1.423  0
1.412  0 1.402  0 1.392  0 1.383  0 1.375  0 1.367  0 1.359  0 1.352  0 1.346  0 1.340  0 1.334  0 1.329  0 1.324  0 1.320  0 1.316  0 1.313  0 1.310  0
1.307  0 1.305  0 1.303  0 1.302  0 1.301  0 1.300  0 1.300  0 1.300  0 1.301  0 1.302  0 1.303  0 1.305  0 1.307  0 1.310  0 1.313  0 1.316  0 1.320  0
1.324  0 1.329  0 1.334  0 1.340  0 1.346  0 1.352  0 1.359  0 1.367  0 1.375  0 1.383  0 1.392  0 1.402  0 1.412  0 1.423  0 1.434  0 1.446  0 1.459  0
1.472  0 1.486  0 1.501  0 1.517  0 1.533  0 1.550  0 1.568  0 1.587  0 1.607  0 1.628  0 1.650  0 1.673  0 1.697  0 1.723  0 1.749  0 1.778  0 1.807  0
1.838  0 1.843  0 1.905  0 1.941  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0
2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0
2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0
2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.000  0 2.0001.607  0 1.618  0 1.630  0 1.642  0 1.65
0 1.669  0 1.683  0 1.701  0 1.716  0 1.738  0 1.765  0 1.774  0 1.811  0 1.817  0 1.852  0 1.864  0 1.885  0 1.921  0 1.941  0 1.978  0 2.000  0 1.944  0
1.889  0 1.835  0 1.838  0
```

Relational Databases



PostLinks: +Id, +CreationDate, +PostId, +RelatedPostId, +LinkTypeId

Posts: +Id, +PostTypeId, +AcceptedAnswerId, +ParentId, +CreationDate, +Score, +ViewCount, +Body, +OwnerUserId, +OwnerDisplayName, +LastEditorUserId, +LastEditorDisplayName, +LastEditDate, +LastActivityDate, +Title, +Tags, +AnswerCount, +CommentCount, +FavoriteCount, +ClosedDate, +CommunityOwnedDate

PostHistory: +Id, +PostHistoryTypeId, +PostId, +RevisionGUID, +CreationDate, +UserId, +UserDisplayName, +Comment, +Text

Votes: +Id, +PostId, +VoteTypeId, +UserId, +CreationDate, +BountyAmount

Comments: +Id, +PostId, +Score, +Text, +CreationDate, +UserDisplayName, +UserId

ReviewRejectionReasons: +Id, +Name, +Description, +PostTypeId

PostFeedback: +Id, +PostId, +IsAnonymous, +VoteTypeId, +CreationDate

PendingFlags: +Id, +FlagTypeId, +PostId, +CreationDate, +CloseReasonTypeId, +CloseAsOffTopicReasonTypeId, +DuplicateOfQuestionId, +BelongsOnBaseHostAddress

ReviewTaskStates: +Id, +Name, +Description

Users: +Id, +Reputation, +CreationDate, +DisplayName, +LastAccessDate, +WebsiteUrl, +Location, +AboutMe, +Views, +UpVotes, +DownVotes, +ProfileImageUrl, +EmailHash, +Age, +AccountId

Badges: +Id, +UserId, +Name, +Date

ReviewTasks: +Id, +ReviewTaskTypeId, +CreationDate, +DeletionDate, +ReviewTaskStateId, +PostId, +SuggestedEditId, +CompletedByReviewTaskId

SuggestedEdits: +Id, +PostId, +CreationDate, +ApprovalDate, +RejectionDate, +OwnerUserId, +Comment, +Text, +Title, +Tags, +RevisionGUID

PostTags: +PostId, +TagId

ReviewTaskResults: +Id, +ReviewTaskId, +ReviewTaskResultTypeId, +CreationDate, +RejectionReasonId, +Comment

SuggestedEditVotes: +Id, +SuggestedEditId, +UserId, +VoteTypeId, +CreationDate, +TargetUserId, +TargetRepChange

TagSynonyms: +Id, +SourceTagName, +TargetTagName, +CreationDate, +OwnerUserId, +AutoRenameCount, +LastAutoRename, +Score, +ApprovedByUserId, +ApprovalDate

Tags: +Id, +TagName, +Count, +ExcerptPostId, +WikiPostId

Comments.PostId->Posts
Votes.PostId->Posts
PostLinks.PostId->Posts
PostHistory.PostId->Posts
PostFeedback.PostId->Posts
PostHistory.UserId->Users
Votes.UserId->Users
Comments.UserId->Users
Posts.OwnerUserId->Users
PendingFlags.PostId->Posts
Posts.LastEditorUserId->Users
Badges.UserId->Users
ReviewTasks.ReviewTaskStateId->ReviewTaskStates
ReviewTasks.PostId->Posts
SuggestedEdits.PostId->Posts
PostTags.PostId->
ReviewTasks.SuggestedEditId->SuggestedEdits
SuggestedEdits.OwnerUserId->Users
ReviewTaskResults.ReviewTaskId->ReviewTasks
SuggestedEditVotes.UserId->Users
TagSynonTagSynonyms.OwnerUserId->Users
SuggestedEditVotes.TargetUserId->Users
PostTags.TagId->Tags
SuggestedEditVotes.SuggestedEditId->SuggestedEdits
TagSynonyms.SourceTagName->Tags
TagSynonyms.TargetTagName->Tags

Complexity

- Data from many different types of sources
  - Web pages, Web services, databases, FTP servers, github, …
- in many different formats
  - CSV, Excel, XML, JSON, YAML, PDF, …
  - Structured, semi-structured and free-form text.
