UNIVERSITY OF OSLO

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How can R and Quarto help?

A one year recap on teaching statistics to medical students

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2024-06-13 R/Medicine 2024

About me

Lead developer of MF9130 course website with R+quarto+webR

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Statistician turned R developer - RWD, EHR and large public health registries

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THE CARPENTRIES

Carpentry@UiO

R-Ladies

phuse

This is a recap on …

A story of **Zero to Hero** (sort of)

MF9130: introduction to statistics

Faculty of Medicine, University of Oslo

PhD students at UiO (and/or hospital) + other Norwegian universities. **Many have their own data - motivated**!

Background: **clinicians, biologists, lab researcher, psychologists, nutritionists**, …

Statistical competency: very basic - basic: over 75%

Software: none, some SPSS / Stata.

Few know R, basic IT competency

MF9130: 8 days intensive course, offered 3 times per year (8/30 credits required for PhD)

Topics: probability and distributions, sensitivity/ specificity, commonly used hypothesis tests, regression, survival analysis

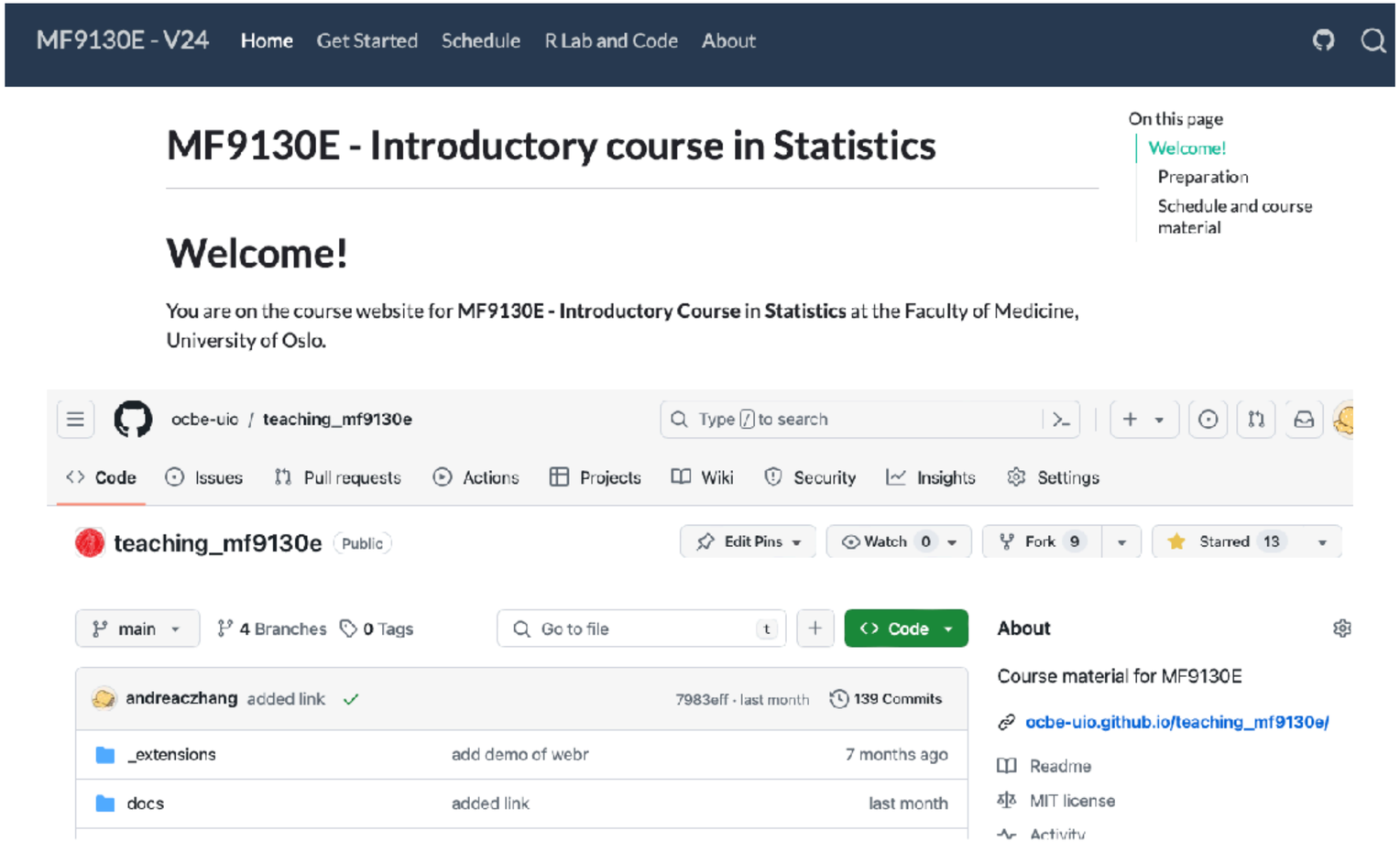
How it has always been:

