Stat 302
Statistical Software and Its Applications
The \texttt{knitr} Package and RStudio

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The knitr Package

- The *knitr* package integrates code, output, and narrative.
- It was created by Yihui Xie who was inspired by Sweave.
- Right click on the R icon and start an Administrator R session.
- **Install** *knitr* via
  ```r
  install.packages("knitr",
                  dependencies=TRUE)
  ```
- It is assumed that *\LaTeX* is already installed on your system.
- In the initial use of *knitr* in R or RStudio you may be prompted to install further *\LaTeX* packages.
- That happens just once and is automatic.
Create a working directory, say EX2.

Inside EX2 and using a text editor create a file named minimal.Rnw with content shown on the next two slides.

Note that it looks very much like a \LaTeX\ file in structure, except for the chunk delimited by

\begin{verbatim}
<<plot .... >>=
R code commands
@
\end{verbatim}

Also note the use of \texttt{\$expr{...}} to access contents of R objects created with the R commands.

You can use 'right' or 'left' in place of 'center' in fig.align.

The plot after \texttt{<<} acts as plot file name handle, see the figure subfolder in EX2. Different plots require different handles.
We examine the relationship between speed and stopping distance using a linear regression model:

$$Y = \beta_0 + \beta_1 x + \epsilon.$$
The slope of a simple linear regression is $\text{Sexpr{round(coef(fit)[2],4)}}$. 
\end{document}
Using \texttt{knit} in R

- Start an R session and make EX2 your working directory.
- Then execute the commands

  \begin{verbatim}
  library(knitr)
  knit("simple.Rnw")
  \end{verbatim}

- After R is done processing there will be a corresponding file \texttt{simple.tex} in EX2.
- Using \TeXmaker convert this file into a pdf output.
- It will show your analysis narrative, your code, and plot and other requested output from your commands.
RStudio and **knitr**

- RStudio can be used for editing and processing via **knitr**.
- Start RStudio $\rightarrow$ File $\rightarrow$ New Project $\rightarrow$ New Directory or Existing Directory, say with name EX2.
- Create a file `minimal.Rmd` with content shown on next slide and save it in EX2.
- It is similar to `simple.Rnw` but used Markdown syntax instead of \LaTeX, but it leaves out some \LaTeX constructs.
- The code chunk is delimited by `'''{r model, ...}...'''`.
- `model` acts as handle for graphics files, as before.
- References to R objects values is via `r ...`.
# A Minimal Example

We examine the relationship between speed and stopping distance using a linear regression model: $Y=\beta_0+\beta_1 x+\epsilon$.

```r
model, fig.width=4, fig.height=3, fig.align='center'}
par(mar=c(4,4,1,1), mgp =c(2,1,0),cex=0.8)
plot(cars,pch=20,col="darkgray")
fit <- lm(dist~speed,data=cars)
abline(fit,lwd=2)
```

The slope of a simple linear regression is `r round(coef(fit)[2],4)`.
Processing in RStudio

- In RStudio ➔ File ➔ Open File minimal.Rnw ➔ Open
- On the editor top bar you see a PDF icon, try it out.
- It will \LaTeX{} process the file and produce a PDF in one step.
- In RStudio ➔ File ➔ Open File minimal.Rmd ➔ Open
- The editor top bar shows a yarn ball + needle stuck into it.
- The down arrow next to it gives you 3 options, to create an HTML, a PDF, or Word file. Try out each.
- The HTML process works just fine.
- Depending on the latest development version of \texttt{knitr} you may encounter problems with the other two.
- You may get an error or the figure is missing.
- That can be avoided by removing \texttt{fig.align='center'} in the minimal.Rmd file.
- But then the figure is left adjusted.
More on RStudio

- For more on using RStudio and knitr see
  - Reproducible Research with R and RStudio, by Christopher Gandrud, CRC Press.

- This should put you at the forefront of documented and reproducible research. It is still in flux.