- Different Domain Specific Languages to manipulate data - SQL, XPath, Regular Expressions, CSS selectors

Learning Goals

- Learn important and commonly used technologies to access and manipulate data.
- Learn fundamental concepts and data technology architectures so you can quickly embrace new technologies
- Be able to get data from many different sources and formats.
- Strengthen and Master programming knowledge
- Deeper experience with R
- Computational problem solving.

Syllabus/Topics

- R fundamentals
- Text Processing and Regular Expressions
- Relational Databases & SQL
- Web Scraping & APIs (Application Programming Interfaces)
- Interactive Data Visualization - Web-based, HTML, JavaScript, SVG, CSS from R.

Additional/Optional Topics

- If we have time and you are interested
  - Advanced aspects of R
  - UNIX shell basics
  - Version Control (git)

Making sense of the Data

- The focus is on computing, but we also take this opportunity to explore real data and to do common sense data analysis.
- This does not necessarily mean using complex, sophisticated statistical methodology (unless it is appropriate).
- More about summarizing data and finding evidence within data and illustrating your conclusions,
- Or identifying conjectures/hypotheses and exploring with data.

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Textbook

- No single text book
  - I'll point you to chapters of different books
  - But much of the material will be online Web sites & resources
- You have to use the Web and different resources to find information you need.
- This is a very important but highly non-trivial skill
  - composing the question/goal
  - finding resources
  - honing queries (Web or human) to get the relevant information
  - knowing when to detour and when not to

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Communicating

- Feel free to call me Duncan.
  - My last name is "Temple Lang"
- Ask all questions about the course (content, logistics, …) on Piazza.
  - Make them public, not private.
- Send private/personal emails to me at dtemplelang@ucdavis.edu

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Lectures

- I want you to raise questions and discuss problems, questions, concepts in class.
- The beginning of every class, I ask for questions. I expect there to be some. If not, then you are not working on the assignments.
- If I say something you don't understand, but you have tried to follow, ask me to explain it a different way.
- If I speak too quickly, ask me to slow down.

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Assignments as Labs

- *Lecture courses offer the opportunity to show whether you can get the right answer. Labs on the other hand offer an essential opportunity for students to learn about the practice of science and this practice includes presenting one's work in a clear and compelling fashion.* – Moskovitz & Kellogg. Science, 29 July, 2011.
- This is a lab class with guidance/instructions in lectures.
- You need to start working on each lab when I post it
  - They take time
  - Don't wait until a day or two before the due date.
  - Way too much stress and you won't learn much.

Assignments/Labs/Mini-Projects

- 5-6 "labs" or short projects
  - Each about 2 weeks

Grading

- 5 assignments - 90%. (16% each, all count)
- 10% participation
  - Piazza, office hours, lecture
  - asking and answering questions

Exams, Quizzes

- Hands-on computing is difficult to assess via written exams & quizzes
- However, if there is significant copying in assignments or cheating, I'll conduct exams.
  - Please don't copy or cheat
  - No benefit to you in medium- and long-term

Copying & Cheating

- Read and understand the Code of Academic Conduct
- You ***can*** use
  - Ideas and code you find on the Web
  - Code snippets posted on Piazza
  - YOU MUST NOTE IN YOUR CODE AND REPORT WHERE YOU GOT THESE!