Lectures and exercise sessions
Focus on theory and hand-calculation, no emphasis on software / data analysis

Since 2023 Spring class: use **R**, teach more **data skills;** 2024: added **WebR**

Change I: course website

R + Quarto + GitHub + WebR



Open access to students and instructors

Lecture notes, data and code more **organized** than university portal

Collaboration: can be **reused** with minimal effort

Change I: course website

R + Quarto + GitHub + WebR

Formula: mean

The mean of data $X = (x_1, x_2, \ldots x_n), \bar{x} = \frac{1}{n}\sum_{i=1}^{N} x_i$

```
# enter the data
heart <- c(11.5, 14.75, 13.75, 10.5, 14.75,
           13.5, 10.75, 9.5, 11.75, 12,
           10.5, 11.75, 10, 14.5, 12,
           11, 14, 15, 11.5, 10.25)
```

You can either compute the sample mean by summing each data point, and divide by command `mean()`.

```
# compute the mean
sum_heart <- 11.5 + 14.75 + 13.75 + 10.5 + 14.75 +
  13.5 + 10.75 + 9.5 + 11.75 + 12 +
  10.5 + 11.75 + 10 + 14.5 + 12 +
  11 + 14 + 15 + 11.5 + 10.25

# this is the sum
sum_heart
```

```
[1] 243.25
```

```
# sample size: 20
n <- 20
# if we do not know the size, can find out with length(heart)
sum_heart/n
```

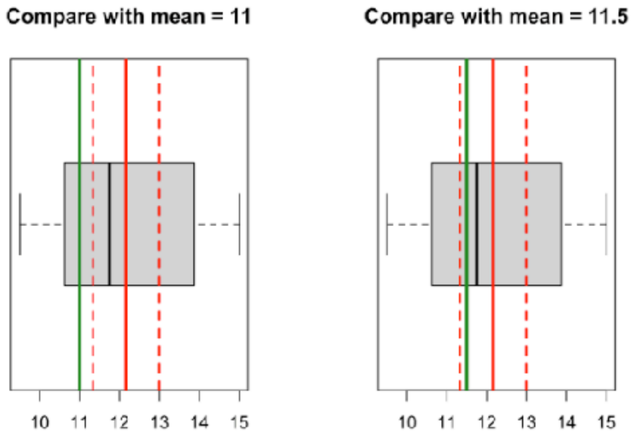
```
[1] 12.1625
```

```
# formula: sum(heart)/length(heart)
mean(heart)  # should be the same as above
```

```
[1] 12.1625
```

```
# boxplot
par(mfrow = c(1, 2))
# compare with 11
boxplot(heart, horizontal = T, main = 'Compare with mean = 11')
abline(v = mean(heart), col = 'red', lwd = 3)
abline(v = c(ci_lower, ci_upper), col = 'red', lwd = 2,
       lty = 'dashed')
abline(v = 11, col = 'forestgreen', lwd = 3)


# compare with 11.5
boxplot(heart, horizontal = T, main = 'Compare with mean = 11.5')
abline(v = mean(heart), col = 'red', lwd = 3)
abline(v = c(ci_lower, ci_upper), col = 'red', lwd = 2,
       lty = 'dashed')
abline(v = 11.5, col = 'forestgreen', lwd = 3)
```



