Math 3890, Machine Problem 11: Due 11/12

1) Write a script to compute a penalized-least squares spline from the argyris space $\mathcal{S}_5^{1,2}(\triangle$ based on measurements zd of a function f at nd points (xd, yd). The script should
   a) use `[xd,yd] = randpts(nd)` to read in `nd` points `xd,yd`. Set all weights to one
   b) read in nd noise values using my funtion `readnoise`. Multiply these values by a parameter `eps` and add to `zd`.
   c) Read in a triangulation $\triangle$. Plot this triangulation overlaid with a plot of the data points (as dots).
   d) Call `trilists` and `mds15`
   e) Prompt for a value of `lambda` and call `penlsqbiv` to produce the coefficients of the spline fit.
   f) Use my function `valspgrid` to compute the values of the spline on a rectangular grid of size 51×51. Use the values to compute the max and RMS errors on this grid, and to plot the surface.
   g) Report the size and condition number of the system solved, the number of coefficients, the time to compute the coefficients, and the max and RMS errors.

2) Write a second script that works with the space $\mathcal{S}_3^1(\triangle_{CT})$, where $\triangle_{CT}$ is the Clough-Tocher triangulation refinement of $\triangle$. In this script you will replace the call on `mds15` by
   a) a call on my function `ctsplit` to create $\triangle_{CT}$. Note that it also updates the triangulation lists.
   b) a call on my function `mdsctb` to create a transformation matrix A for this space. Don't plot the original triangulation, but instead plot the refined one along with the data points. Do f) and g) as above.

3) Run your scripts for the Franke function on the unit square. Take $nd = 3000$ and eps = .2, and use the triangulation `tri36.dat`. Use lambda = .01 for the quintic spline, and .005 for the cubic one. Note you will turn in two triangulation plots, and two surface plots along with the output listed above. Here are the calls for the above functions:

```
[x,y,v1,v2,v3,e1,e2,e3,ie1,ie2,tril,trir] = ...
ctsplit(x,y,v1,v2,v3,e1,e2,e3,ie1,ie2,tril,trir)
```

```
[A,dof,dofv] = mdsctb(no,neo,nto,x,y,v1,v2,v3,e1,e2,e3,...
ie1,ie2,tril,trir,bdy)
```

`no,neo,nto` are numbers of vertices, edges, and triangles in the initial triangulation.