Piazza

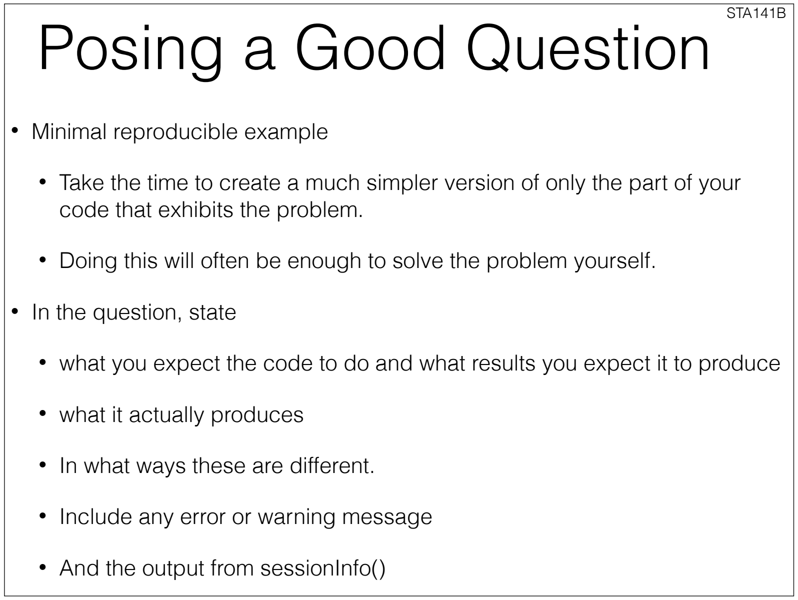
- We'll use Piazza for all questions and answers about assignments, code, lecture, …
- Page: https://piazza.com/ucdavis/spring2023/sta141b
- Should already be registered
  - login ASAP
- Change your settings to get notifications of posts
- Please post using your login (not anonymously)
  - Helps for participation grade.

Before Posting a Question

- Make certain to read all the posts - regularly
  - You will learn a lot and find suggestions about how to approach aspects of the assignments.
- Don't repeat a question, i.e., that was asked previously.
- Try to find the answer or some background information before simply expecting others to look it up for you.

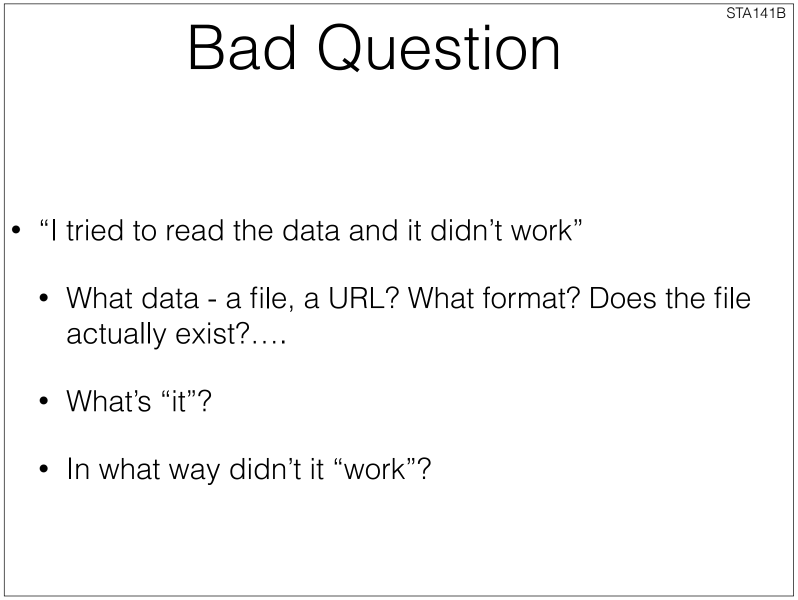
Posting Questions

- Much more likely to get a good answer quickly if you pose a question well
- Focus on what information is necessary for a reader who isn't sitting in front of your computer
  - Enough to give all the relevant details
  - Not too much so reader can't see the relevant element
    - And doesn't bother to reply.



Posing a Good Question

- Minimal reproducible example
    - Take the time to create a much simpler version of only the part of your code that exhibits the problem.
    - Doing this will often be enough to solve the problem yourself.
- In the question, state
    - what you expect the code to do and what results you expect it to produce
    - what it actually produces
    - In what ways these are different.
    - Include any error or warning message
    - And the output from sessionInfo()



Bad Question

- “I tried to read the data and it didn’t work”
    - What data - a file, a URL? What format? Does the file actually exist?….
    - What’s “it”?
    - In what way didn’t it “work”?