CM3

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2/23/2023

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Course Notes for CM3

https://www.education.ox.ac.uk/study/msc-educational-assessment/

MODULE 3: PSYCHOMETRICS AND ASSESSMENT ANALYSIS This paper builds on concepts introduced in the first two core papers and constitutes the foundation of technical measurement and data analysis in educational assessment. It is specifically focussed on psychometric methods for the evaluation of assessment data and integrates these technical aspects with the historical and philosophical underpinnings of psychometrics. Students will be introduced to various psychometric frameworks, including Classical Test Theory, Item Response theory and Rasch Measurement Theory, their approaches to assessment reliability and validity, as well as relevant criticisms of the frameworks. Students will also gain hands-on experience of different psychometric analyses using the R statistical software.

1 Modern Tools for Rasch Analysis

Tools The following tools are recommended for the course. They are all free and open source with the exception of Github Copilot which offers a free trial.

R

https://cran.r-project.org/ Follow the standard installation of R. If you have used R before make sure you update to the latest version.

Once you have installed R, you will need to install the following package before going any further. Installing a package is done by typing the following command in the R console:

```
install.packages("languageserver")
```

Visual Studio Code

https://code.visualstudio.com/ Download and install the latest build. You will then need to install two extensions. This guide explains what an extension is, and how to install it: https://code.visualstudio.com/docs/editor/extension-marketplace

VSCode extension: R

https://code.visualstudio.com/docs/languages/r The extension suggests various optional enhancements that you can install, but these are not neccessary if you are using Quarto.

VSCode extension: Quarto

https://marketplace.visualstudio.com/items?itemName=quarto.quarto

Github Copilot

https://copilot.github.com/ Copilot is an AI pair programmer. As you type copilot will make suggestions for your code which will accelerate your learning experience. Copilot offers a 60 day free trial. To sign up for Copilot you will first need a free Github account.

Github Copilot for Visual Studio Code

https://docs.github.com/en/copilot/getting-started-with-github-copilot/getting-started-with-github-copilot-in-visual-studio-code Once you have signed up for copilot you will need to install the extension in Visual Studio Code.

2 Verifying your installation

Once you have installed your tools, you should be able to recreate the example shown here: https://quarto.org/docs/computations/r.html

Inside VS Code, click on View - Command Palette and type "Quarto: New Document" to create a new Quarto document.

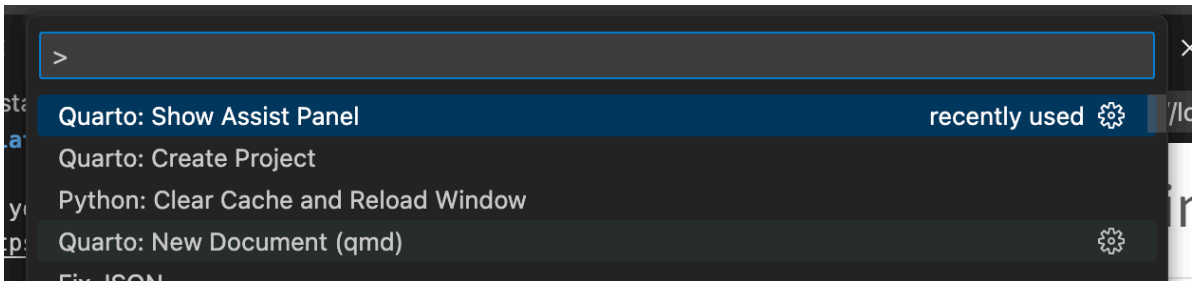

Figure 2.1: Command Palette

You should then be able to paste the code from the example into your new document and run it. Along the way you will be prompted to install any missing packages.

Exercises

1. Using the example above, create one new Quarto document for each of the three built-in formats: HTML, PDF and Word. Render each of the three documents. How do the outputs differ? How do the inputs differ? (You may need to install LaTeX in order to build the PDF output — Quarto will prompt you if this is necessary.)
2. Create a new Quarto document usingView - Command Palette and type "Quarto: New Document". Create one chunk with R with some lines of R Code. Don't worry if you don't know R, you can in any line starting with a hash, press return, and Copilot will tell you how to write the code! Simply press TAB to accept the suggestion.

```
# Write a look up table of US states and their capitals
```

```
# Write a look up table of US states and their capitals
states <- c("Alabama", "Alaska", "Arizona", "Arkansas", "California", "Colorado", "Connect
```

```r
capitals <- c("Montgomery", "Juneau", "Phoenix", "Little Rock", "Sacramento", "Denver", "H
state_capitals <- data.frame(states, capitals)
state_capitals
```

```
          states       capitals
1        Alabama     Montgomery
2         Alaska         Juneau
3        Arizona        Phoenix
4       Arkansas    Little Rock
5     California     Sacramento
6       Colorado         Denver
7    Connecticut       Hartford
8       Delaware         Dover
9        Florida    Tallahassee
10       Georgia        Atlanta
11        Hawaii       Honolulu
12         Idaho          Boise
13      Illinois    Springfield
14       Indiana   Indianapolis
15          Iowa     Des Moines
16        Kansas         Topeka
17      Kentucky      Frankfort
18     Louisiana    Baton Rouge
19         Maine        Augusta
20      Maryland      Annapolis
21 Massachusetts         Boston
22      Michigan        Lansing
23     Minnesota     Saint Paul
24   Mississippi        Jackson
25      Missouri Jefferson City
26       Montana         Helena
27      Nebraska        Lincoln
28        Nevada    Carson City
29 New Hampshire        Concord
30    New Jersey        Trenton
31    New Mexico       Santa Fe
32      New York         Albany
33 North Carolina        Raleigh
34  North Dakota       Bismarck
35          Ohio       Columbus
36      Oklahoma  Oklahoma City
37        Oregon          Salem
```

```
38   Pennsylvania     Harrisburg
39   Rhode Island     Providence
40 South Carolina       Columbia
41   South Dakota         Pierre
42      Tennessee      Nashville
43          Texas         Austin
44           Utah Salt Lake City
45        Vermont     Montpelier
46       Virginia       Richmond
47     Washington        Olympia
48  West Virginia     Charleston
49      Wisconsin        Madison
50        Wyoming       Cheyenne
```

Practice running the chunks individually. Then render the document by clicking the appropriat

3. Try out some markdown in your quarto document. Use <https://quarto.org/docs/authoring/mark

`<!-- quarto-file-metadata: eyJyZXNvdXJjZURpciI6Ii4ifQ== -->`{=html}

```{=html}
<!-- quarto-file-metadata: eyJyZXNvdXJjZURpciI6Ii4iLCJib29rSXRlbVR5cGUiOiJjaGFwdGVyIiwiYm9vaG
```

3 Prequesites

3.1 R for data science

https://r4ds.hadley.nz/ The tidyverse is the modern method for data science in R. Note that this book uses RStudio with Quarto, but I recommend you run all examples in Quarto in VSCode.

I would highly recommend you work through the book, chapter by chapter. There are lots of good examples to work on.

3.2 Assignment

'I do not expect this model to hold at all if applied to items belonging to different fields of mathematics' (Rasch, 1969, p. 100).

Rasch, G. 1969. "Personal communication, quoted". In 1969 Item banking, Edited by: R. Wood and L. S. Skurnik Slough: National Foundation for Educational Research.

If you search Google scholar for papers in the field of Rasch measurement published since 2023 you will find a huge range of topics, far beyond Rasch's initial conception of an model that may work for a few maths items. Summarise the range of topics that you can see, and the motivations for using the Rasch model.

References