Graduate School Class Reminders

- ▶ Maintain six feet of distancing
- ▶ Please sit in the same chair each class time
- ▶ Observe entry/exit doors as marked
- ▶ Use hand sanitizer when you enter/exit the classroom
- ▶ Use a disinfectant wipe/spray to wipe down your learning space before and after class
- ▶ Media Services: 414 955-4357 option 2

Documentation on the web

- ▶ CRAN: `http://cran.r-project.org`
- ▶ R manuals: `https://cran.r-project.org/manuals.html`
- ▶ SAS: `http://support.sas.com/documentation`
- ▶ SAS 9.3: `https://support.sas.com/en/documentation/documentation-for-SAS-93-and-earlier.html`
- ▶ Step-by-Step Programming with Base SAS 9.4 (SbS): `https://documentation.sas.com/api/docsets/basess/9.4/content/basess.pdf`
- ▶ SAS 9.4 Programmer s Guide: Essentials (PGE): `https://documentation.sas.com/api/docsets/lepg/9.4/content/lepg.pdf`
- ▶ Wiki: `https://wiki.biostat.mcw.edu` (MCW/VPN)

`proc print` for producing output

- ▶ `proc print` is the go-to for many printing tasks
- ▶ The `var` statement lists the variables to output
- ▶ The `uniform` option makes each page's columns look like all the others
- ▶ Subset the data for printing with a `where` statment
- ▶ Specify SAS formats with a `format` statement
- ▶ Specify labels for variable names with the `label` statement that is used in tandem with the `label` option
  don't forget to use both!
  `proc print label data=NAME; var X;`
  `label X="LABEL"; run;`
- ▶ A `by` clause will force each `by` group on their own pages
  can be fine-tuned with the `pageby` statement

`title` and `footnote`

- ▶ These two statements are similar
- ▶ They can appear anywhere before a `run;` statement
- ▶ You can have up to 10 titles and 10 footnotes
- ▶ `title "TITLE";` and `footnote "FOOTNOTE";` produce the top title or footnote respectively
- ▶ `titlen "TITLE";` and `footnoten "FOOTNOTE";` where n is a number from 1 to 10 to produce the nth title or footnote
- ▶ `title;` and `footnote;` clear all titles or footnotes
- ▶ `titlen;` and `footnoten;` where n is a number produce, clear the nth through 10th title or footnote respectively

`proc plot` for producing plots

- ▶ These are primitive TEXT plots
- ▶ For quick and dirty looks at the data
- ▶ Much easier to use than more advanced PROCs but extremely limited functionality
- ▶ `proc plot data=NAME;`
  `plot Y*X="CHARACTER"; run;` where CHARACTER is the symbol to use: a symbol with a mark at its center is preferable like "+" rather than "."
- ▶ You can specify multiple plots
  `proc plot data=NAME;`
  `plot Y1*X1="C1" ... Yn*Xn="Cn"; run;`
- ▶ Similarly, plot them on the same page/axis
  `proc plot data=NAME;`
  `plot Y1*X="C1" ... Yn*X="Cn" / overlay; run;`

proc chart for producing bar charts

- ▶ These are primitive TEXT charts
- ▶ For quick and dirty looks at the data
- ▶ Much easier to use than more advanced PROCs but extremely limited functionality
- ▶ `proc chart data=NAME;`
  `vbar X; run;` for vertical bars
- ▶ `proc chart data=NAME;`
  `hbar Y; run;` for horizontal bars
- ▶ You can specify multiple charts
  `proc chart data=NAME;`
  `vbar X; hbar Y; ...; run;`
- ▶ Use the `discrete` option for categorical variables
- ▶ `proc chart data=NAME;`
  `vbar X / discrete; run;` for vertical bars

SAS/Graph, graphics stream files and ~/autoexec.sas

- ▶ Using the SAS/Graph product to produce graphics stream files
- ▶ This is a still relevant legacy system of GPROCs which predates modern ODS and SAS Statistical Graphics SGPROCs
- ▶ Typically, GPROCs are named proc GNAME and Statistical Graphics SGPROCs are named proc SGNAME
- ▶ We have this setting in our ~/autoexec.sas file
- ▶ goptions device=pslcmyk gsfmode=replace gsfname=gsasfile colors=(black red blue green cyan magenta yellow);
- ▶ This specifies Adobe PostScript color graphics stream files with Cyan/Magenta/Yellow/blacK (CMYK) color standard
- ▶ And this setting as well
  filename gsasfile "&fnroot..ps";
  so, if your SAS program is named NAME.sas then the macro variable fnroot resolves to NAME
  fnroot is a global macro variable created by the _fn macro

SAS/Graph, graphics stream files and `~/autoexec.sas`

- ▶ So, the smart defaults in `~/autoexec.sas` result in a GPROC replacing the file `&fnroot..ps` (or creating it if it does not exist)

- ▶ Notice that there are two does in `&fnroot..ps` `&fnroot.ps` would resolve to NAMEps one dot is macro variable concatenation, so the second dot is necessary to produce `NAME.ps` instead

- ▶ If you press F12, Emacs/ESS will open a viewer of the file (by reading your `.log` to find the stream file you created)

- ▶ Since the GPROC is replacing the file by default, if you want to produce more than one you need to specify append rather than replace between the first graph creation and the second `goptions gsfmode=append;` For the rest of the SAS program, append will be in effect which is likely what you want

- ▶ Of course, you can over-ride these settings at any time as necessary, but smart defaults will save a lot of your time

proc univariate's histogram statement

- ▶ proc univariate uses the GPROC facility with its histogram statement for a continuous variable
- ▶ proc univariate noprint data=NAME; histogram X; run;
- ▶ You can only produce one histogram from a proc univariate noprint data=NAME; ... run; block
- ▶ In between the first and the second, you need to switch to append, then you can append as many histrograms as needed

```
proc univariate noprint data=NAME;
histogram X;
run;
goptions gsfmode=append;
proc univariate noprint data=NAME;
histogram Y;
run;
proc univariate noprint data=NAME;
histogram Z;
run;
```