Learn by **verification**
formula vs preset function/pkg

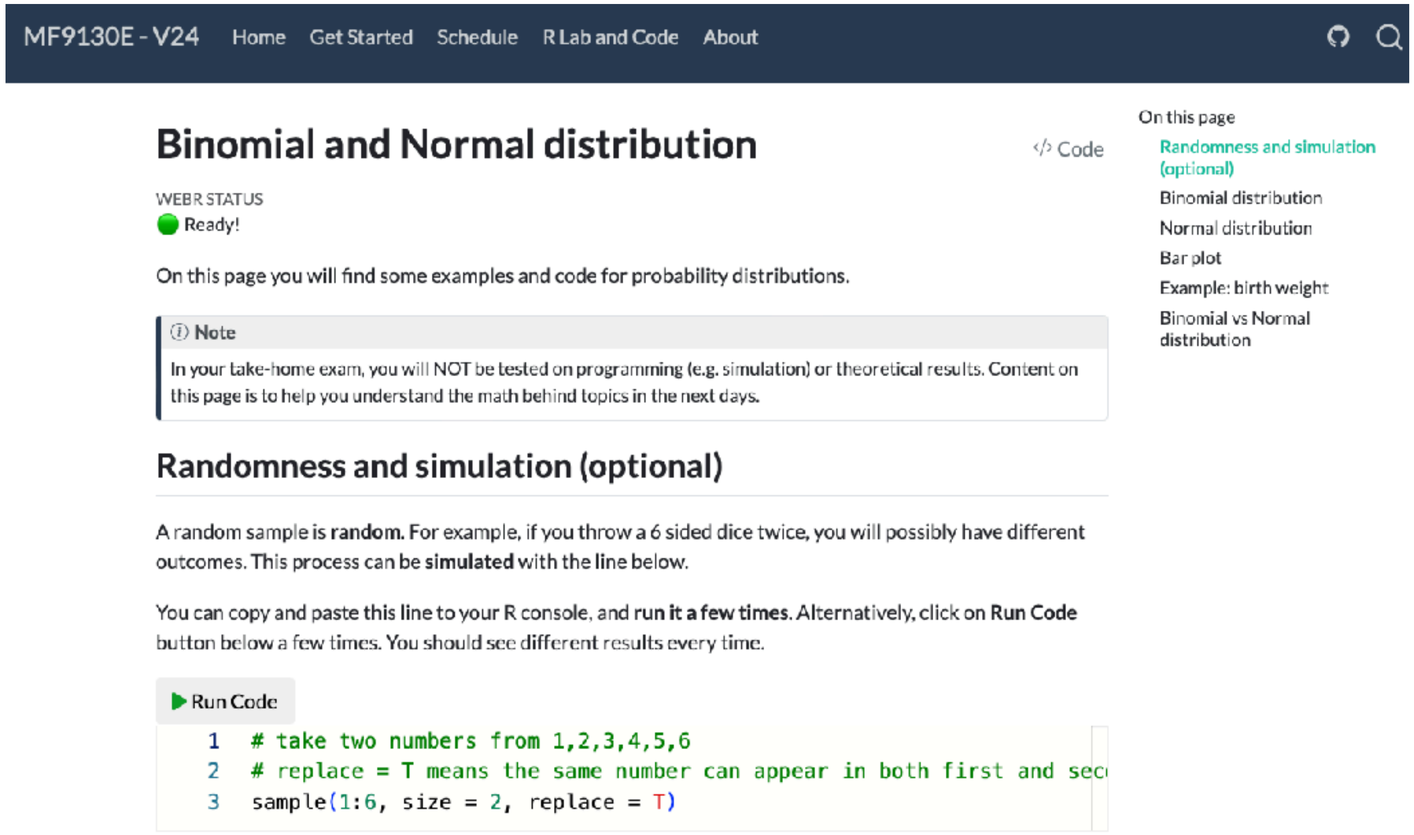
Learn by **visualization**

Extremely useful for teaching statistical concepts:

summary statistics, p-values, t-tests etc

Change I: course website (NEW 2024)

