

## 18.06 (Fall '13) Problem Set 7

This problem set is due Thursday, October 31, 2013 by 4pm in E17-131.

1. Do Problem 35 from 5.3.
2. Do Problem 12 from 6.1.
3. Do Problem 19 from 6.1.
4. Do Problem 30 from 6.1.
5. Do Problem 9 from 6.2.
6. Do Problem 38 from 6.2, by diagonalizing  $A$ .
7. Do Problem 3 from 6.6 (in general, there is no mechanical procedure for finding  $M$ .)
8. Do Problem 9 from 8.3.
9. Do Problem 11 from 8.3.
10. Use Julia or otherwise to see the eigenvalues of a random matrix with positive eigenvalues.

```
n=2500
a=randn(n,n)
ev=sqrt(eigvals(a'*a))
h=hist(ev,50)
x=(h[1][1:end-1]+h[1][2:end])/2
plot(x,h[2])
```

This Julia code takes the square roots of the eigenvalues of  $A' * A$  for a large matrix  $A$ . The Marcenko-Pastur law tells us that the histogram is some scaled version of a quarter circle.

Run this replacing 2500 with  $n$ , and find the quarter circle scaling. Note: A scaled quarter circle has the form  $y = s * \sqrt{r^2 - x^2}$ . Plot the smooth scaled quarter circle along with the histogram.