GG250 Lab 12
Oil Supply (Hubbert's Method)

The objective here is to estimate how much of the total U.S. petroleum supply has been produced to date and when 90% of the U.S. petroleum supply will have been produced.

You will do this using data and a model production function $r = Ae^{-((t-T)/S)^2}$. The data file with U.S. petroleum production rate data is on the lab website. It was obtained from http://www.eia.doe.gov/emeu/aer/petro.html. The values in the first column are the years (t), and the values in the second column are the annual production rates (r), in barrels/day.

Exercise 12 **(47 pts total)**
Create a function [A,T,S,ratio] = gg250_lab_12_yourname (S,t_range,tau) **(7 pts)**
to address the objective. The function should be well documented. **(5 pts)**
The input parameters are
S = model parameter
t_range = values of t at which r is calculated
tau = upper limit of integral
The output parameters the function returns are
A,T,S = model parameters
ratio = proportion of oil produced at t = tau relative to the total ultimate production.

The function should perform the following tasks:
A Load the production rate data file (US_petroleum_overview.dat) **(1 pt)**
B Plot the production rate data against time with small "o's" **(4 pts)**
C Find the value of the peak production rate (A) **(1 pt)**
D Find the year of the peak production rate (T) **(2 pts)**
E Superpose the model curve on the data, with the model values of r being calculated over the range of time specified by t_range **(4 pts)**
F Label the axes on the plot **(2 pts)**
F Integrate the model curve from min(t_range) to max(t_range) to find the (total) production (Q1) **(4 pts)**
G Integrate the model curve from min(t_range) to tau to find the cumulative production over that time interval (Q2). **(4 pts)**
H Calculate the ratio of Q2 to Q1. **(4 pts)**
I The function should have a subfunction called "r = bell_curve(t)" that calculates model values of r as a function of t. The values of A,S, and T can be passed to the subfunction as global variables. **(4 pts)**

You could use the approach in labs 9-10 to find a value of S to minimize the misfit, but here you can do an "eye-ball best-fit" to find S. Try several values of S and pick one that you consider to yield the best fit. Use the following values for t_range:
t_range = 1800:2200
In your e-mail to us, give your S value, and comment on your results. **(5 pts)**