R + Quarto + GitHub + WebR



WebR extension has made it more interactive to demonstrate certain concepts such as **randomness and distribution**

Students can try the code in the browser at home

Try it out here

Change II: Guided R lab sessions

How we improved

We kept the good things:

Live coding demo - the Carpentry way

Sticky notes system (depends on helper capacity)

An complete example of data analysis (**data import**, **EDA, tests, interpret**)

Give sufficient time to practice and troubleshoot

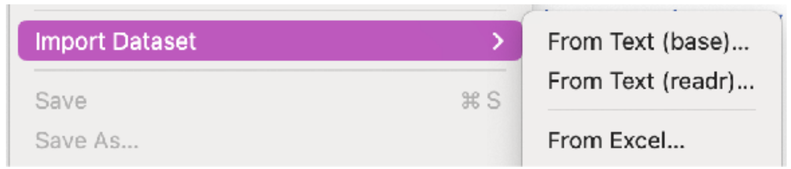
Some NEW practices:

Use **R project**, avoid working directory config

Use RStudio **point-and-click for data import**, rather than ‘read_csv(path)’

Less ambitious, use **few but good datasets**

Repeat the basic workflow many times

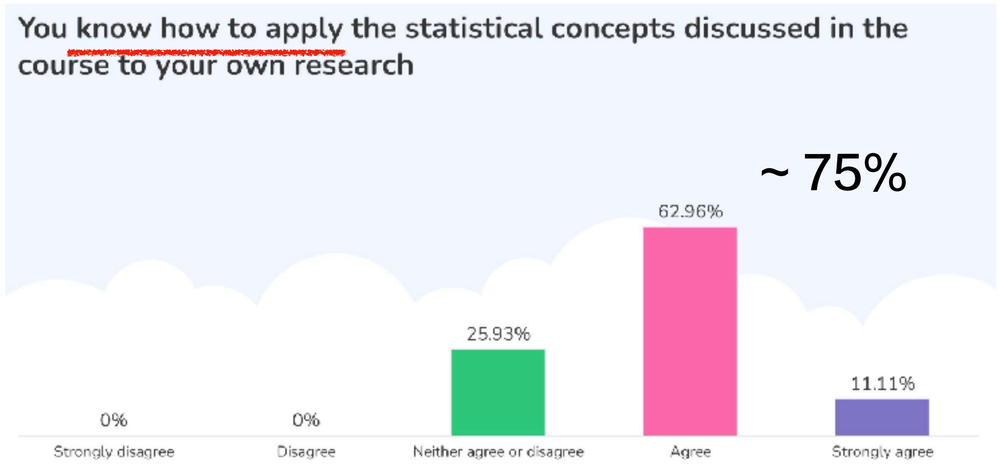


How did it go?

Based on student survey

By the end of day 4 (first week), **every one** can
- load a dataset, extract the target variable
- make a histogram, carry out a test

More **confidence** and interests in statistics



Generally **positive** feedback: 😀

More organized course material,

Skills taught are very **useful for their own work**

I**nteractive (live demo) lab sessions** particularly helpful

Negative: “R is not user friendly” 🥺

Less negative in 2024, possibly because students who do not like coding choose the alternative course (in stata)

Find out more

MF9130E course website
https://ocbe-uio.github.io/teaching_mf9130e/

Zero to Quarto Workshop (R Ladies Zurich 2023)
https://andreaczhang.github.io/workshop-02quarto/

qtwAcademic
an R package to get you started building a quarto website, tailored for academics

Let's chat!

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