Group work: review

Consider the function

$$z = f(x,y) = \left(1-\frac{x}{k}\right)\left(1+\frac{x}{k}\right)\left(1-\frac{y}{k}\right)\left(1+\frac{y}{k}\right)\left[-(y+47)\sin\left(\sqrt{\left|y+\frac{x}{2}+47\right|}\right) - x\sin\left(\sqrt{|x-(y+47)|}\right)\right]$$

over the region $-k < x < k$ and $-k < y < k$, where $k = 120$.

(See `http://www.stat.wisc.edu/~jgillett/327-3/f.R` for code for `f()`.)

Answer as many of these questions as you can during the available class time:

- Graph f. Hint: Try `persp3d` in package `rgl` to make a graph you can rotate. (If `rgl` doesn't work for your Mac, try installing XQuartz from `https://www.xquartz.org`. If that fails, try `?persp` and see `gradientDescent.R` from the first week.)
- Find a local maximum and mark it with a red dot. Hint: Try `points3d` in package `rgl`. (If `rgl` doesn't work, try `points(trans3d(...))` as in `?persp`'s examples.)
- Find other local maxima and mark each with a red dot.
- Find the global maximum and mark it with a green dot.
- Find n, the number of distinct local maxima.
- Speed up your program.
  - Profile your code. Where is the program spending its time?
  - Make your program faster:
    - Consider ideas from 5profile.pdf
    - See 6multicore.pdf and use `parallel` to make your code use all your laptop's CPUs
    - See 7Rcpp.pdf and use `Rcpp` to implement the bottleneck code in C++

    Time your code before and after each change to ensure that it's really an improvement. Which improvement helped most?

What to turn in

Please submit one "`.R`" file including, near the top, a line like this for each group member:

```
"Last name, First name" <NetID@wisc.edu>
```

(Note that we can't use a "`.Rmd`" file because the HTML output of KnitHTML doesn't allow the interactive `rgl` graph we want to use to see f's maxima.)