

36-315: Statistical Graphics and Visualization

Lab 10

Date: March 18, 2003

Due: end of lab

1. Download all the files for this lab into My Documents.
2. Unzip `maps.zip` by pressing right mouse and selecting `Extract All...` In the wizard, click `Next`, `Next`, and `Finish`.
3. Open a Word document to record your work.

Start R

4. `Start` -> `Programs` -> `Class software` -> `R 1.5.1`
5. Set the working directory to My Documents:

```
File -> Change dir...
```

6. Load the special functions for this lab:

```
source("lab10.r")
```

Make maps

7. Make a map of the U.S. using a **rectangular** projection tangent at the middle latitude. A grid can help you choose the latitude value.
8. Make a map of the U.S. using a **conic** projection with grid overlaid. Choose the parameter (a latitude value) to minimize distortion. You probably cannot tell from looking at the map whether it is distorted; you have to rely on the definition of the projection.
9. Make a map of the U.S. using an **equal-area conic** projection. Choose the parameters (two latitudes) to minimize distortion. *Comparing this projection to the rectangular projection, which states have changed the most in appearance?*
10. Using the previous maps, determine the coordinates of New York City. Then make a planar equal-area projection of the U.S., tangent at New York City. Draw a circle on NYC, like so:

```
points(mapproject(longitude, latitude),col=2,cex=2)
```

11. Show us your graphs.

`map` is the command which draws maps. There are three basic maps that we will be using; a world map, a state map, and a county map:

```
map("world")
map("state")
map("county")    # this may take a while to draw
```

Within each map, you can select subregions by name (or prefix of the name):

```
map("world","iraq")
map("state","pennsylvania")
map("state","penn")    # same as above
map("county","penn")  # note the difference from "state"
```

`map.text` is just like `map`, except it labels the regions:

```
map.text("world","ira")
map.text("state","penn")
map.text("county","penn")
```

A map outline can also be added to an existing plot, via `add=T`:

```
plot(LAT~LON,frame,asp=1)
map("state","penn",add=T)
```

The plot should have aspect ratio 1 for the map to be properly scaled.

Projection The above maps use latitude for y and longitude for x . More sophisticated projections are available using the `proj` option. The standard parallels for cylindrical and conic projections are given by the `par` options: Examples:

```
map("world",proj="rectangular",par=10)    # tangent at latitude 10
map("world",proj="conic",par=10)
map("world",proj="lambert",par=c(10,20))  # secant at latitudes 10 and 20
```

Planar projections do not have standard parallels, but a tangent point which is given by the `orient` option. The point is specified as `c(latitude,longitude,rotation)`, where `rotation` is only used to rotate the map.

```
map("world",proj="gnomonic",orient=c(0,-100,0))
map.grid()
```

The function `map.grid()`, as used above, adds a latitude/longitude grid to an existing map. All of the projections and their parameters are described in the help:

`?mapproject`

Of course, all of the above options like subregions, text, and projections can be used simultaneously.