Instructions. Identify the group of 2 classmates with whom you will complete this assignment. Then, for each of the homework problems below,

1. Please have the group write up one complete solution in LaTeX.
2. Document the contributions of each member of the group in solving this problem. Be sure to include any references you have used to arrive at this solution, *e.g.* web pages, texts, etc.
3. Include sufficient written discussion to demonstrate your understanding of the problem.

Please submit homework solutions by **February 27** before 11:59 pm.

Homework Problems.

1. The Matlab script `poisson.m` solves the Poisson problem on a square $m \times m$ grid with $\Delta x = \Delta y = h$, using the 5-point Laplacian. It is set up to solve a test problem for which the exact solution is $u(x, y) = \exp(x + y/2)$, using Dirichlet boundary conditions and the right hand side $f(x, y) = 1.25 \exp(x + y/2)$.
   (a) Test this script by performing a grid refinement study to verify that it is second order accurate. Plot the error versus mesh width and compute an estimate for the convergence rate.
   (b) Modify the script so that it works on a rectangular domain $[a_x, b_x] \times [a_y, b_y]$, but still with $\Delta x = \Delta y = h$. Verify that your computed solution agrees with the exact solution.
   (c) Further modify the code to allow $\Delta x \neq \Delta y$ and test the modified script. Verify that your computed solution agrees with the exact solution.
   (d) When $\Delta x \neq \Delta y$, how do you expect the error to behave? Give a brief discussion on your reasoning.