Homework 3 (due Wednesday April 7)

The solutions must be your own. Simply copying from other students will result in no credit.

Your homework should be done in LaTeX and the R code, output, graphics etc. must be embedded using Sweave. Your score will be determined by the quality of your written discussion of the results, along with the code and output.

1. Create a 10×10 *symmetric* matrix where all the entries are random uniform numbers between 0 and 5. Use the classical Jacobi method to get the eigenvalues and approximate eigenvectors. While applying the method, use a tolerance of $\epsilon = 0.001$, that is stop the algorithm when all the off-diagonal entries are less than ϵ.

   There is an inbuilt function in `R` which computes eigenvectors and eigenvalues. See `https://rpubs.com/aaronsc32/eigenvalues-eigenvectors-r`. Compare your solution with that obtained from the inbuilt R function.

2. Write a program that does the following. It accepts as inputs a (5 times) differentiable function, the interval on which the function must be integrated, and a tolerance level ϵ. It outputs the approximate integral of the function obtained by subdividing the interval into small subintervals and applying each of the rectangle rule, midpoint rule, trapezoid rule and the Simpson rule, such that the error in computing the integral is at most ϵ. Try it on $\int_{1/4}^{3/4}(1-x^2)^{3/2}dx$ and $\int_{-1}^{1}\sin(x^2)dx$.

   You can compute derivatives in `R`, see `https://rpubs.com/venkatritch/333327`