1. Implement the Kalman filter in Matlab using slide 18 in lecture 7.
   With these suggestions
   a) Neglect the time index on matrices M, Q, H, and R.
   b) In the Prediction step it is more logical to have k|k-1 (as opposed to k+1|k)
   c) I find it easier to have a prediction step and an update step.

I suggest the following structure

```
function [ x_hat, P_hat, K ] = KalmanPG( y,sys)

%The simplest Kalman filter
%   x_p   = M x_hat+ N(0,Q)
%   x_hat = H x_p +N(0,R)

% dimensions
[Nobs Ntime] =size(y);
Nx=length(sys.x0);
M=sys.M; % state eq matrix
H=sys.H; % observation eq matrix
R=sys.R; % observation noise
Q=sys.Q; % prediction noise
%%
K=zeros(Nx,Nx,Ntime);  P_p=zeros(Nx,Nx,Ntime);P_hat=zeros(Nx,Nx,Ntime);
x_hat=zeros(Nx,Ntime);x_p=zeros(Nx,Ntime);
%initial states
x_hat(:,1)=sys.x0;
P_hat(:,:,1)=sys.P0;
for iobs=2:Ntime
% predict
   x_p(:,iobs)=
   P_p(:,:,iobs)=
% update
   Ptemp=P_p(:,:,iobs);
   K(:,:,iobs)=
   P_hat(:,:,iobs)=
   x_hat(:,iobs)=
end
end
```

2) load the attached GPS ice data from my deployment on the Ross Ice Shelf.
The data (yobs) is showing south, west and elevation movement in meters. The time (iday) is day from Jan 1, 2015.
Plot the

a) Components,
b) Kalman gain
c) Experiment with different levels of the noise. These are so called tuning parameters and requires some experimentation to get correct.

   Background information: This is a cheap GPS stations with a standard deviation of 10m for a locations measurement, it is used for getting

accurate timing. The ice shelf drift about 3m/day, which can be seen over several days. We expect the drift to vary daily due to tides and weather, maybe less than 0.1 m. Can that be observed?
Next year we will have geodetic GPS with higher precision.

```
clear all
%close all
load station2
y = [yobs];  %case 1
sys.M = eye(3);
sys.Q = [1 0 0; 0  0.2 0; 0 0 .1];  % prediction noise
sys.x0 = y(:,1); %[ Lat(2)'/100'; Lon(2)'/100];
sys.P0 = eye(3);

sys.H = eye(3);
sys.R = [1 0 0; 0 1 0 ; 0 0 2]*10; %observation noise

 %%
[x,P,K] = KalmanPG(y,sys);
T=iday;
figure
subplot(311)
plot(T,y(1,:),'b')
hold on
grid on
plot(T,x(1,:),'r')
```