**Final project (due on June/13 23:30PM)**

**1. Use the following steps to redo the PCA analysis of X=V\*Z and calculate V and Z. (20 points)**

x=[2 0 4 -2;2 -2 0 -2]

a=x\*x’/4

[v,d]=eig(a)

eigval=diag(d)

eigval=eigval(end:-1:1)

v=fliplr(v)

z=v’\*x

**2. Load a global scale 456-year 2-D (120\*61) variable from var.mat (var, lon, lat)**

1. Calculate the EOFs of var within the domain (lat1 is from -30 to 30, lon1 is from 0 to 357) from year 1 to year 456. Plot the first four EOFs and their corresponding PCs and indicate how much of total variance of var each EOF could explain. (30 points)
2. Do you think how many leading EOFs are necessary to reconstruct original data with 90% accuracy? Show original var and the reconstructed one (with 90% accuracy) at time step (year=100) and the difference between the two at that time step. (20 points)
3. Use your calculation to illustrate that the first four PCs and EOFs are orthogonal functions, respectively. (15 points)
4. Calculate the power spectrum of the PC1 and the correlation between PC1 with the original var in a global scale ( lat1 from -90 to 90 and lon1 from 0 to 357) over the entire period (year1 to year 456) (15 points).

Use the following script to plot var at step year=1 in a global map

for i=1:120

for j=1:61

map(j,i)=var(i,j,1);

end

end n

pcolor(lon1,lat1,map)

shading interp

colorbar